

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLTAGE, LLC

Petitioner,

v.

SHOALS TECHNOLOGIES GROUP, LLC'S

Patent Owner

Inter Partes Review IPR2024-00876,

Declaration of Thomas W. Kenny in Support of the

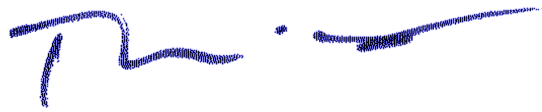
Petition for *Inter Partes* Review of U.S. Patent No. 10,992,254

DECLARATION OF DR. THOMAS W. KENNY

[0001] I currently hold the opinions expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

[0002] I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare 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 the Title 18 of the United States Code.

Dated: May 8, 2024

By: 
Thomas W. Kenny, Ph.D.

QUALIFICATIONS AND BACKGROUND INFORMATION

[0003] My education and experience are described more fully in my curriculum vitae provided as Exhibit 1004. For ease of reference, I have highlighted certain information below.

[0004] My academic and professional background is in Physics, Mechanical Engineering, Sensing, and Robotics, with a research specialization focused on microfabricated physical sensors, and I have been working in those fields since the completion of my Ph.D. more than 30 years ago. The details of my background and education and a listing of all publications I have authored in the past 35 years are provided in my curriculum vitae, attached as Appendix A. Below I provide a short summary of my education and experience which I believe to be most pertinent to the opinions that I express here.

[0005] I received a B.S. in Physics from University of Minnesota, Minneapolis in 1983, and a Ph.D. in Physics from University of California at Berkeley in 1989. I was educated as a Physicist specializing in the design and fabrication of sensors to be used for measurements of many kinds. My Physics Ph.D. thesis involved measurements of the heat capacity of monolayers of atoms on surfaces and relied on precision measurements of temperature and power using time-varying electrical signals, and also on the design and construction of miniature sensor components and associated

electrical circuits for conditioning and conversion to digital format.

[0006] My training in Physics at the University of Minnesota and at UC Berkeley relied on understanding of fundamental principles of electromagnetism, which include detailed study of the basic principles of electrical conduction, and the properties of resistors, capacitors, inductors, diodes, fuses, and many other semiconductor devices, including the basic properties of thermovoltaic devices and photovoltaic devices, and the ongoing research to optimize the band structures and other materials properties for more efficient conversion of thermal and optical energy to electrical energy. The basic electrical properties of cables and connectors are part of this training, including an understanding of the special requirements for systems that produce and carry large currents.

[0007] After completion of my Ph.D. in Physics at U.C. Berkeley in 1989, I joined the Jet Propulsion Laboratory (JPL) in Pasadena, CA, as a staff scientist, and began working on miniature sensors and instruments for small spacecraft. This work involved the use of silicon microfabrication technologies for miniaturization of the sensors and served as my introduction to the field of micro-electromechanical systems (MEMS), or the study of very small mechanical sensors powered by electricity and used for detection of physical and chemical signals.

[0008] While at JPL, we developed accelerometers, uncooled infrared sensors, magnetometers, seismometers, force and displacement sensors, soil chemistry sensors, miniature structures for trapping interstellar dust, and many other miniature devices. Some of these projects led to devices that were launched with spacecraft headed for Mars and for other interplanetary missions. Much of this work involved the use of physical sensors for detection of small forces and displacements using micromechanical sensors. In many cases, the design of the sensors included considerations for packaging of the sensor to protect from external environments, and for management of electrical connections to the sensor. In this regard, my work at JPL involved the same two fundamental concepts behind the '254 Patent: (1) electrical connections and (2) molding to protect the electrical connections from environmental factors.

[0009] I am presently the Richard Weiland Professor at the Department of Mechanical Engineering at Stanford University, where I have taught for the past 30 years. I am also currently the Senior Associate Dean of Engineering for Education and Student Affairs at Stanford.

[0010] For almost all of these 30 years, I have taught courses in the Mechanical Engineering department at Stanford University on Sensors and Mechatronics. The annual enrollment in these collections of courses has

exceeded 100 students for most of this time, and so I have had the privilege of teaching thousands of Stanford undergraduate students and graduate students in these topics. Of course, teaching is a great way to learn, so my education in these topics includes approximately 40 years of learning, first as a student and then as an educator.

[0011] The ME210 course titled “Introduction to Mechatronics” is a review of the mechanical, electrical, and computing technologies necessary to build electromechanical systems. The applications of this course include everything from cars and robots to cellphones and other consumer electronics devices. Alumni of this course are currently working at Apple, Tesla, Google, Meta, SpaceX, Intel, Bosch, Waymo, and many other large and small enterprises. A significant part of this course focuses on the design and implementation of power systems for mobile robots which includes batteries, regulators, protection diodes, fuses, and wiring harnesses. I was one of the instructors for the first offering of this course in 1995, and this course has been offered at least once each year ever since, except for the pandemic year of 2021. Students from this class include undergraduates with majors in Mechanical Engineering, Electrical Engineering, Computer Science, and other disciplines, and we also have representation of MS and PhD students from all these departments as well. Over the history of this

course, as many as 2,000 students in this course have subsequently earned a B.S., M.S., or Ph.D. degree in electrical engineering, mechanical engineering, or an equivalent such as applied physics or general engineering, and many of the students in this course enter with two or more years of professional experience relating to the design and/or manufacturing of electromechanical systems that include electrical wiring and connectors.

[0012] I am the co-author of a textbook titled “Introduction to Mechatronic Design,” which is used for the ME210 course described above. This textbook broadly covers the topic of integration of mechanical, electronic and computer systems design into “smart products.” This textbook includes chapters on Voltage Regulators, Power Supplies and on Batteries, Noise, Isolation and Grounding, which includes discussion of design and construction of wiring harnesses that connect power sources to electronic systems, including microprocessors, diodes, fuses, and other elements.

[0013] The ME220 course titled “Introduction to Sensors” is a broad overview of all sensing technologies, from thermometers to inertial sensors, ultrasound devices, flow sensors, optical and IR sensors, chemical sensors, pressure sensors, and many others. This course is focused on sensors that operate based on determination of changes in capacitance, resistance, piezoelectricity that arise from external signals. This course specifically

includes discussion of the relation between sensor performance and environmental stresses, such as temperature, moisture, chemical corrosives, and mechanical strain. I first taught this course at Stanford in the Spring of 1994, and I offered this course at least annually until 2016, when my duties as Senior Associate Dean made this impractical, yet have continued to offer this course periodically since, including these last two years.

[0014] My research group at Stanford has focused on the area of microsensors and microfabrication—a domain in which we design and build micromechanical sensors using silicon microfabrication technologies. The various applications for these technologies are numerous.

[0015] I have advised 75 Ph.D. students that have completed Ph.D. degrees and many more M.S. and B.S. students in Engineering during my time at Stanford.

[0016] I have published over 250 technical papers in refereed journals and conferences in the field of sensors, MEMS, and measurements. I have further presented numerous conference abstracts, posters, and talks in my field. I am a named inventor on 50 patents in my area of work.

[0017] From 2006 to 2010, I served as a program manager at DARPA in the Microelectronics Technology Office. I launched and managed programs in Thermal Management of High-Power Systems, Nanofabrication, and other

areas. The Thermal Management Programs were focused on systems, such as the THAAD radar systems currently deployed around the world for missile defense, which required design and development of complex, systems that relied on delivery of huge amounts of electrical power to a compact radar module, followed by extraction of huge amounts of thermal power in order to keep the radar systems operating within allowed temperatures. At a basic level, these systems required cables, connectors, and other structures for delivery of significant current, extraction of significant return current, and the simultaneous removal of heat. The underlying systems included cables, connectors, junctions, and protective insulation layers – all similar to the structures discussed in the '254 Patent.

[0018] I received the Office of the Secretary of Defense Award for Exceptional Public Service in 2010, the IEEE Sensors Council Technical Achievement Award in 2011, and was named Fellow of the ASME in 2014. I was awarded the 2018 IEEE Daniel Noble Award for Emerging Technologies. In 2022, I was elected to the National Academy of Engineering.

[0019] I have been retained on behalf of Voltage, LLC to offer technical opinions relating to U.S. Patent No. 10,992,254 (“the '254 Patent”) and prior art references relating to its subject matter. I have reviewed the '254 Patent,

and relevant excerpts of the prosecution history of the '254 Patent. Based on my experience and education, and the acceptance of my publications and professional recognition by societies in my field, I believe that I am qualified to offer opinions as to the knowledge and level of skill of one of ordinary skill in the art at the time of the invention of the '254 Patent (which I further describe below).

[0020] Additionally, I have reviewed U.S. Patent No. 11,689,153 (“the '153 Patent”), which is a continuation of the '254 Patent, and the prosecution history of both the '254 Patent and the '153 Patent, which are drawn from the same provisional Patent Application No. 62/047,773 (“'773 Provisional”). *See* EX1014, EX1020, EX1021. The full prosecution history, starting from the '773 Provisional to the issuance of the '254 Patent, followed by the prosecution of the '153 Patent, is informative to understand the terms used in the claims of the '254 Patent. *See, id.*

[0021] As will be discussed below, the '254 Patent describes the cables, connectors, harnesses, and lead assemblies that gather current from solar panels and deliver this current to an inverter for conversion to useful electrical energy (i.e., conversion from DC to AC). The '254 Patent does not cover any of the technology that is represented by the semiconductor devices within the solar panels that convert sunlight to electrical energy, and

the '254 Patent does not discuss the technology within the inverter that converts DC current from the solar panels to useful AC electrical power. The '254 Patent only covers wiring assemblies, which entirely consist of cables, cable junctions, molding to protect the electrical junction points, and connectors.

[0022] Based on my experience, education, and research, including extensive experience with teaching courses that include emphasis on the design and fabrication of power systems and wiring harnesses for integrated systems, I believe that I am qualified to offer opinions as to the knowledge and level of skill of one of ordinary skill in the art at the time of the invention of the '254 Patent (which I further describe below).

[0023] Based on my experiences, I have a well-informed understanding of the capabilities of a person of ordinary skill. Indeed, I have taught, participated in organizations, and worked closely with many such people over the course of my career, including the thousands of students who were enrolled in courses that I have taught on these topics. Based on my knowledge, skill, and experience, I understand the capabilities of a person of ordinary skill.

[0024] In addition to any materials cited in the present declaration, I have also reviewed the following references:

[0025] **“Solar Line – Photovoltaic Interconnections System – Helios,”**

Amphenol Industrial Solar Technologies (“Amphenol,” EX1007)

[0026] I understand that Amphenol is prior art under AIA § 102(a) because it was published no later than November 30, 2012, more than one (1) year before the earliest possible priority date of the ’254 Patent. I have been informed by counsel that Amphenol was not identified to or considered by the Examiner who allowed the ’254 Patent.

[0027] **Chinese Patent No. 2785100 to Shao et al. (“Shao,” EX1008)**

[0028] I understand that Shao is prior art under 35 U.S.C. §§ 102(a)(1) because it was published on May 31, 2006, before the earliest priority date of the ’254 patent. I have been informed by counsel that Shao was not identified to or considered by the Examiner who allowed the ’254 patent.

[0029] **U.S. Patent No. 6,268,559 to Yamawaki (“Yamawaki,” EX1006)**

[0030] I understand that Yamawaki is prior art under 35 U.S.C. §§ 102(a)(1) because it was published on July 31, 2001, long before the earliest priority date of the ’254 Patent. I have been informed by counsel that Yamawaki was addressed in prosecution, and that the Examiner asserted Yamawaki against various claims including the independent claims, but that the assertions by the Examiner regarding Yamawaki were not overcome by Applicant. *See* EX1002, pp. 143-151, 169-171, 177-185, 201-203, 219-225.

I discuss further below the significance of Yamawaki in the prosecution history in understanding the scope of the claims of the '254 Patent.

[0031] Japanese Published Patent Application No. 4080663 to Tamura
(“Tamura,” EX1009)

[0032] I understand that Tamura is prior art under 35 U.S.C. §§ 102(a)(1) because it was published on April 23, 2008, before the earliest priority date of the '254 patent. I have been informed by counsel that Tamura was not identified to or considered by the Examiner who allowed the '254 patent.

[0033] Chinese Patent No. 102332345 to Yu et al. (“Yu,” EX1015)

[0034] I understand that Yu is prior art under 35 U.S.C. §§ 102(a)(1) because it was published on January 25, 2012, before the earliest priority date of the '254 Patent. I have been informed by counsel that Yu was not identified to or considered by the Examiner who allowed the '254 Patent.

[0035] I have also reviewed various supporting references and other documentation as further noted in my opinions below. I have analyzed various publications and materials, in addition to other materials I cite in my declaration.

[0036] In the prosecution of the '254 Patent, the Examiner considered prior art references that are specifically associated with solar power generation (e.g., U.S. Published Patent Application No. 2010/0139733 to Jonczyk et al

(“Jonczyk” EX1025), U.S. Published Patent Application No. 2012/0217973 to Avrutsky (“Avrutsky” EX1026), and U.S. Published Patent Application No. 2011/0209741 to Solon (“Solon741” EX1005), as well as references that have nothing at all to do with solar power generation (e.g., U.S. Patent No. 3,852,516 to Vander Ploog (“Vander Ploog” EX1023). On the face of the ’254 Patent, there is a customary presentation of the ‘Field of Classification Search,’ which includes classifications that relate to solar power (generally, the H01L fields), as well as classifications that are associated with cables, connections, and packaging of cables (generally, the H01R fields). *See* EX1001, cover page. Therefore, the Examiner for the ’254 Patent believed it to be appropriate to consider prior art examples from outside of the solar power generation category. In particular, Vander Ploog, which was considered along with Yamawaki, as grounds for rejecting proposed claims of the ’254 Patent, relates to power distribution. *See*, EX1023 and EX1006 generally.

[0037] To further corroborate that a person of ordinary skill in the art (POSITA) would possess the foundational knowledge of employing cables and connectors for electrical connections across various applications to combine and distribute electric current before the earliest priority date of the ’254 Patent, I have cited two books. First, the National Electrical Code

(“NEC 2002,” EX1010), which teaches how to determine design details, including acceptable gauges of cable, electrical connector designs and wiring harness requirements. The NEC 2002 includes a section titled “Solar Photovoltaic System,” which demonstrates that such systems are within the knowledge of a POSITA related to systems employing cables and connectors for electrical connections across various applications to combine and distribute electric current. *See* EX1010, Article 690, pp. 543-552.

Second, “Photovoltaic System Engineering, Third Edition,” (“PSE textbook,” EX1011), which teaches the basic information and engineering considerations for designing a wide range of solar power installations. The PSE textbook restates basic engineering concepts used in combining and distributing electric current using cable assemblies or wire harnesses that I have used repeatedly in my decades of teaching engineering courses. Also, the PSE textbook refers to the NEC 2002. *see* EX1011, *e.g.*, p.86. I have also reviewed various supporting references and other documentation as further noted in my opinions below.

[0038] Counsel has informed me that I should consider these materials through the lens of one of ordinary skill in the art related to the '254 Patent at the time of the earliest possible priority date of the '254 Patent, and I have done so during my review of these materials. The '254 Patent claims the

benefit of priority to a provisional application filed September 9, 2014 (“the Critical Date”). EX1014. Counsel has informed me that the Critical Date represents the earliest possible priority date to which the challenged claims of ’254 Patent are entitled, and I have therefore used that Critical Date in my analysis below.

[0039] I have no financial interest in the parties or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

[0040] In writing this declaration, I have considered the following: my own knowledge and experience, including my work experience in the fields of mechanical engineering, computer science, and electrical engineering; my experience in teaching those subjects; and my experience in working with others involved in those fields. In addition, I have analyzed various publications and materials, in addition to other materials I cite in my declaration.

[0041] My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the ’254 Patent. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the art as of the Critical Date, or before. Any figures that

appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the '254 Patent and the prior art discussed below.

OVERVIEW OF CONCLUSIONS FORMED

[0042] This declaration explains the conclusions that I have formed, based on my analysis. To summarize those conclusions, based upon my knowledge and experience and my review of the prior art publications listed above, I believe the following:

[0043] Claims 1-5 and 7-15 are unpatentable under AIA 35 U.S.C. § 103(a) as obvious over Amphenol (EX1007) in view of Shao (EX1008) and Yamawaki (EX1006).

[0044] Claim 6 is unpatentable under AIA 35 U.S.C. § 103(a) as obvious over Amphenol (EX1007) in view of Shao (EX1008), Yamawaki (EX1006), and Tamura (EX1009).

[0045] Claims 1-15 are unpatentable under AIA 35 U.S.C. § 103(a) as obvious over Amphenol (EX1007) in view of Yu (EX1015), Yamawaki (EX1006), and Tamura (EX1009).

[0046] Claims 1-5 and 7-15 are unpatentable under AIA 35 U.S.C. § 103(a) as obvious over Yamawaki (EX1006) in view of Shao (EX1008).

[0047] The exhibits considered for this declaration include:

EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 10,992,254 to Solon (“’254 Patent”)
1002	Prosecution History of ’254 Patent
1004	Curriculum Vitae of Thomas W. Kenny
1005	U.S. Published Patent Application No. 2011/0209741 to Solon (“Solon741”)
1006	U.S. Patent No. 6,268,559 to Yamawaki
1007	“Solar Line – Photovoltaic Interconnections System – Helios,” Amphenol Industrial Solar Technologies (“Amphenol”)
1008	Chinese Patent No. CN 2785100 to Shao et al. (“Shao”) – <i>Translation Certified</i>
1009	Japanese Published Patent Application No. 4080663 to Tamura (“Tamura”) – <i>Translation Certified</i>
1010	“National Electrical Code 2002,” by National Fire Protection Association (“NEC2002”)
1011	“Photovoltaic System Engineering, Second Edition,” (“PSE textbook”)
1012	Chinese Patent No. CN 2785100 to Shao et al. (“Shao”) – Original
1013	Japanese Published Patent Application No. 4080663 to Tamura (“Tamura”) – Original
1014	’254 Patent priority Provisional Patent Application (“’254 Provisional”)
1015	Chinese Application Pub. No. CN 102332345 A to Yu et al. (“Yu”) – <i>Translation Certified</i>
1016	Chinese Application Pub. No. CN 102332345 A to Yu et al. (“Yu”) – Original
1017	Order No. 16: In the Matter of CERTAIN PHOTOVOLTAIC CONNECTORS AND COMPONENTS THEREOF, Inv. No. 337-TA-1365, (Int’l Trade Comm., February 20, 2024)

1018	Shoals Technologies Group, LLC v. Voltage, LLC et al., Docket No. 1:23-cv-00365, Order on Motion to Stay, Dkt. 20 (M.D.N.C. June 28, 2023)
1019	Japanese Patent Application KOKAI Publication No. 7-131045 to Ito (“Ito”) – Original
1020	U.S. Patent No. 11,689,153 to Solon (“’153 patent”)
1021	Prosecution History of the ’153 patent
1022	Japanese Patent Application KOKAI Publication No. 7-131045 to Ito (“Ito”) – Machine Translation
1023	U.S. Patent No. 3,852,516 to Vander Ploog, et al. (“Vander Ploog”)
1024	Amphenol Declaration of Gary Joseph (“Joseph Decl.”)
1025	U.S. Published Patent Application No. 2010/0139733 to Jonczyk et al. (“Jonczyk”)
1026	U.S. Published Patent Application No. 2012/0217973 to Avrutsky (“Avrutsky”)
1027	Wayback Machine, Amphenol-Industrial, web capture, September 2012.

I. Statutory Grounds for Challenge

[0048] Counsel has informed me that I should consider the following grounds:

GROUND 1: The validity of Claims 1-5 and 7-15 under AIA 35 U.S.C. § 103(a) as obvious over Amphenol (EX1007) in view of Shao (EX1008) and Yamawaki (EX1006).

GROUND 2: The validity of Claim 6 under AIA 35 U.S.C. § 103(a) as obvious over Amphenol (EX1007) in view of Shao (EX1008), Yamawaki (EX1006), and Tamura (EX1009).

GROUND 3: The validity of Claims 1-15 under AIA 35 U.S.C. § 103(a) as obvious over Amphenol (EX1007) in view of Yu (EX1015), Yamawaki (EX1006), and Tamura (EX1009).

GROUND 4: The validity of Claims 1-5 and 7-15 under AIA 35 U.S.C. § 103(a) as obvious over Yamawaki (EX1006) in view of Shao (EX1008).

II. Level of Ordinary Skill in the Art

[0049] I believe that a person of ordinary skill in the art (POSITA) would have a B.S. degree in electrical engineering, mechanical engineering, or an equivalent such as applied physics or general engineering, and two years of

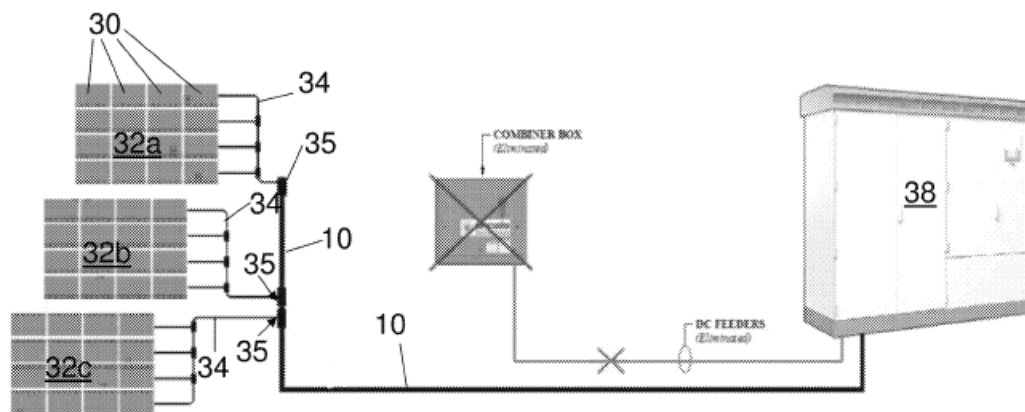
professional experience relating to the design and/or manufacturing of electrical wiring and connectors. Lack of professional experience can be remedied by additional education and related experience, and vice versa. The '254 Patent is focused on the cables, harnesses, assemblies, and connectors that bring power from solar panels to an inverter, all of which are based on very basic concepts around electrical connectors and molded protective layers.

[0050] I understand that the patent owner has challenged my qualifications as an expert for consideration of the '254 Patent. In the parallel ITC proceedings, the patent owner has asserted that two years of experience with an understanding of Balance of Systems Components for utility-scale photovoltaic power installations is required. This is a substantial overstatement of the requirements for understanding of the '254 Patent. The patent is not limited to utility-scale solar installation (such a limitation was removed from the claims by the patent owner during prosecution of the '254 Patent; *see* 'REQUEST FOR CONSIDERATION OF AN AMENDMENT UNDER 37 CFR 1.312 filed March 1, 2021 (EX1002 pp. 40-48). The specification, figures, and claims are focused on limitations that are associated with the means for forming connections between cables and the geometric features and methods of forming molded protection layers. I look

forward to further discussions on this matter.

III. Summary of '254 Patent

[0051] U.S. Patent No. 10,992,254 to Solon (The '254 Patent) is entitled “Lead Assembly For Connecting Solar Panel Arrays To Inverter” and issued on April 27, 2021 with Dean Solon listed as the sole inventor. EX1001, cover. The technology of the Asserted Patents can be generally understood with reference to FIG. 3 of the '254 Patent.



EX1001, FIG. 3

[0052] FIG. 3 depicts an embodiment which generally includes a plurality of solar panels 30 that are electrically coupled from solar arrays 32a, 32b, 32c, and so forth. EX1001, 4:30-33. Panels 30 are coupled using wire harnesses 34 which each includes a plurality of branches each connecting to one solar panel and a central trunk. *Id.*, 4:33-37. The solar arrays 32a, 32b, 32c, and so forth, are connected to a lead assembly 10 via the wire harnesses 34. *Id.*,

4:38-42.

[0053] The '254 Patent is essentially a combination of pre-existing elements commonly found in solar array installations, which are assembled in a way that does not extend beyond their conventional functions. The claims of the '254 Patent describe a lead assembly used in solar energy installations that includes a first drop line, a second drop line, and at least one 30-amp feeder cable, where the first drop line and the feeder cable are electrically connected at a nexus. As explained further below, before the priority date of the '254 Patent, assemblies combining multiple cables, such as a first drop line, a second drop line, and at least one feeder cable, to gather power from solar arrays and transmit it to an inverter, were already well known.

[0054] The claims also specify that the lead assembly omits a combiner box between the solar arrays and the inverter in a solar energy installation. At the time of the invention, a combiner box was an optional component in solar lead assemblies. Additionally, the claims mention an undermold that fully encases a securing mechanism at the nexus, with an overmold surrounding the undermold and creating an undermold-overmold interface. Cable assemblies with undermold-overmold structures predated the '254 patent's application.

[0055] It is my opinion that overall, each of these elements existed before the

'254 patent's filing, and the patent employs them in ways consistent with their conventional functions. When combined, the claimed invention essentially describes a conventional lead assembly that could be used in solar installations.

IV. Prosecution History

[0056] U.S. Patent Application No. 14/849,458, issued on 4/27/21 as the '254 Patent ("the '254 Application"). EX1001, Cover. The original filed claim 1 in the '254 Application was directed to a lead assembly for use in a solar energy installation including at least one drop line and one feeder cable electrically coupled at a nexus, a means for securing said nexus such a compression lug, and an overmold surrounding the compression lug. EX1002, p. 328. The entire claim is reproduced below:

1. A lead assembly for use in a solar energy installation including:
 - A. At least one drop line terminating in a drop line connector;
 - B. At least one feeder cable terminating in a feeder cable connector, said at least one drop line and said at least one feeder cable electrically coupled at a nexus;
 - C. A means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof; and
 - D. An overmold surrounding said compression lug, wherein said lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between said solar arrays and said inverter.

[0057] After the Applicant of the '254 Patent filed two preliminary amendments (EX1002, pp.304-307, p.294), the Examiner issuing a restriction requirement (EX1002, p.290), and the Applicant filed a response to the restriction requirement that further amended the claims (EX1002, pp.275-282), the Examiner issued the first non-final office action rejecting all claims (EX1002, pp.260-265). It is notable that in that first office action, the Examiner included a rejection of claims that combined two U.S. patent publications specifically directed to solar photovoltaic systems (i.e., Jonczyk, EX1025 and Avrutsky, EX1026) with a patent more generally directed to electrical cable splice enclosures (i.e., Vander Ploog, EX1023). See EX1002, p.265.

[0058] Subsequently, the applicant amended proposed claim 1 in the '254

Patent on 12/11/19 to what is shown below. *Id.*, p. 130. I note that new language previously added to the claim includes an “undermold having an inner surface and an outer surface, said inner surface surrounding and fully encasing said securing means” and “an undermold-overmold interface”. In the 12/11/19 amendment, the Applicant added the limitation “and is suitable for utility-scale installations.” *Id.*

1. **(Currently Amended)** A lead assembly for use in a solar energy installation including:
 - A. A first drop line and a second drop line, said first drop line terminating in a drop line connector;
 - B. At least one 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said at least one feeder cable electrically coupled at a nexus;
 - C. A means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof;
 - D. An undermold having an inner surface and an outer surface, said inner surface surrounding and fully encasing said securing means; and
 - E. An overmold surrounding said undermold and forming an undermold-overmold interface only at said outer surface, wherein said lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between said solar arrays and said inverter, and wherein said lead assembly has a voltage rating of 1500 VDC **and is suitable for utility-scale installations.**

[0059] On 4/22/2020, the Examiner, Eric Ryan Smith, sent e-mail correspondence to the prosecuting attorney with proposed amendments to the claims that would bring the case into condition for allowance if accepted. EX1022, p. 103-105. The proposed amendment added 113 words to the “undermold” limitation, which included “aperture” structures and defining features of said apertures, such as the “first aperture concentric with said securing means”, “first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter”, “second aperture concentric with said first drop line”, “second aperture... parallel to said first aperture”, “second aperture only partially extending through said undermold in said longitudinal direction” and “second aperture having a second diameter small than said first diameter.” *See id.* The proposed amendment in Examiner Smith’s e-mail is re-produced and the “aperture” structures highlighted below:

D. An undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said at least one feeder cable, said inner surface surrounding and fully encasing said securing means, said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter, said at least one feeder cable continuously extending through said first aperture, and a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture; and

[0060] The proposed amendment also struck “and is suitable for utility scale installations.” *Id.*

[0061] On 5/8/2020, the prosecuting attorney responded to Mr. Smith's inquiry as to whether the Applicant would accept or deny the amendments that she "[r]eached out again and still not response" and that she "will wait for the Office Action." *Id.*, p. 103.

[0062] On 5/13/2020, Examiner Smith issued an office action with new rejections to the 12/19/2019 amendments. *Id.*, pp. 79-95. Notably, the Examiner found the claims indefinite under 35 U.S.C. § 112 as indefinite based on the added language "suitable for utility-scale installations." *Id.* at 273-274. "Further a skilled artisan would not inherently understand that the lead assembly of the disclosure is suitable for utility-scale installations, based on the disclosure as originally filed. Therefore, a skilled artisan would not understand that the inventor had possession of the claimed invention at the effective date of filing of the application." The Examiner further wrote: "Put another way, the examiner does not understand 'suitable for utility-scale installations' to be a commonly used term of the art with a definite meaning that clearly describes what is included and excluded by the phrase. Are some lead assemblies having a 30 amp feeder cable and voltage rating of 1500 VDC that are not suitable for utility-scale installations? If so, what structure is present in the claimed invention that differentiates it from such (hypothetical) lead assemblies? Would a lead assembly with a 20 amp

feeder cable and 1000 VDC voltage rating be suitable for utility scale installations? Such distinctions cannot be determined from the disclosure as originally filed, and the claims are indefinite. *Id.*

[0063] On 11/12/20, the prosecuting attorney filed a response to non-final office action adopting Examiner Smith’s proposed amendments without any modifications, which included the addition of the examiner-authored 113-word addition regarding the geometric features of apertures through the molds and striking the requirement that the lead assembly be suitable for utility-scale installations. *Id.*, p. 65-70. Thereafter, a notice of allowance was issued. *Id.*, pp. 49-57.

V. Grounds of Invalidity

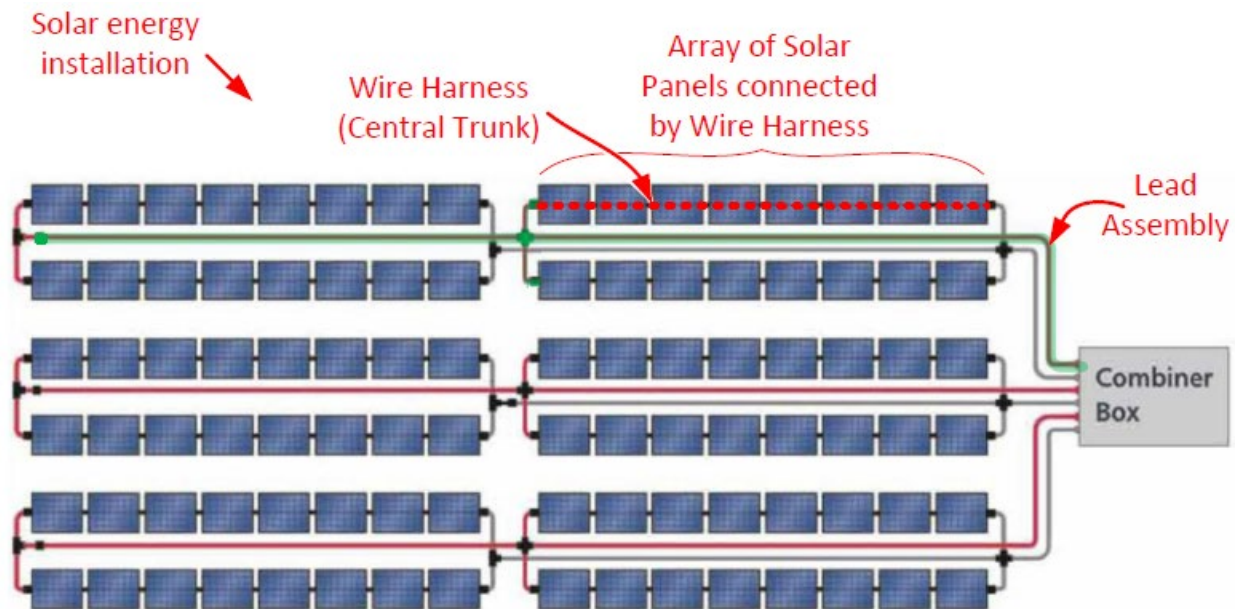
A. Ground 1: Claims 1-5 and 7-15 are unpatentable under 35 U.S.C. § 103 as obvious based on Amphenol, Shao, and Yamawaki.

[0064] A POSITA would have found the limitations in claims 1-5 and 7-15 to be obvious in view of the Amphenol, Shao, and Yamawaki.

(i) Amphenol

[0065] Amphenol is a product catalog disclosing a broad array of electrical products that can be used to make electrical connections or junctions between cables and other elements in an electrical system. EX1007, generally. The catalog states “Amphenol designs, manufactures and markets

electrical, electronic and fiber optic connectors, interconnect systems, and coaxial and specialty cables...and provides solutions for customers in the automotive, broadband, industrial, information technology and data communications, military and aerospace, mobile devices and mobile networks markets.” EX1007, p. 2. This includes cables, cable assemblies, and other elements used in solar installations. *See id.*, pp. 2-16, middle image (1st-annotation), reproduced below.



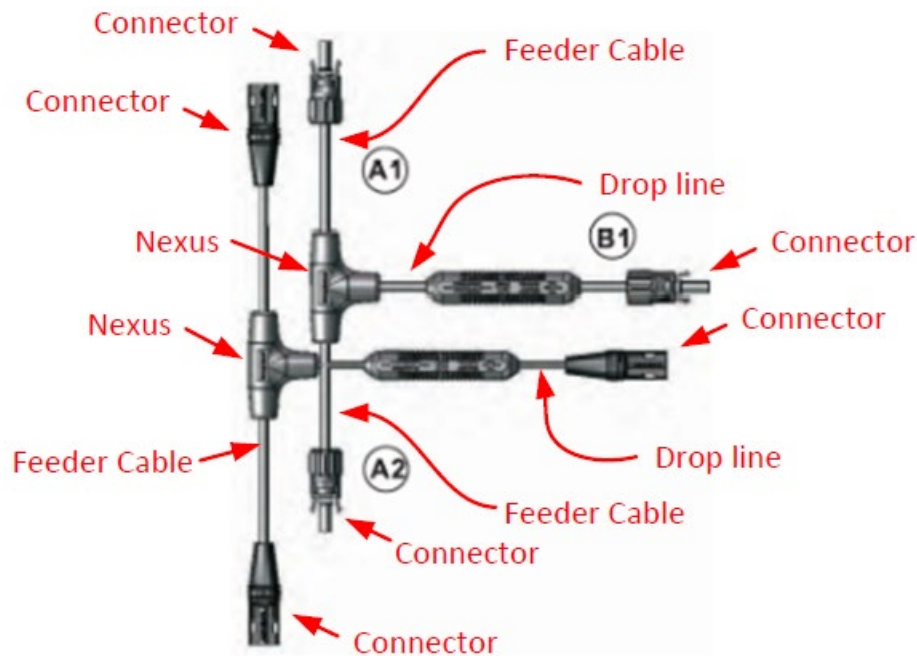
EX1007, p. 5, middle image (1st-annotation)

[0066] I have been informed by counsel that Amphenol was not identified to or considered by the Examiner who allowed the '254 Patent. I have also reviewed the declaration of Gary Joseph, EX1024, which I understand corroborates Amphenol as prior art. For further support, I used the Internet

Archive Wayback Machine at <https://web.archive.org> to view web captures of Amphenol's website (<https://amphenol-industrial.com>) in the 2012-2014 time frame. I noted, for example that on the September 5, 2012 web capture, the front page under "NEWS" includes a link titled "Visit us at Solar Power International 2012" which links to information regarding Amphenol's booth at the SPI 2012 conference, referenced in Mr. Joseph's declaration. I also noted links under "LITERATURE" for "Catalog", which included an icon for "Solar Catalog", consistent with my understanding of Mr. Joseph's declaration regarding the public availability of Amphenol. While I have not relied on any datasheets for specific products disclosed in Amphenol, I further note that also under "LITERATURE", there is link titled "Data Sheets" and within, there is an icon entitled "Overmolded Solar Junctions". The same icons appear under the "Catalog" and "Datasheet" links in web captures from 2013 and 2014. EX1027.

[0067] Amphenol specifically illustrates and provides specifications for cable installations for solar cell arrays including solar panels, wiring harnesses, and lead assemblies each with a feeder cable, drop lines, and connectors. *See id.*, e.g., pp. 3-13. In Amphenol, the lead assemblies are referred to as "junction cable assemblies," and a variety of such assemblies are disclosed. e.g., pp. 5 and 13. Each of the variety of disclosed junction cable assemblies

address the general problem of providing convenient, flexible, reliable, and low-cost wiring connections for solar cell installations. *See id.*, p. 21, top image, reproduced below.



EX1007, p. 21, top image (1st-annotation)

[0068] Also, in Amphenol, the lead assemblies include a feeder cable, which is referred to as a “main cable,” and drop lines, which are referred to as “branch cables.” *See id.*, p. 21, generally. From well-known practices in the field of solar power systems (e.g., EX1010) and illustrations in Amphenol (e.g., EX1007, p. 5, middle image reproduced above), a POSITA would understand that a solar power installation is one example of a system that employs cables and connectors for electrical connections, and one that includes a number of individual solar panels and a set of cables that connect

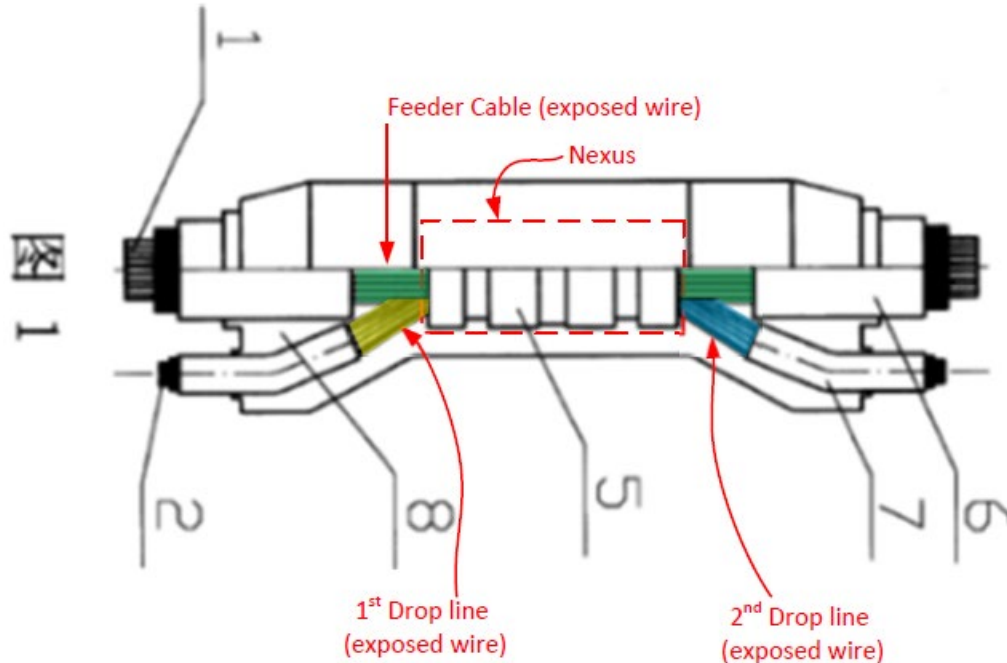
the solar panels to a common terminal at the inverter, and that this set of cables would include wiring assemblies that provide a convenient conductive structure for making electrical connections with individual solar panels in large solar power installations. Also, from well-known practices in the field of solar power systems, a POSITA would understand that such cables need to be joined together at a single terminal to the inverter or alternatively be brought together at an intermediate combiner box (e.g., EX1010, Figure 690.1(B), p. 544).

(ii) Shao

[0069] Shao is Chinese patent CN 2785100, published May 31, 2006. *See* EX1008, cover page. Shao was not identified to or considered by the Examiner who allowed the '254 patent. This patent is titled, "Power cable with bi-directional K-type branch." *See id.* Shao particularly discloses a K-shaped branch connector structure that:

"...can enable single-branch-joint double- branch power distribution. The branch lines are led out in an upper direction and a lower direction of the branch joint, respectively and can be led to two floor power distribution boxes, respectively. The branch lines no longer need to be bent and turned, so that one branch joint can be omitted, a space occupied for mounting is small, and a line can also be simple and clear."

See EX1008, Abstract and FIG. 1 (1st annotation), below.



EX1008, FIG. 1 (1st-annotation)

[0070] I have been informed by counsel that Shao was not identified to or considered by the Examiner who allowed the '254 Patent.

[0071] Shao describes details of construction of a k-branch connector which combines a bi-directional feeder cable with a pair of branch cables to provide an element of a cable harness for a solar cell installation. *See* EX1008, Abstract. “One trunk conductor and two branch-line conductors are symmetrically overlapped and crimped by means of the K-shaped branch connector 5 to form one joint and two branchline conductor out-leads, and directions of the branch-line conductor out-leads are opposite.” *Id.*, 6:18-22. “A K-shaped branch connector outer sheath 8 is made of an injection molding material of injection molding grade, and a trunk outer sheath 6 and

branch-line outer sheaths 7 are made of polyvinyl chloride, polyethylene or low-smoke zero-halogen polyolefin, ensuring that the connector outer sheath and the cable outer sheath are similar in the terms of material and are tightly combined,” *Id.*, 6:24-30. “The bidirectionally led branch lines are a whole cable, so that the workload of peeling the cable during production can be decreased, the branch connection reliability of the branch lines can also be improved, and the service life of the branch joint can be prolonged.” *Id.*, 5:31-34.

(iii) Yamawaki

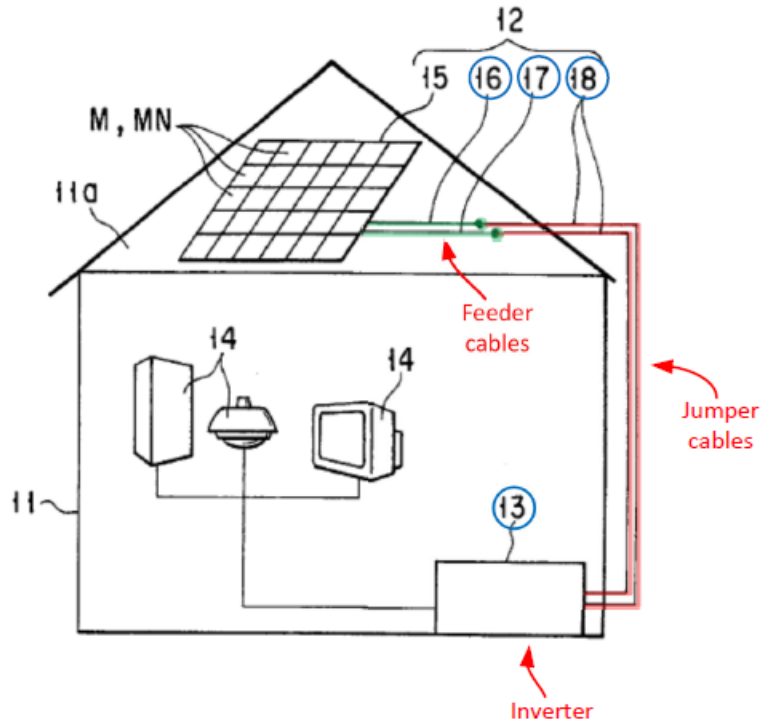
[0072] Yamawaki is U.S. Patent No. 6,268,559, issued July 21, 2001, titled, “PHOTOVOLTAIC GENERATION SYSTEM, WIRING APPARATUS FOR PHOTOVOLTAC GENERATION SYSTEM, AND WIRING STRUCTURE THEREFOR.” EX1006, cover page. Yamawaki addresses an existing challenge in solar installations, namely “fetching outputs conventionally requires use of many wiring apparatuses, so that the installation of the photovoltaic generation system on a roof or the like costs much labor. Accordingly, there is a high possibility of misconnection. Since a large hole for a lot of wiring apparatuses must be bored through a wall of the building, so that sealing the building against rainwater and the like entails labor.” *See id.*, 2:5-11.

[0073] I have been informed by counsel that Yamawaki was addressed in prosecution, and that the Examiner asserted Yamawaki against various claims including the independent claims, but that the assertions by the Examiner regarding Yamawaki were not overcome by Applicant. *See* EX1002, pp. 143-151, 169-171, 177-185, 201-203, 219-225.

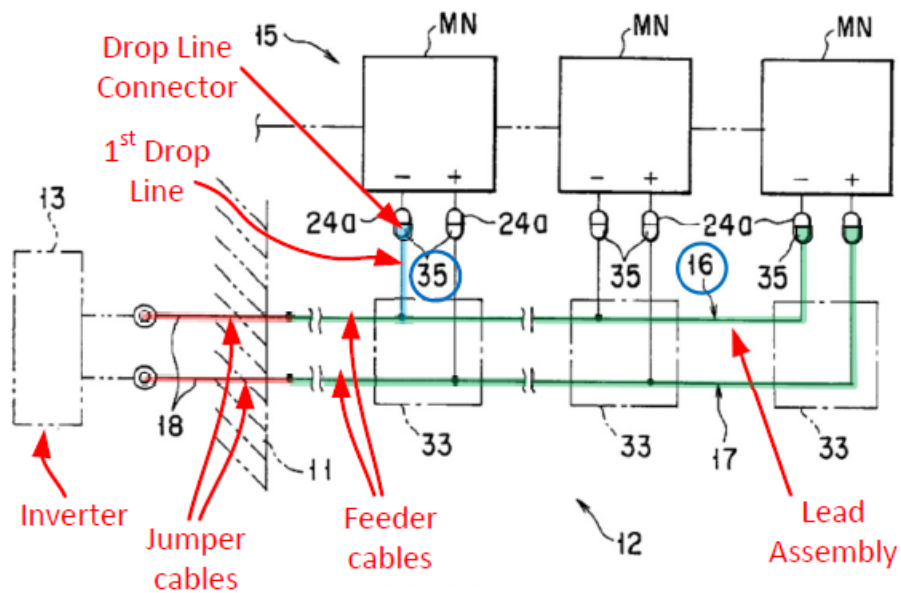
[0074] Yamawaki describes an improved system to address this challenge:

A plurality of photovoltaic modules, which are arranged side by side on a roof of a building or the like, or module units, composed of the modules, serve as generating sections. The respective outputs of the generating sections are lead into the building by means of a trunk conductor of the trunk cable. Each branch cable includes a branch conductor that is connected to the trunk conductor of the trunk cable. Each branch cable of the wiring apparatus is connected to a connector for use as an output terminal of the module units by means of a connector attached to the distal end portion thereof. The module units are connected in parallel with one another by means of the wiring apparatuses, and their respective outputs are supplied to loads in the building by means of a pair of lead-in wires.

EX1006, Abstract. As shown in Yamawaki, FIGS. 1 and 2, reproduced below with annotations, the feeder cables (i.e., wiring apparatus 16, 17) from the photovoltaic modules or module units (i.e., M, MN) connect the individual solar cells (i.e., photovoltaic panels 15) directly to an inverter unit 13 via jumper cables (i.e., lead-in wires 18). *See id.*, 7:54-8:11.



EX1006, FIG. 1 (1st-annotation)



EX1006, FIG. 2 (1st-annotation)

[0075] Although Yamawaki discloses “a photovoltaic generation system 12 attached to a building” and includes an example of that building that is

described as a house (11), which is generally considered a residential (i.e., non-commercial) application, as discussed below I believe that Yamawaki teaches and discloses systems suitable for commercial applications.

[0076] A POSITA would understand that the primary distinction between small-scale and large-scale solar installations is the number of solar panels, and the total current that is generated and combined prior to the inverter. As the current moves from the individual panels through the harnesses and assemblies, each successive combination of cables progresses to an increase in the output current carried by the “trunk” or “feeder” cables. In order to accommodate the larger currents in each successive stage of the system, a POSITA would understand and consider the safe operation of electrical wiring for the anticipated current passing through the various cables, and which may be standardized via various regulations, amongst which may relate the size of the wire to the current being carried. As discussed below with respect to Table 310.16 of the NEC 2002, titled “Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts...” (see EX1010, p. 148), a POSITA would consider selection of cable diameters at each section of an installation to meet the requirements at that stage.

[0077] Yamawaki describes assemblies without limiting the structures to specific ranges of cable diameters or current capacities, and therefore a

POSITA would understand that the disclosure of Yamawaki could be utilized for components of small-scale installations and large-scale installations, including components directly connected to the solar panels where the currents are at relatively low levels, all the way to components that are merging larger currents already gathered from many solar panels, all the way to the last stage prior to an inverter in a large-scale installation. *See* EX1010, generally.

[0078] Yamawaki also provides descriptions of assemblies with smaller current connected to more assemblies for larger current, connected to even more assemblies for even larger current, which is delivered to an inverter. Specifically, Yamawaki FIG. 3 and its related description provides details of the branch cables 32 and junctions 33 that gather and combine current from several modules (MN) and deliver this current to wiring apparatuses 16 and 17. *See* EX1010, 8:15-20 and FIG. 3. Further, in FIG. 3, we see that the currents from several wiring apparatus 16, 17 are ultimately merged at branch junction 36 of the final lead-in wire assembly 18. *See id.*, 12:3-13 and FIG. 3. Yamawaki FIG. 14 provides details of connections within the module units MN that includes several modules M, which includes wiring apparatus 19 that includes branch cables 32 and junctions 33. *See id.*, 17:19-26 and FIG. 14. Taken together, in Yamawaki, the following may be

observed:

- i. In FIG. 14, there is a wiring apparatus 19 with branch cables (32) and junctions (33), intended to combine the small-scale currents from individual modules (M) within a module unit (MN) to form medium-scale currents at the module outputs. *See id.*, 17:19-26 and FIG. 14.
- ii. In FIG. 3, the medium-scale outputs of the module units (MN) detailed in FIG. 14 are shown emerging from the units and are further connected to a next-level wiring apparatus (16, 17) via branch cables (32) and junctions (33), which combines the medium-scale currents from the module units to large scale currents in the wiring apparatus (16, 17). *See id.*, 8:15-20 and FIG. 3.
- iii. FIGS. 1-3 further illustrate that all of the large-scale currents from apparatuses (16, 17) are further combined into another lead-in wire assembly (18) at branch junction (36), producing an even larger-scale current that is delivered to the inverter (13). *See id.*, 8:1-11, 11:35-42, and FIGS. 1-3.

[0079] In these sections, we see that Yamawaki discloses an apparatus within

the module unit (MN) with branch cables (32) and junctions (33), and then discloses an apparatus (16 and 17) that combines currents from multiple module units, again using branch cables (32) and junctions (33), and further describes a lead-in cable that includes cables and junctions. In this regard, Yamawaki is describing apparatuses intended for combining currents for at three different scales. *See id.*

[0080] Further reinforcing the understanding that sequential combinations of currents from small to medium to large scale can be achieved using successive apparatuses, Yamawaki additionally discloses that this apparatus can be exchanged for one another at different scales by reciting that “[i]n the wiring structure of FIG.3 that includes the wiring apparatuses 16 and 17, the trunk cables 31 may be arranged so as to double as lead-in wires 18. In this case, the trunk cables 31 of the wiring apparatuses 16 and 17 connected to the module unit MN are extended into a housing, and the extended portions of the trunk cables 31 are used as lead-in wires 18. If the trunk cables 31 have a branch junction 33, they can be used in place of the branch junctions 36 which have branch lines 36 as described above.” EX1010, 12:54-63. Therefore, Yamawaki discloses that trunk cables can “double as” or “be used in place of” the lead-in wires. *See id.*

[0081] Yamawaki, in some later embodiments (referred to therein as “fifth

embodiment” and “sixth embodiment”) discloses some additional details relating to the connections that may be formed at various points in the trunk cables to improve flexibility and adaptability of the system design. *See id.*, 18:6-15 and FIGS. 18A, 18B, 19A, and 19B (fifth embodiment) and 19:45-55 and FIGS. 20 and 21 (sixth embodiment). The details provided in these later embodiments do not limit the broader scope of the disclosure of Yamawaki with respect to the apparatuses shown in FIGS. 1, 3, and 14. For Example, Yamawaki explicitly states that, “[f]or other functions and effects than those described above, the fifth embodiment resembles the first embodiment...” *Id.* 19:40-42. Therefore, in as much as Yamawaki describes features with respect to the fifth and sixth embodiments that might require use of pre-fabricated consistent cables of consistent size throughout portions of the apparatus, the first embodiment of Yamawaki clearly contemplates combining currents from small to medium to large scale, and a POSITA would understand that the cables used at various locations throughout a system like this could use a variety of cable diameters at different stages to minimize cost and weight. *See id.*, generally.

(iv) '254 Patent Terminology

[0082] Although the '254 Patent claims use particular terminology for various elements of its wiring assemblies (e.g., “lead assembly,” “feeder

cable,” drop line,” and “wire harness”), a POSITA at the time the ’254 Patent was filed would understand that such terminology is not universal within the industry. *See* EX1010, Article 690, pp. 543-552 and EX1011, generally. For example, neither the NEC 2002 nor the PSE textbook uses these terms. *See id.* A POSITA familiar with the selection of suitable electrical wiring and connectors (e.g., EX1010, 690.8 Circuit Sizing and Current, p. 546), including photovoltaic wiring and connectors, would understand that the terms “wire harnesses” and “lead assemblies” both refer to wiring assemblies used for organizing and facilitating electrical connections within electrical power systems.

[0083] A POSITA familiar with the selection of suitable electrical wiring and connectors (including the cables, connectors, fuses sometimes grouped under the description of “Electrical Balance Of Systems” (EBOS) components in solar power systems) (e.g., EX1010) and familiar with the basic physical and electrical principles of current conduction in cables and connectors would understand that components described in the ’254 Patent as “wire harnesses” and “lead assemblies” are generally similar physical, electrical, mechanical and chemical structures for devices used for power combining or for power distribution. In particular, the materials and dimensions of their construction and the physics of their operation are the

same and/or analogous. The distinctions in the role played by these cable assemblies do not change the materials and dimensions of wiring assemblies used in power gathering or power distribution systems. For example, the Yamawaki reference, which like the '254 Patent relates to photovoltaic generation wiring and systems, uses the terms “wiring apparatus,” “trunk cable,” “branch cable,” and “branch junctions,” for electricity conducting elements that the '254 Patent calls the “lead assembly,” “feeder cable,” “drop line,” and “joint,” respectively. *See* EX1006, 9:57-10:19. Similarly, Solon741 -- which has the same inventor as the '254 Patent -- like the '254 Patent relates to photovoltaic generation wiring and systems, uses the terms “wire harness,” “trunk,” “branch,” and “cross joints,” for electricity conducting elements that the '254 Patent calls the “lead assembly,” “feeder cable,” “drop line,” and “joint,” respectively. *See* EX1005, ¶29.

[0084] Despite the variations in terminology commonly used in the field of photovoltaic power systems, a POSITA would appreciate that the basic electrical wiring and connector elements perform similar functions and have similar requirements. *Id.* Solar power electrical wiring and connector assemblies all include junctions between cables and serve to merge or divide current from a power generation system or a power distribution system. For example, the lowest current wires may feed or drop into a larger connecting

line that carries the higher current to another larger line that receives current from multiple connecting lines. Accordingly, a POSITA familiar with the design of such electrical wiring and connectors (e.g., EX1010 and EX1011) would have understood that the solar array includes a hierarchy of branches where the wires and connections can have different names despite operating in the same manner in the same hierarchy.

[0085] A POSITA familiar with the design of electrical wiring and connectors (e.g., EX1010 and EX1011) would have understood that main cables supplying power and carrying higher currents may be called “trunks,” “trunk cables,” “trunk conductors,” “main cables,” “feeder cables,” or the like. *See* EX1005, ¶¶ 13, 27-28; EX1006, 3:20-30; EX1002, pp. 130-132, 143. Similarly, the smaller diameter cables branching off a main cable and carrying lower currents may be called “branches,” “branch cables,” “branch conductors,” “branch lines,” “drop lines,” or the like. *See* EX1007, p. 13; EX1008, p. 4; EX1002, p. 150. Also, wiring assemblies that join electrical components and/or wires may be called “wire harnesses,” “lead assemblies,” “wiring apparatus,” or the like depending upon local and/or regional parlance. *See* EX1005, ¶¶ 25-26, 39; EX1001, 2:5-20. A POSITA would understand that the main difference between cable junctions used for merging or dividing current flow is the direction of the current flows into or

out of the junctions – there is no underlying physical, electrical, chemical, or mechanical phenomena that would distinguish these junctions based on the direction of the current flow. A POSITA would have understood that it is important to use appropriately sized cables for the intended application, (which may be specified via regulations or codes, such as those set forth in the NEC 2002), have very good electrical connections within these junctions, and provide protective moldings to prevent the effects of external environments from causing corrosion or failure of the cables and junctions.

[0086] The requirements and certifications expressed in the NEC 2002, Article 690, are associated with EBOS components, such as harnesses and connectors similar to those described in the '254 Patent. These requirements were initially implemented during the emergence of the solar power industry in the 1980s to ensure safety during installation and operation of solar systems, and to provide a pathway for implementation of building codes which can be applied across jurisdictions in a consistent and reliable manner. These regulations and codes are intended to provide an installer, who might not possess the qualifications of a POSITA as defined in these proceedings, guidance in the selection of components and the design and installation of solar systems that will work safely and reliably together. There is nothing in these codes for cables and connectors that is dependent on any unique

physical, electrical, mechanical, or chemical characteristics associated with solar energy – once the electrons leave the solar panel, they are simply electrons moving in wires, just like electrons from any other energy source moving through any other wires. The purpose of the codes and regulations in the solar industry is to enable an installer without any specialized understanding of solar energy, understanding of the electrical operation of such systems, or the additional qualifications of a POSITA as defined in these proceedings, to be able to select components from a pre-approved list of EBOS components and assemble them according to codes in a way that will be safe and reliable during installation and use.

[0087] In contrast with a solar installation technician, a POSITA as defined in these proceedings would understand the benefits of the details disclosed in the '254 Patent, and the similarity to the benefits of details disclosed in the prior art references cited in this declaration. A POSITA would understand that *electrons are electrons*, no matter where they come from or go to, and that the performance of electrical connections and molded protection layers are similarly not dependent in any way on where the electrons came from or are going to. Likewise, a POSITA would understand that the direction the electrons flow is irrelevant to the structural limitations of the "undermold" of a "first aperture" and "second aperture" proposed by the Examiner (including

their relationship to one another and the undermold, and whether they extend partially or completely through the undermold structure). A POSITA would instead understand that the claimed "apertures" are 3-D holes within the undermold structure. This is consistent with my review of the Markman Order's discussion of "aperture" in the parallel ITC proceedings. EX1017.

[0088] The '254 Patent describes the objectives of the claimed invention as “there is a need for a device that renders a combiner box unnecessary. It is desirable that this device is small, inexpensive to manufacture and transport, and easy to use. It is also desirable that the device is extremely durable and can be adapted for a variety of circumstances.” EX1001, 1:50-54.

[0089] A POSITA familiar with the design of electrical wiring and connectors (e.g., EX1010 and EX1011) would further understand that a combiner box is one example of a convenient means for merging current from several lead assemblies to a single cable that is applied to the terminal of the inverter. Such a POSITA would also understand that the cable assemblies may be arranged so that all of the currents from some or all of the power sources (e.g., solar panels) in the installation are brought together through a series of junctions and or branch structures to a single cable that can be applied to the terminal of the inverter without need for a combiner box. For example, Yamawaki demonstrates this in various illustrated

schematic drawings disclosed therein. *See* EX1006, FIGS. 2-7.

(v) *Motivation to Combine Amphenol and Shao*

[0090] A POSITA would have been motivated to combine the teachings of Amphenol and Shao (i.e., the “Amphenol-Shao combination”) for the reasons set forth below.

[0091] Both Amphenol and Shao address the general problem of providing convenient, flexible, reliable, and low-cost wiring assemblies for power applications. *See* EX1007, generally; EX1008, generally. Amphenol is concerned with wire assemblies, cable junctions, connectors, in-line fuses, and other components to be used for combining and distributing power from elements of a solar array installation. *See* EX1007, generally. Shao is also concerned with the field of wires (i.e., cables) and more specifically the detailed design of a cable junction to be used for power distribution. *See* EX1008, generally. These references discuss the design of cable junction elements that can be used to combine or distribute electrical power. The important details disclosed in Amphenol and Shao relate to the formation of a reliable electrical contact between different cables, protecting the connection from environmental factors and damage from handling, and fabricating the electrical contact elements in a way that reduces cost and simplifies the assembly and maintenance of the power facilities. Amphenol

focuses on solar array electrical connection systems, and Shao compliments this by focused on power distribution connections of cables and the geometric features and methods of forming molded protection layers of those connections, but the underlying mechanics, materials, assembly processes, molding processes, and other details are similar such that a POSITA would have been motivated to consider both publications in combination. *See* EX1007, generally; EX1008, generally. Fundamentally, within a cable junction, the most significant difference between power combining and power distribution is the direction in which that electrons are moving in some parts of the junction. Based on known practices, such as those included in the PSE textbook (EX1011) and the NEC 2002 (EX1010), a POSITA would understand how to apply the teaching of Shao to the wiring assembly disclosed by Amphenol to produce systems with the benefits sought in both references.

[0092] I have been informed by counsel that in order to determine whether a particular example of prior art is analogous to the claimed inventions of the '254 Patent requires satisfying at least one of two separate tests: "(1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference is still reasonably pertinent to the particular

problem the inventor is involved with.” *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004); *see also Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1379 (Fed. Cir. 2019).

[0093] I believe that Amphenol and Shao are in the same field of endeavor as the '254 Patent, and are thus analogous prior art, since both references relate to electrical wiring assemblies and connectors. Additionally, I believe that it would be reasonable and practical for a POSITA working in the field of wiring assemblies for solar energy installations, and concerned with cost, simplicity, performance, and reliability to look outside solar energy applications and to other related and more-established fields, such as electrical wiring and connectors more generally, for ideas that could lead to these sought-after improvements. *See* EX1001, cover.

[0094] Evidence that a POSITA working in the field of wiring assemblies for solar energy installations would look to the more general field of electrical wiring and connectors is that the Patent Examiner, during the prosecution of the '254 Patent, searched and cited references from classifications that are associated more generally with cables, connections, and packaging of cables (e.g., H01R). *See* EX1001, cover. For example, the Patent Examiner, during the prosecution of the '254 Patent, cited Vander Ploog (EX1023), which like Shao is not explicitly related to photovoltaic power distribution

systems, but is related to cables and connectors for cables. *See* EX1002, p.265. This consideration and citation of Vander Ploog by the Examiner demonstrates that the Examiner considered cables and connectors for cables to be analogous prior art to photovoltaic power distribution systems.

[0095] As the claims of the '254 Patent are primarily focused on means for forming connections between cables and the geometric features and methods of forming molded protection layers, a POSITA should be interested in looking to established fields where there are similar objectives. As mentioned above, the soldering and crimping methods for forming electrical connections described in the '254 Patent have been established for decades prior to the Critical Date of the '254 Patent. Also, methods for forming molded protection layers for electrical connections had been established decades prior to the Critical Date of the '254 Patent. In my opinion, a POSITA interested in wiring assemblies that achieve the stated objectives of the '254 Patent; namely to provide a device that is “small, inexpensive to manufacture and transport, and easy to use” and are “extremely durable and can be adapted for a variety of circumstances” would look to the established fields of electrical connections, cables and harnesses, and power distribution, as the disclosures available within these related fields would be reasonably pertinent to addressing the objectives stated by the author of the '254 Patent.

EX1001, 1:50-54.

[0096] Even though Shao does not explicitly disclose combining power in a solar energy installation, a POSITA would appreciate that the means for forming electrical connections between cables, the geometric arrangement and configuration of those cables being connected, and the means for protecting those cables and connections from the environment using injection molding, as described in Shao, could be applied to the products described in Amphenol. *See* EX1008, p. 6 and generally. Also, these disclosures by Shao would have been reasonably pertinent to the established objectives of Amphenol. A POSITA would expect to be successful in providing improved performance and reliability based on the combination of the Shao and Amphenol references.

[0097] Amphenol and Shao are not cumulative to any of the prior art cited during prosecution because Amphenol focuses on variations of cable assemblies, connectors, tools, and accessories and Shao addresses the details of forming connections between cables and the geometric features and methods of forming molded protection layers not disclosed by other prior art. Key elements in Amphenol, Shao, and all the other prior art references cited herein, relate to the fact that cable junctions are used to manage the gathering and/or distribution of power, particularly where a larger-diameter

cable is joined to one or more smaller diameter cables. More importantly, a POSITA would understand that the benefits of design elements and materials choices for any of these cable junctions are likely to apply to all of these junctions, as all of these elements are concerned with electrical system installations which rely on intersections between cables carrying small currents and large currents, used in situations that benefit from reliability, resistance to environmental factors, simplicity in installation, and maintenance and low cost.

[0098] As discussed above, the fundamental physical, electrical, mechanical, and chemical requirements for cable junctions to be used for combining current in a solar array cable harness and for distributing current in a power distribution cable harness are the same, and that elements of the design of the K-shaped branch connector in Shao would be considered by a POSITA interested in improvements to the cable junctions disclosed by Amphenol. As one example, the K-shaped branches of Shao are described as being useful for power distribution within buildings, where the current flow is in the vertical direction. Some might wonder if the horizontal arrangement of most solar installations, where the current flow is generally in the horizontal direction, presents any unique challenges to designers of solar installations. Of course, a POSITA would understand from their education that the mass

of electrons is infinitesimal (literally $<10^{-27}$ grams each), and that the electrical forces on electrons are many, many, many orders of magnitude more important than gravitational forces, and so the orientation of electrical components with respect to gravity is irrelevant. For example, the well settled relationship between voltage (V), current (I), and resistance (R) as defined by Ohm's Law is $V = IR$, which does not consider gravitational terms. A specialized version of Ohm's law that considers height differentials (h_1, h_2), object mass (m), gravity (g), and electric charge (e), which is $V = IR + (h_1 - h_2)mg/e$, might be considered to be relevant only under specific and extreme scenarios where gravitational potential differences might impact the electrical measurements, such as in certain special types of sensors or experimental setups. Generally, in electrical engineering and physics, the simple version of Ohm's Law is sufficient because the gravitational term (i.e., $(h_1 - h_2)mg/e$) is several orders of magnitude smaller than the resistance term (i.e., IR).

[0099] A POSITA would appreciate the fact that the disclosure of Shao would provide useful details for the design and assembly of a cable junction. Further, a POSITA would understand that there may be some practical differences in the details for the design of power combining and power distribution cable assemblies in specific situations.

[0100] A POSITA would also understand that the details of Shao, which include bringing wires together, removing a portion of the insulation, crimping the cables together, and providing a molded outer sheath would be useful in the design and manufacture of the cable junctions disclosed by Amphenol. Specifically, a POSITA would appreciate that the details disclosed by Shao could be used together with the teachings of Amphenol to provide cable junctions that have increased reliability, improved resistance to environmental factors, provide a low profile installation configuration, and would be easy to install. In this regard, a POSITA would understand how to apply the teaching of Shao (stripping and crimping of wires, molding to protect the exposed elements of the junction) to the wiring harnesses disclosed by Amphenol to produce systems with the benefits sought in both references. A POSITA would understand that the resulting improved components could be tested and validated as needed to meet the specific requirements associated with regulations in the solar industry as happens with any new or revised products in this or any other electrical-related industry.

[0101] As discussed above, the fundamental requirements for cable junctions to be used for combining current in a solar array cable harness and for distributing current in a power distribution cable harness are the same.

Therefore, the elements of the design of the K-shaped branch connector in Shao could be considered by a POSITA interested in improvements to the cable junctions disclosed by Amphenol, and such a person would be able to apply the elements from Shao to the designs of Amphenol in a way that provided improvements which could be used in solar installations.

[0102] A POSITA would understand that the solar power system junctions disclosed by Amphenol could be designed and manufactured using the fabrication processes disclosed by Shao, such as the details associated with overlapping and crimping the cable and the pair of drop lines within the assembly, which ensures electrical contact between the feeder cable and the drop lines. Additionally, Shao discloses using insulation layers and injection molding to form the protective packaging around the nexus of the cables. The wire harness and lead assembly designs disclosed by Amphenol (*see* Figures on pages 6 and 21 from Amphenol, above) would obviously benefit from the features disclosed by Shao, as related to the design and manufacture of the K-shaped branch structure shown in Figure 1 from Shao, which provide “good insulation performance, heat resistance stability and overheating aging performance.” *Id.*, 6:40-7:1. Although the K-shaped connector disclosed in Shao is described in the context of power distribution between two areas (e.g., between two floors), a POSITA would consider a

wide range of applications for the electrical connector designs disclosed in Shao. For example, a POSITA would consider the contributions disclosed by Shao, such as the way wires are connected, the compact wiring configuration, and the injection molding layer that can withstand environmental conditions, like extreme moisture, as well as the resistance to tension loads from forces (e.g., wind) acting on cables, which is what is needed for solar installations. *See id.*, 5:27-40. The extended copper C-shaped clamp in the Shao's K-shaped connector provides both an electrical and mechanical joint, resulting in a robust physical connection of the drop lines to the main. *See id.*, 7:7-26 Shao also emphasizes the importance of connection reliability, a low-profile design that occupies a small mounting space, and eliminating extra branch joins, as well as moisture and water proofing that would also be important for the solar power installations of Amphenol. *See id.*, 5:27-31,37-40. A POSITA would consider the use of details provided by Shao to form the branch elements in the broader variety of cable assemblies disclosed by Amphenol in order to capture the features and benefits of the Shao junctions throughout the harnesses of Amphenol. In particular, the details in Shao associated with overlapping and crimping the cable and drop lines within the assembly and using insulation layers and injection molding to form the packaging around the nexus of the cables

would be understood to provide a concise installation with increased service life. *See id.*, 6:18-30.

[0103] Stated more directly, Amphenol discloses solar power system components that are obviously intended for use in outdoor settings, because outdoors is where the sunlight is available for capture and conversion to energy. Installations such as those disclosed in Amphenol are obviously intended for reliable capture and conversion of sunlight for years of use because reliable operation, over extended periods, is required because years of use are needed to create enough economic benefit to overcome the cost of the initial installation. A POSITA tasked with designing or assembling wiring components would be interested in any disclosures that could provide improvements in reliability, flexibility, structural integrity, and cost of the components. Specifically, a POSITA would appreciate that the cables, connectors, and junctions disclosed in Amphenol can be improved by incorporation of details from a reference such as Shao, as the basic characteristics of cable junctions in Amphenol and Shao are the same. Specifically, the detailed description of overlapping and crimping cables, and the formation of insulation and protection by injection molding from the power distribution k-shaped branch connector of Shao would be understood by a POSITA to provide a more robust connection with the benefits of

improved reliability and simplicity if used for the assembly of at least some of the cable junctions of Amphenol for solar power combining applications.

[0104] Additionally, a POSITA would consider replacement or addition of the connectors in the wire assembly of Amphenol with the K-shaped branch connectors disclosed by Shao for providing additional branches at each junction while minimizing connectors needed to do so, and for addressing the reliability and performance benefits disclosed in the abstract of Shao, including:

The branch lines no longer need to be bent and turned, so that one branch joint can be omitted, a space occupied for mounting is small, and a line can also be simple and clear. The bidirectionally led branch lines are a whole cable, so that the workload of peeling the cable during production can be decreased, the branch connection reliability of the branch lines can also be improved, the service life of the branch joint can be prolonged, and the power cable has a very good popularization and application value.

EX1008, Abstract.

[0105] Although Shao, like Amphenol, does not explicitly refer to the cables and wiring assemblies as “drop lines,” “a feeder cable,” “lead assembly,” “a wire harness,” or “a central trunk,” as discussed above, a POSITA would understand that the disclosed cables and wiring assemblies correspond to and/or analogous to drop lines, a feeder cable, a lead assembly, a wire harness, and/or a central trunk.

[0106] Also, a POSITA would have an expectation of success in combining Amphenol and Shao since Shao complements the disclosure of Amphenol by disclosing design and materials that are appropriate choices for these junctions while also providing alternative connector configurations and advantages thereof. A POSITA that selects components for a solar energy installation and performs the installation would be familiar with the families of components, wire harnesses and lead assemblies disclosed in Amphenol, and would appreciate the benefits of the details provided by Shao in design and manufacturing of reliable and easily utilized branch structures. Further, the K-shaped branch connectors disclosed by Shao could be spliced into cables and wire harnesses of Amphenol using the assembly processes taught in Shao as well as ordinary electrical practices.

[0107] For these reasons, a POSITA would be motivated to combine the teachings of Amphenol and Shao because the wire harnesses, lead assemblies and solar photovoltaic power generation systems disclosed by Amphenol are intended for use in an environment subject to exposure to physical harm and would benefit from added protection from the elements and improved reliability for the branch structures provided by the more robust design and manufacturing processes for the connectors disclosed in Shao.

[0108] For these reasons, I believe a POSITA would be motivated to combine Amphenol and Shao to arrive at the Amphenol-Shao combination.

(vi) Motivation to Combine Amphenol, Shao, and Yamawaki

[0109] A POSITA would have been motivated to combine the teachings of Amphenol and Shao with those of Yamawaki (i.e., the “Amphenol-Shao-Yamawaki combination”) for the reasons set forth below.

[0110] As noted above, the Amphenol-Shao combination discloses an enhanced lead assembly with a compact protective insulating case that a POSITA would appreciate may be used in a solar energy installation. Similar to Amphenol, in combination with Shao, Yamawaki discloses photovoltaic modules that may be arranged in various ways to overcome challenges and support the design of a photovoltaic panel array, such as on a home solar energy installation. *See* EX1006, 7:54-8:11. Within this disclosure, Yamawaki demonstrates that the feeder wire of a wire harness may be connected to an inverter, such as directly or via another cable. *See id.*, and FIGS. 4-6, which are reproduced herein. Yamawaki teaches that including intermediate wire harnesses can provide a practical and obvious way to combine the current from a collection of panels, and that such intermediate cable assemblies provide a practical and obvious way to combine the current from a collection of wire harnesses for delivery to a

final terminal of the inverter or combiner box. *See* EX1006, FIGS. 1-5.

Thus, Yamawaki complements the Amphenol-Shao combination by teaching that the structure of photovoltaic power connectors may be directly connected to an inverter. Yamawaki discloses that it was known to include wire harnesses coupled to other wire harnesses and cable assemblies for combining the current from solar panels to deliver to a common connection point, such as the inverter or junction box. *See id.*, FIGS. 3-7.

[0111] I believe that Amphenol, Shao, and Yamawaki are analogous prior art because they are in the same field of endeavor as the '254 Patent. Not only do all three references relate to electrical wiring assemblies and connectors, but Amphenol and Yamawaki are more particularly directed to solar power wiring assemblies like the ones claimed in the '254 Patent.

[0112] Yamawaki complements Amphenol and Shao by teaching that the structure of photovoltaic power connectors at any scale may be directly connected to an inverter.

[0113] Amphenol discloses a variety of cable junction geometries allowing users to select combinations for wire harnesses and cable assemblies that are appropriate for their system configuration. Shao discloses details of the connection (stripping, crimping, molding) and arrangement thereof that can be used for joining the main cables and drop lines and providing insulation

and molding to protect the junctions. Yamawaki provides further improvements to branch junctions that include a molded body (i.e., an undermold) covered by a cover member (i.e., an overmold). *See* EX1006, 10:19-22 and FIG. 9B. In addition, Yamawaki discloses that such branch junctions provide water-resistance and improved reliability. *See id.*, 13:15-18.

[0114] A POSITA would be motivated to combine the teachings of Amphenol, Shao, and Yamawaki, specifically the addition of the overmold, in the form of a cover member, over an undermold to achieve further improvements in reliability and performance such as the “water-resistance” as described by Yamawaki. Further, a POSITA would have been motivated to use these detailed junction designs, processes, and materials of Shao and Yamawaki, to build the entire catalog of wiring harness components disclosed by Amphenol suitable for small-scale and large-scale installations, and with specific designs suitable for current ranging from the smallest to the largest amounts contemplated in the guidelines provided in the NEC 2002. *See* EX1010.

[0115] Although Yamawaki, like Amphenol and Shao, does not explicitly refer to the cables and wiring assemblies as “drop lines,” “a feeder cable,” “lead assembly,” “a wire harness,” or “a central trunk,” as discussed above,

a POSITA would understand that the disclosed cables and wiring assemblies correspond to and/or analogous to drop lines, a feeder cable, a lead assembly, a wire harness, and/or a central trunk. *See* ‘A(v) Motivation to Combine Amphenol and Shao,’ discussed above. In fact, as discussed above, Yamawaki discloses that various elements with different labels “...can be used in place of” one another in a solar power system, which further blurs any distinction that might be associated with the labels used to describe the elements of these systems. *See* Yamawaki, 12:60-62.

[0116] A POSITA would have had an expectation of success in combining the Amphenol-Shao combination with the teachings of Yamawaki because the photovoltaic modules and wiring junctions in Yamawaki are intended for use with solar installations based on standard solar panels that generate similar current and voltage outputs to those disclosed in the Amphenol-Shao combination.

[0117] Also, as illustrated below, Amphenol provides examples of a variety of junction cable assembly elements that a POSITA would understand can be selected to match the design of a solar array installation. These assemblies include wires, insulation, and molded housings for different configurations of junctions that provide protection from corrosion or failure in the field during use. *See id.*, p. 5, bottom image.

Cable Assy and Diversity Junctions



EX1007, p. 5, bottom image

[0118] A POSITA would also understand that the basic objectives: merging current from power sources through a cable assembly that progresses from small diameter drop lines to larger diameter feeder cables and trunk busses is fundamentally a simple problem, which is solved by design of components with these characteristics:

- There must be very good, low-resistance connections between the cables at the cable junctions.
- The exposed metal of the wires and the crimps or solder joints must be protected from the external environment.
- The materials used as insulators and junction moldings must be chosen to withstand high voltage without arcing and must operate over extended periods through exposure to environmental factors.
- The systems should be easy to assemble and deploy, so

reliable easily operated connectors are important.

- The geometries of the cable junctions should make it easy to position and assemble the entire system.
- The elements of the system should not be any heavier than necessary.
- The overall system design can include design decisions around when and how to merge the power from elements of the array – through a distributed network of junctions and harnesses, or through large numbers of cables from each solar cell module all the way to a central combiner/inverter.
- The design decisions should reflect an awareness of the cost of the elements, and the component should make it easy to develop designs that meet requirements without being excessively expensive.

[0119] A POSITA would appreciate all of these factors, and be looking to ideas and inventions from the related fields of wiring, power distribution, and other domains where the above considerations are important.

Discoveries or good ideas from power distributions systems in fields other than photovoltaic energy would certainly be of interest to a POSITA considering developing improved elements for solar power installations.

[0120] As would be well-known to a POSITA at the time the '254 Patent was filed, the use of a lead assembly to collect power from a power source and feed it to a feed line simply distributes the functions of what had traditionally been centralized at a combiner box. *See, e.g.*, EX1007, generally. The combiner box can provide a convenient location for several individual cables to be brought together, and electrically merged using connectors or screw terminals that are easy for an installer to work with, and possibly including fuses in line with each cable, all in the same physical location— similar to an electrical panel/fuse box. Along with some benefits of a centralized combiner box, there can be some disadvantages, and costs, including the need to run many expensive separate cables from each section of the solar array all the way back to a central location, and reliability issues associated with the routing and protection of so many individual cables.

[0121] A POSITA would understand that decentralization (and vice versa, centralization) provides the benefits of either a distributed (or centralized (or hybrid)) system that would have been a common and obvious design choice. For example, if a problem arose, troubleshooting may be easier to complete in a distributed system, as only a portion of the system needs to be investigated and repaired, while the rest of the system could remain in operation. In contrast, a centralized system could see cost savings in only

needing a single node for a particular feature or requirement, rather than having this feature repeated at multiple locations in a distributed system. In either event, distributing the combiner box function to multiple points upstream toward the solar panels as discussed in the '254 Patent would have been a conventional and well-known option available as a design choice at the time of the '254 Patent when designing such a solar power installation, particularly as a system increased in size.

[0122] A POSITA considering the components available in the Amphenol brochure would have understood that it would be possible to combine the currents from elements of the solar array using cable junctions and other elements from Amphenol to eliminate the need for a combiner box, and to connect the outputs of the system directly to the inverter. *See* EX1007, generally. Yamawaki presents embodiments of systems that do not include combiner boxes and combines the current from the solar panels directly to an inverter. *See* EX1006, generally.

[0123] The disclosure of Yamawaki includes examples of many different cable harness architectures, including combinations of parallel and series combinations of power from solar cells and arrays, and many different arrangements for the cable harnesses, junctions, and connectors for bringing all of the power together from individual modules within module units, and

then from small or large collections of module units, all the way to a single cable pair for delivery directly to an inverter. A POSITA would appreciate that the system of combining power from numerous solar arrays and delivering that power to an inverter without the need of a combiner box, as taught by Yamawaki, provides easier installation, and more reliable operation while simplifying the overall system design.

[0124] Yamawaki's embodiments also provide examples for the overall system that would be comprised of elements such as those disclosed in Amphenol and Shao, and also provides descriptions of a double-molded cable junction that brings a feeder cable and a drop line together. A POSITA would appreciate that the elements of the cable junctions disclosed in Shao and Yamawaki could be combined with the overall cable harnesses described in Amphenol and Yamawaki to provide the entire wire assembly for a variety of solar installations, including rooftop-scale installations for a single home and larger-scale installations for industrial applications.

[0125] A POSITA would further understand and appreciate that Yamawaki's teaching of a complete system that can deliver the power from a solar array to an inverter without a junction box can be combined with examples of cable junctions and harnesses from Amphenol and the detailed description of the K-shaped cable connector of Shao to provide improved cable assemblies

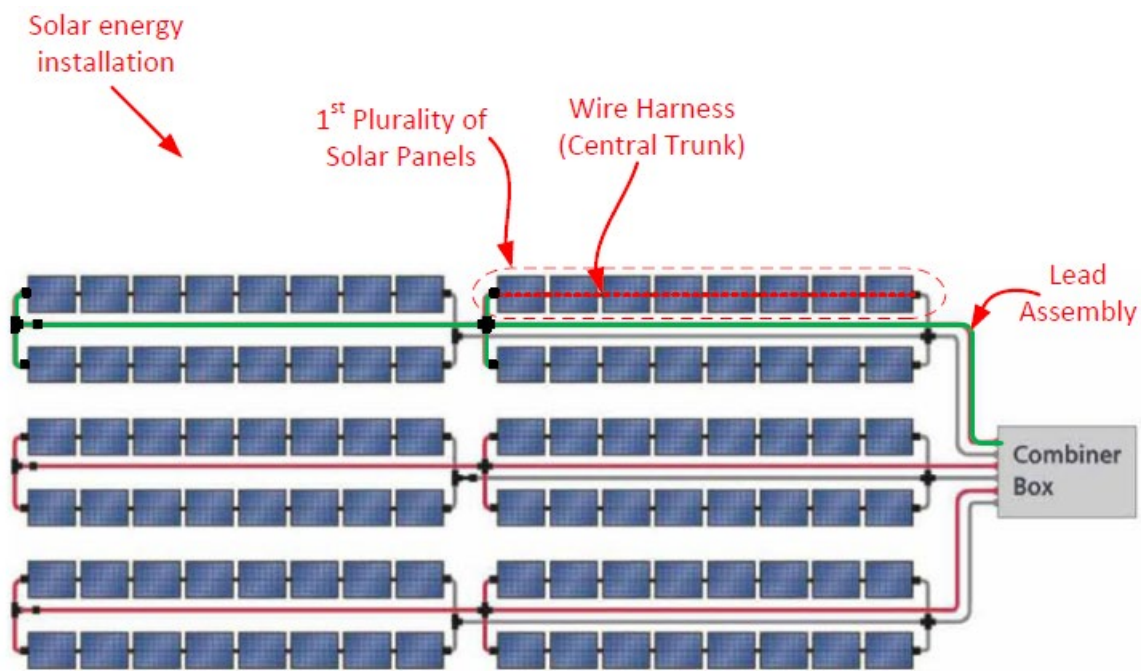
that provide easier installation, and more reliable operation while simplifying the overall system design.

[0126] For these reasons, I believe a POSITA would be motivated to combine Amphenol, Shao, and Yamawaki to arrive at the Amphenol-Shao-Yamawaki combination.

1. Claim 1

Preamble. A lead assembly for use in a solar energy installation including:

[0127] To the extent the preamble is limiting, Amphenol discloses and shows in an illustration of a lead assembly (annotated in green below) for use in a solar energy installation. See EX1007, p. 6, middle image (1st-annotation), reproduced below.



EX1007, p. 6, middle image (1st-annotation)

[0128] The specification of the '254 Patent does not explicitly define the expression “lead assembly,” other than to describe that a lead assembly includes a feeder cable with one or more drop lines branching off at joints. *See*, EX1001, Abstract. A POSITA would understand that a feeder cable is used to supply power from one point to another. Amphenol discloses a lead assembly (annotated in green below) for use in a solar energy installation. *See* EX1007, p.6, middle image (1st-annotation), below.

[0129] A POSITA would understand that a solar power installation of Amphenol includes a number of individual solar panels and a set of cables that connect the solar panels to a common terminal of an inverter. That set of cables would include one or more wire harnesses that provide a convenient structure for making connections to and between the individual solar panels. In addition to the wire harness(es) connecting series of solar panels, the set of cables would also include lead assemblies that are connected to the wire harnesses and come together at a single terminal of the inverter, a combiner box, or other junction. An illustration of such a system from the Amphenol brochure is provided above, with annotations, showing the arrangement of solar panels, wire harnesses, and lead assemblies that gather the electrical power from the solar panels and delivers the electrical power to a combiner box. *See* EX1007, p. 6, middle image (1st-annotation),

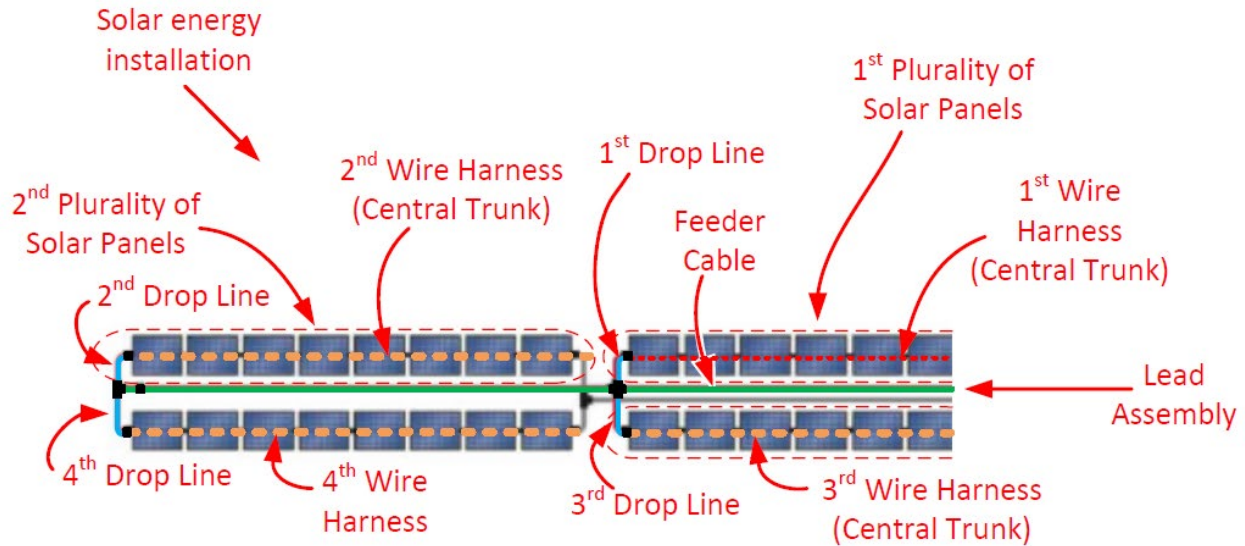
above.

[0130] As discussed above, A POSITA would further understand that the combiner box is one example of a convenient, centralized means for merging current from several lead assemblies to a single cable that is applied to the terminal of the inverter. Alternately, a POSITA would understand that the cable assemblies may be arranged so that all of the current from the solar panels in the installation are brought together through a distributed series of junctions and or branch structures, eventually merging to a single cable that can be applied to the terminal of the inverter without need for a combiner box.

[0131] For these reasons, a POSITA would have found the limitations in claim 1(Preamble) to be obvious in view of Amphenol.

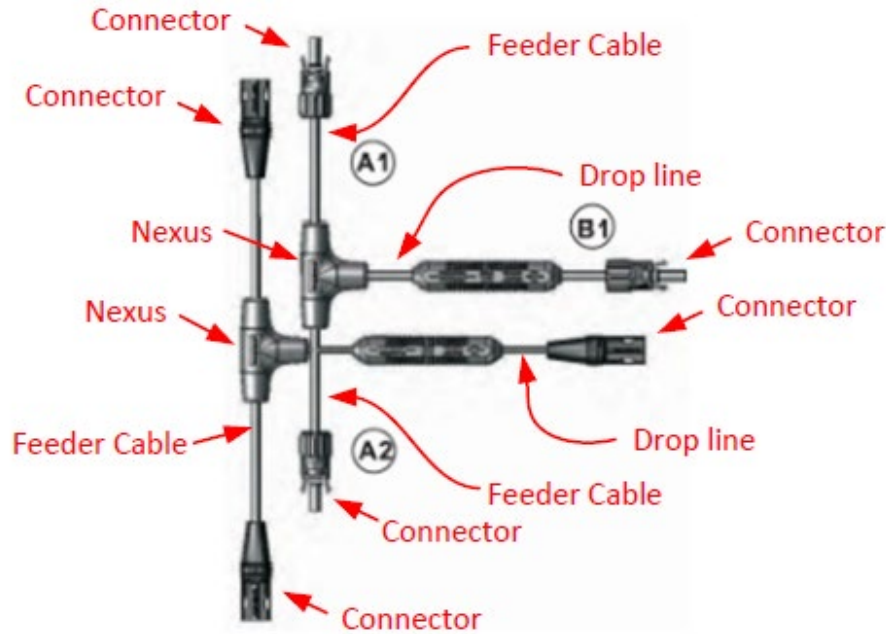
A. A first drop line and a second drop line, said first drop line terminating in a drop line connector;

[0132] Amphenol discloses numerous drop lines (annotated in blue, below) branching from a feeder cable (annotated in green, below) that together form the lead assembly. *See* EX1007, p.6, middle image (Relief & 2nd-annotation), below. As shown, the Amphenol lead assembly includes first and second drop lines, that each terminate in a drop line connector (annotated as small black boxes, below) at the end of each drop line).



EX1007, p. 6, middle image (2nd-annotation)

Also, in addition to the different configurations of junctions disclosed in Amphenol, discussed above, Amphenol demonstrates that the lead assemblies, which include the diversity junctions include connectors on the ends of the feeder cable and the ends of the drop lines. See, EX1007, p. 21, top image (1st annotation), below. A POSITA would understand that the above-noted lead assemblies could be combined in various ways.



EX1007, p. 21, top image (1st-annotation)

[0133] Additionally, as shown above, Amphenol discloses cable junctions with drop lines terminating in a drop line connector. *See*, EX1007, p. 21, top image (1st annotation), above.

[0134] For these reasons, a POSITA would have found the limitations in claim 1(A) to be obvious in view of Amphenol.

B. At least one 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said at least one feeder cable electrically coupled at a nexus;

[0135] Amphenol discloses a feeder cable terminating in a feeder cable connector. EX1007, p. 21, top image (1st annotation), above. Amphenol also discloses a list of gauges for feeder cables (i.e., the main cable) that may be selected for a lead assembly, including 8AWG, 10AWG, 12AWG, or

14AWG. *See* EX1007, p. 21 (Main cable size list). A POSITA would recognize that either 8AWG or 10AWG cables are rated for 30 amps; thus, Amphenol discloses at least one 30 amp feeder cable.

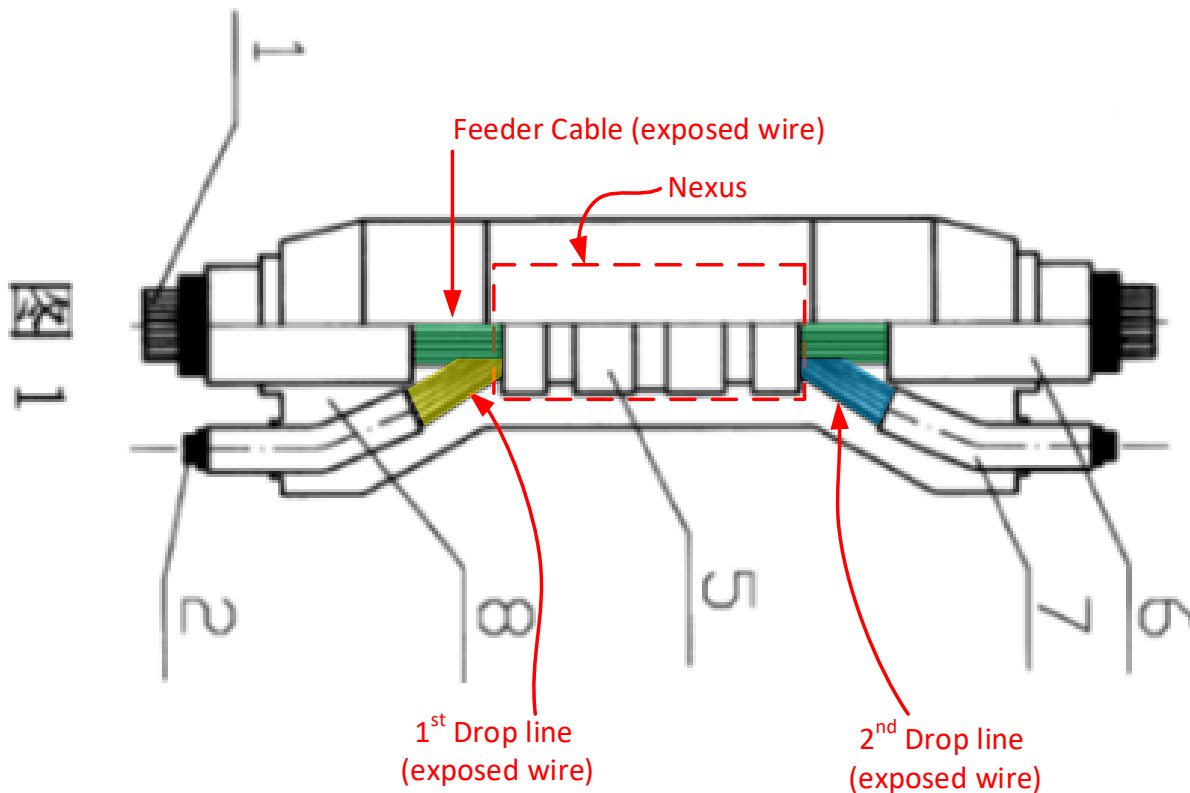
[0136] For example, the ampacity rating of 30 amps for an 8AWG or 10AWG cable is demonstrated in Table 310.16 of the 2002 Version of the National Electric Code, titled “Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts...” *See* EX1010, p. 148. This table is a wire ampacity size table with which a POSITA would be familiar and provides a guide for what gauge wire is appropriate for different ampacities of insulated conductors. *See id.* In the table above, wire gauges between 18 AWG and 4 AWG are expected to carry current from 14A to 95A at temperatures up to 90°C, and up to 70A at temperatures up to 60°C. *See id.* A POSITA would understand how to find and use such guides to make decisions about the gauge of different sections of a solar installation. Similar tables are available with information on selection for different voltages, and for resistances.

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13.)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM				
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

EX1010, Table 310.16

[0137] While Amphenol inherently discloses the electrical coupling of the feeder cable and the drop line at a nexus, Amphenol does not illustrate the actual electrical coupling between the feeder cable and drop line that is inside the illustrated molded junction. Shao discloses details of the feeder cable's electrical coupling to the drop line at the nexus within the description of the K-shaped branch connector, along with details associated with the encapsulation of the junction to provide protection from the external

environment. Shao, which is in the related field of electrical connectors, discloses a feeder cable electrically coupled to the drop line at a nexus that includes a clamp holding the feeder cable in contact with the drop line. *See* EX1008, FIG. 1 (1st-annotation), below.



EX1008, FIG. 1 (1st-annotation)

[0138] As illustrated, Shao discloses a nexus configuration with a clamp that maintains contact and good conductivity between the two conductive elements. A POSITA would be motivated to combine these elements from Shao with Amphenol to provide cable junctions with increased reliability (see A(v) ‘Motivation to Combine Amphenol and Shao, further discussed

above).

[0139] For these reasons, a POSITA would have found the limitations in claim 1(B) to be obvious in view of the Amphenol-Shao combination.

C. A means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof;

[0140] I believe a POSITA would understand that the plain and ordinary meaning of a “means for securing said nexus” refers to the element or elements maintaining the strong electrical and mechanical connection between the feeder cable and the drop lines, and that Shao provides a C-shape clamp which is crimped and is thus a means for securing the nexus.

[0141] As noted above, Shao discloses a feeder cable (i.e., a trunk conductor 1) electrically coupled to a drop line (i.e., a branch-line conductor 2) by a securing means in the form of a c-shaped clamp (i.e., connector 5), which forms a nexus that holds the feeder cable and the drop line together. *See*, EX1008, 6:15-18 and FIG. 1 (1st-annotation), above. In particular, Shao describes, “[a]n elongated copper C-shaped clamp is used to form a K-shaped branch connector 5.” *Id.* Shao further describes, “The joint is formed by symmetrical overlapping and crimping of one trunk conductor and two branch-line conductors.” (5:11-13) Therefore, it would have been obvious to a POSITA to use a clamp, as taught by Shao, to ensure contact is

maintained between the three conductive elements (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further discussed above).

[0142] For these reasons, a POSITA would have found the limitations in claim 1(C) to be obvious in view of the Amphenol-Shao combination.

D. An undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said at least one feeder cable, said inner surface surrounding and fully encasing said securing means,

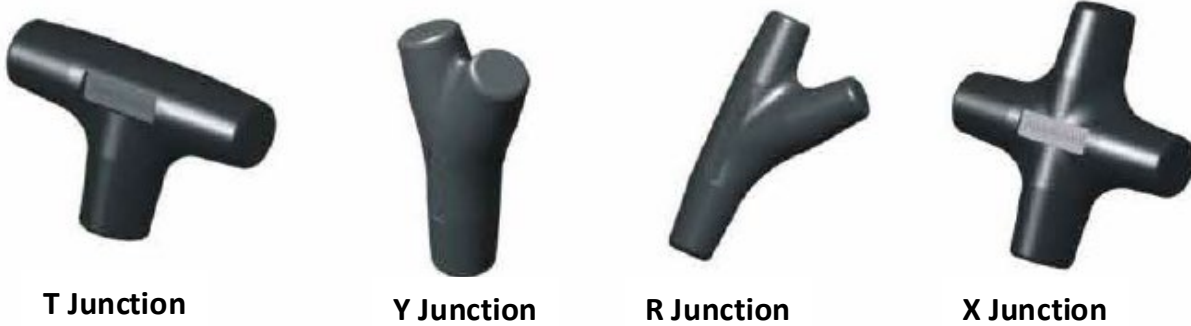
“Undermold”

[0143] The specification of the ’254 Patent does not define the term “undermold.” Based on illustrations in the ’254 Patent and the plain and ordinary meaning of the term “undermold” in the context of the claim, it is my opinion that a POSITA would have understood that the use of the word “undermold” in the ’254 Patent claims meant a “material molded over a piece or part that seals against environmental factors and is surrounded by an ‘overmold’.” *See* EX1001, FIGS. 48, 54, 55, 60 and generally. I note that this understanding is similar to the definition of “undermold” as any “material molded over a piece or part that seals against environmental factors and is surrounded by an overmold,” which was adopted by an Order in parallel proceedings before the International Trade Commission involving the ’254 Patent, for construing claims in U.S. Patent No. 10,553,739 (the “’739 patent”), which shares the same inventor. *See* EX1017, 17:8-1 and

20:14-15. While that construction of “undermold” was specifically for the claims of the ’739 patent, that construction is informative for establishing how a POSITA would understand the term in the context of the ’254 Patent claims since the technology and application is similar.

[0144] As shown in the illustration reproduced below, the molded junction covering the union of the various wires at the nexus in Amphenol is an undermold (i.e., diversity junction) that fully encases the conductive coupling of wires because the molded junction covering the nexus serves as a substrate for an overmold. *See* EX1007, p.5, bottom image, below. A POSITA would understand that the illustrations of example cable junctions from Amphenol represent structures where the outer layer would be formed by injection molding, as injection molding provides a low-cost, reliable manufacturing method that can be used to form shapes and structures such as those illustrated, whereas other methods (direct machining, 3-D printing, extrusion, etc.) would either be incapable of achieving these shapes or would be slower and more expensive than injection molding.

Cable Assy and Diversity Junctions



EX1007, p. 5, bottom image

[0145] While Amphenol discloses an undermold (i.e., a diversity junction) having inner and outer surfaces, including portions thereof that extend in a longitudinal direction of the feeder cable, with the inner surface surrounding and fully encasing the securing means, Amphenol does not illustrate a cross-section of the molded junctions that would allow identification of the claimed inner surface. A POSITA would understand that the structures shown by Amphenol, which are described as “Cable Assy and Diversity Junctions” represent components in which electrical cables enter at the ports on the flat faces of the molded structure and are electrically connected in the interior of the junction. In this regard, a POSITA would understand that the undermold covers over and seals these wires, and that there is necessarily an inner surface that must exist at the interface between the mold and the enclosed cables and nexus.

[0146] Shao discloses a feeder cable’s electrical coupling to drop lines at a

nexus that is covered by a sheath made of injection molding material, which is an undermold that fully encases the nexus. *See* EX1008, 5:16-20. The examples of junctions in Amphenol (above - T Junction, Y Junction, R Junction, X Junction) are examples of 3-terminal and 4-terminal junctions that one would consider for use in lead assemblies. A POSITA would understand that these example junctions, and many more similar examples could be assembled using the details and methods disclosed in Shao. Shao discloses a protective outer sheath that is formed by injection molding to enclose the c-shaped clamp that crimps the cable and drop lines together. This molded sheath fully encloses the insulation sheaths on the main cable and drop lines and includes inner and outer surfaces extending in a longitudinal direction of the feeder cable.

[0147] Therefore, it would have been obvious to a POSITA to rely on the teaching of Shao to provide the design of the cable junction, including methods for baring wires, providing a clamp, forming a nexus by closing the clamp around the wires, and providing an injection-molded undermold to encase the exposed cables and the metal clamp holding them together and protecting those elements from damage and/or exposure (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further discussed above).

[0148] It would have been obvious to a POSITA to use an undermold as

taught by Shao to encase the exposed cables and the clamp holding the feeder and branch cables together to better protect those elements from damage and/or exposure (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further discussed above).

[0149] For these reasons, a POSITA would have found the limitations in claim 1(D) to be obvious in view of the Amphenol-Shao combination.

i. said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter,

(1) “Said Inner Surface”

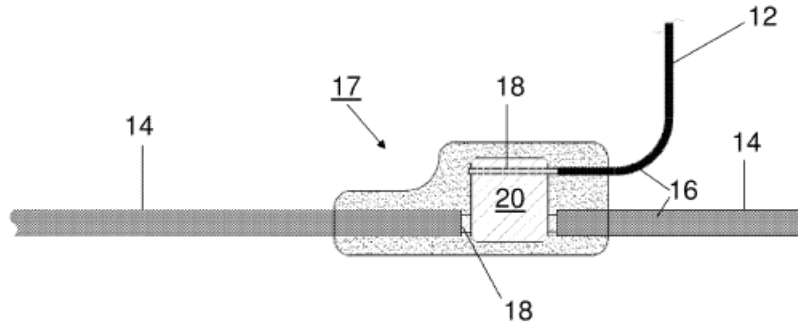
[0150] I am informed by Counsel that the recitation of “said inner surface,” as recited in the claim 1(D)(i) limitation, applying antecedent basis rules refers to the earlier recitation of “An undermold having an inner surface,” as recited in the claim 1(D) limitation, above. As set forth below, I submit that references to the expression “inner surface” of the undermold in claim 1 refers to a defining feature of the inner surface of the undermold. The specification of the ’254 Patent does not explain any details regarding the inner surface of the undermold (22) or what defines an “aperture” *See* EX1001, generally. The ITC construed “aperture” as the “entire pathway of the [feeder cable or drop line] within the [undermold or primary mold], when viewed as if the [feeder cable or drop line] were removed.” EX1017,

pp.38-41. Consistent with the ITC claim construction, I believe a POSITA would have understood that “aperture” in the claims means a “3-D hole (i.e., the entire pathway for a cable in the [undermold/primary mold]) that exists when viewed as if the entire cable is removed.” EX1017, pp.38-41; EX1003. Thus, as best understood by a POSITA, the expression “said inner surface comprised of a first aperture,” means “said inner surface is **defined by** a first aperture,” which refers to the passages that extends completely through the undermold (22) in the longitudinal direction See, EX1001, generally.

(2) “Concentric”

[0151] As set forth below, I submit that the term “concentric” as used in claim 1 must reasonably be interpreted as meaning “substantially concentric.”

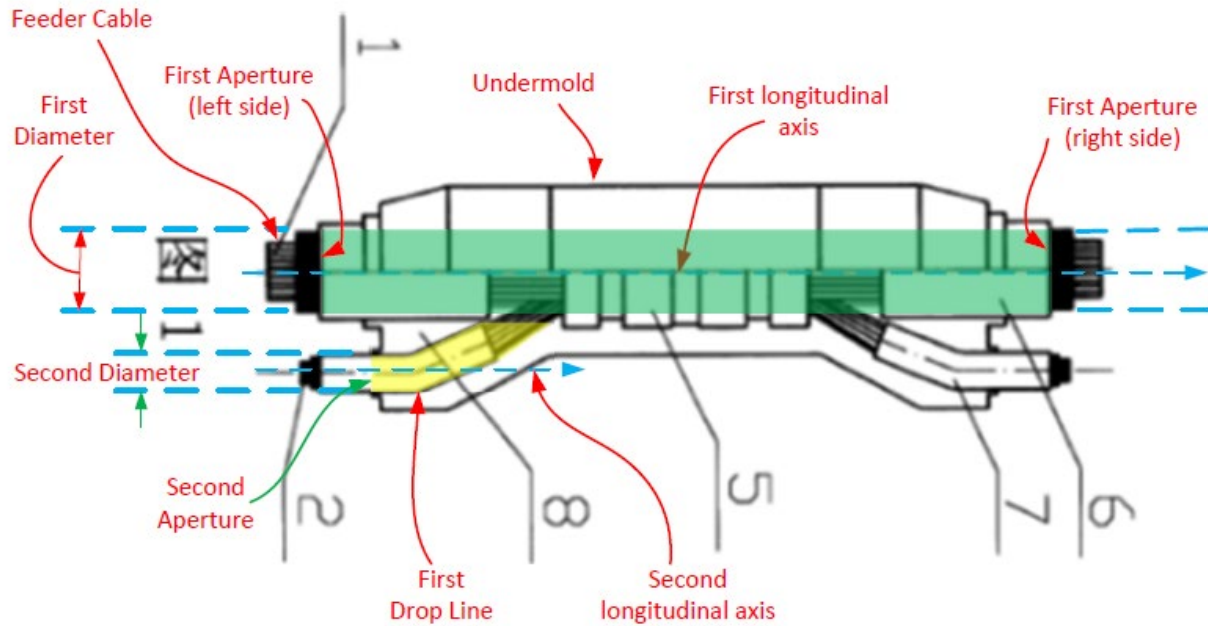
[0152] The specification of the '254 Patent does not explain or illustrate how the first aperture is concentric with both the securing means and the feeder cable (14), since the securing means (20) also surrounds the drop line (12), making it off center of the feeder cable. See EX1001, FIG. 7 (see below).



EX1001, FIG. 7

Thus, an ordinary and customary meaning, as understood by a POSITA, of the term "concentric" would have been that it refers to circles, arcs, or other shapes which share roughly the same center, the larger completely surrounding the smaller. Thus, a POSITA would understand that the term "concentric," as used in claim 1, must reasonably be interpreted as "substantially concentric."

[0153] Shao discloses an undermold (i.e., connector outer sheath 8) that includes an inner surface defined by a first aperture that extends in the longitudinal direction of the feeder cable (i.e., the direction of trunk conductor 1) and that is substantially concentric with the securing means (i.e., C-shaped clamp 5) and the feeder cable. *See* EX1008, FIG. 1 (1st-annotation), below.



EX1008, FIG. 1 (1st-annotation)

Also, in Shao the first aperture extends continuously through the undermold (i.e., connector outer sheath 8) in the longitudinal direction and has a first diameter. *See* EX1008, FIG. 1 (1st-annotation), above.

[0154] It would have been obvious to a POSITA to use an undermold (i.e., a connector outer sheath), as taught by Shao, to encase the exposed cables and the clamp holding the feeder and branch cables together and protect those elements from damage and/or exposure (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further discussed above).

[0155] For these reasons, a POSITA would have found the limitations in claim 1(D)(i) to be obvious in view of the Amphenol-Shao combination.

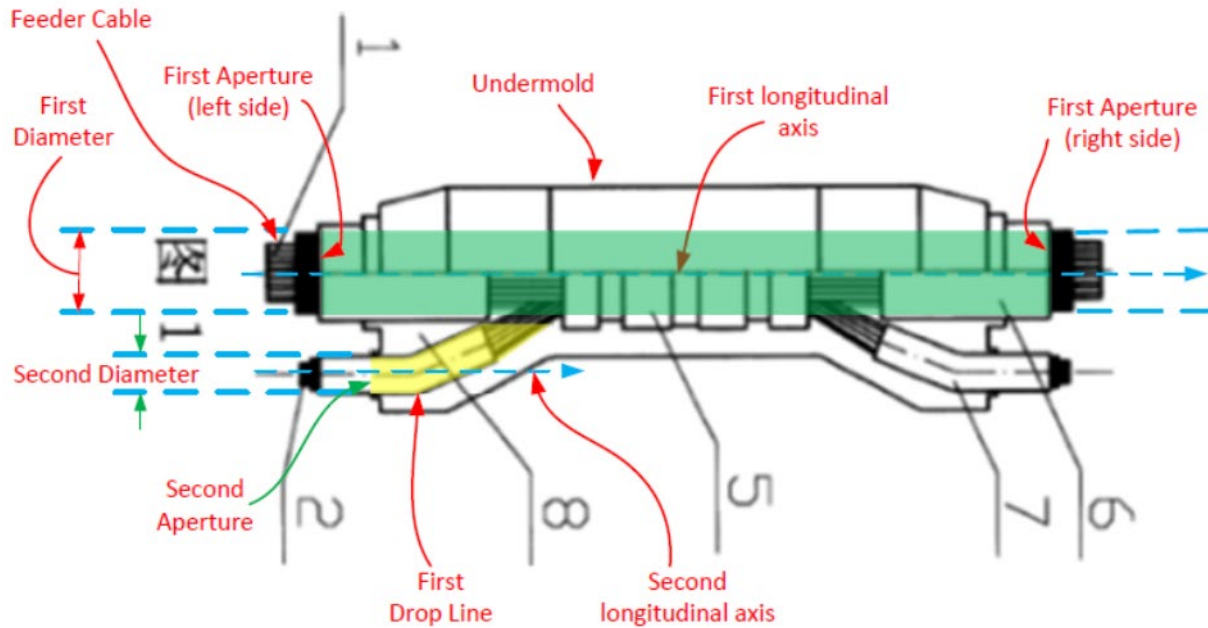
ii. said at least one feeder cable continuously extending through said first aperture, and

[0156] Shao discloses a feeder cable (i.e., trunk conductor 1) continuously extending through the first aperture. *See* EX1008, FIG. 1 (3rd-annotation), above. It would have been obvious to a POSITA to use the configuration of one continuous feeder cable and the associated aperture in the undermold, as taught by Shao, since it is the most natural arrangement of elements. Additionally, a POSITA would understand that using the cable junction design taught by Shao would increase reliability, improved resistance to environmental factors, provide a low profile installation configuration, and would be easy to install. (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further discussed above).

[0157] For these reasons, a POSITA would have found the limitations in claim 1(D)(ii) to be obvious in view of the Amphenol-Shao combination.

iii. a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture; and

[0158] Shao discloses a second aperture concentric with said first drop line (i.e., the branch line conductor 3) and parallel to said first aperture. *See* EX1008, FIG. 1 (4th-annotation), below.



EX1008, FIG. 1 (1st-annotation)

[0159] Additionally, in Shao the second aperture only partially extends through the undermold in the longitudinal direction, while also having a second diameter that is smaller than the first diameter of the first aperture and having the first drop line extend therefrom. *See* EX1008, FIG. 1 (1st-annotation), above. Shao describes “[o]ne trunk conductor and two branch-line conductors are symmetrically overlapped and crimped by means of the K-shaped branch connector 5 to form one joint and two branch- line conductor out-leads.” *Id.*, 6:18-22. This description in Shao indicates that there is a single trunk conductor extending all the way through the junction, and there are also two branch line conductors that are separate cables prior to the assembly, and that they are symmetrically overlapped and crimped to the

trunk. *See id.* Specifically, this process begins with three elements (“one trunk conductor and two branch-line conductors”), and at the conclusion the two branch line conductors represent the two drop lines of the ’254 Patent. *See id.* Further, at the conclusion of the assembly, each of the drop lines (branch line conductors) begins within the nexus (crimp) and extends outward through the undermold (e.g., outer sheath 8). *See id.* Apertures are formed by the cables extending completely through the undermold, and by the conductors extending partially through the undermold from the nexus. *See id.*

[0160] As shown in the Shao FIG. 1, annotated above, the trunk conductor has a first diameter, and the branch line conductors have a second diameter that is smaller than the first diameter, and that the apertures associated with the trunk conductor has a first diameter, and that the aperture associated with the branch lines has a smaller diameter. Further, as shown the apertures are parallel to each other.

[0161] It would have been obvious to a POSITA to use an undermold (i.e., outer sheath 8), as taught by Shao to encase the exposed cables and the clamp holding the feeder and drop lines (i.e., trunk conductor and branch line conductor) together to better protect those elements from damage and/or exposure (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further

discussed above).

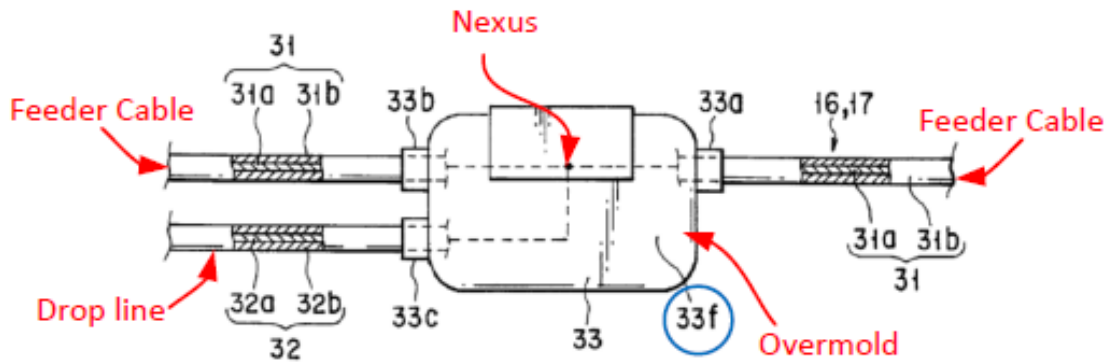
[0162] For these reasons, a POSITA would have found the limitations in claim 1(D)(iii) to be obvious in view of the Amphenol-Shao combination.

E. An overmold surrounding said undermold and forming an undermold-overmold interface only at said outer surface,

[0163] I have been informed by Counsel that the recitation of “said outer surface,” as recited in the claim 1(E) limitation, applying antecedent basis rules, refers to the recitation of “An undermold having an inner surface and an outer surface,” as recited in the claim 1(D) limitation, above. As best understood by a POSITA, I submit that the ordinary and customary meaning of the term “only” in the recitation of “forming an undermold-overmold interface *only at* said outer surface,” as recited in claim 1(E), refers to the undermold-overmold interface existing between the overmold and only the outer surface of the undermold, as opposed to the inner surface of the undermold.

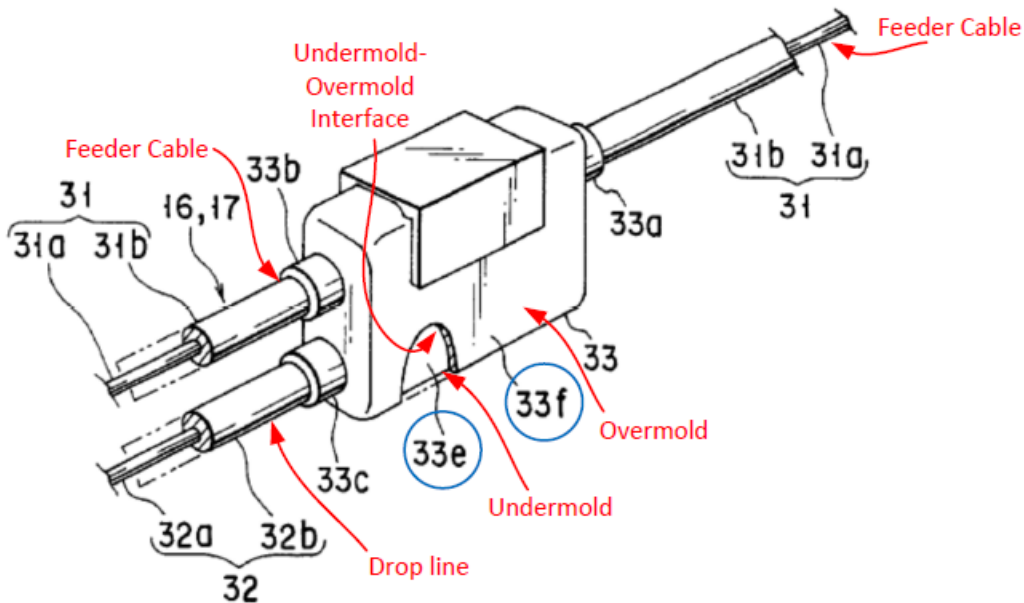
[0164] Yamawaki teaches applying an overmold over an undermold of a branch cable connection to provide an added layer of waterproofing. *See* EX1006, 10:19-22; 13:15-18. In particular, Yamawaki discloses applying a covering member 33f (i.e., an overmold) over the molded underbody 33e (i.e., an undermold) covering a branch junction (i.e., a nexus) of cables (i.e., a feeder cable and a branch cable). *See id.*, FIGS. 9A (1st-annotation) and

9B (1st-annotation), below.



EX1006, FIG. 9A (1st-annotation)

[0165] .



EX1006, FIG. 9B (1st-annotation)

[0166] A POSITA considering Shao and Yamawaki would appreciate that these two disclosures describe methods for encasing cable junctions with insulating layers that can provide protection from the environment and other

benefits discussed earlier with respect to Yamawaki (*see* A(vi) ‘Motivation to Combine Amphenol, Shao, and Yamawaki further discussed above). A POSITA considering Shao and Yamawaki would have found it obvious to add an overmold to the Amphenol-Shao combination in order to provide the added protection against environmental elements (e.g., waterproofing), as taught by Yamawaki (*see* A(vi) ‘Motivation to Combine Amphenol, Shao, and Yamawaki further discussed above).

[0167] For these reasons, a POSITA would have found the limitations in claim 1(E) to be obvious in view of the Amphenol-Shao-Yamawaki combination.

i. wherein said lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between said solar arrays and said inverter, and

[0168] Amphenol discloses that the lead assembly combines power from a plurality of solar arrays and transmits that power, as discussed above, which discussion is incorporated here by reference. *See* EX1007, p. 6.

Additionally, I have been informed by counsel that during the prosecution of the '254 Patent, the Examiner, in the 05/30/2017 Office Action, indicated that the limitations that “the lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between the solar arrays and the

inverter” is an intended use limitation. EX1002, pp. 259-260. This assertion by the Examiner was not rebutted by the Applicant. *See id.*, pp. 239-250.

[0169] A POSITA would recognize that the Photovoltaic Interconnections System of Amphenol is configured to use and include the same intended use limitations as the lead assembly of the recited structure; namely combine power from a plurality of solar arrays and transmit that power to an inverter in a solar energy installation lacking a combiner box between the solar arrays and the inverter.

[0170] In particular, a POSITA would understand that one benefit of building a cable harness system that provides opportunities to connect drop lines to the main feeder cable is that these connections can be made at convenient locations throughout the installation. In doing so, the large number of individual wires that need to come all the way from the solar arrays to the inverter is reduced, and a combiner box can thereby be eliminated. In effect, by combining/joining wires at many nodes throughout the wiring connections, the total length and number of wires can be reduced, and the combiner box can be eliminated. This knowledge by a POSITA of the use of the lead assembly of the Amphenol-Shao combination is demonstrated by the disclosure of Yamawaki, which describes disadvantages of conventional systems in which many wires from individual solar cell arrays come all the

way to a central building node for combining. *See* EX1006, 2:5-12, 2:44-51, and 3:16-31. For example, in this regard Yamawaki discloses that:

fetching outputs conventionally requires use of many wiring apparatuses, so that the installation of the photovoltaic generation system on a roof or the like costs much labor. Accordingly, there is a high possibility of mis-connection. Since a large hole for a lot of wiring apparatuses must be bored through a wall of the building, so that sealing the building against rainwater and the like entails labor...

EX1006, 2:5-12.

Accordingly, a first object of the present invention is to provide a wiring apparatus for a photovoltaic generation system whereby the necessary number of electric wires for fetching outputs from generating sections, including a plurality of photovoltaic modules or module units can be reduced, and which can be easily laid with a lower probability of wrong wiring.”

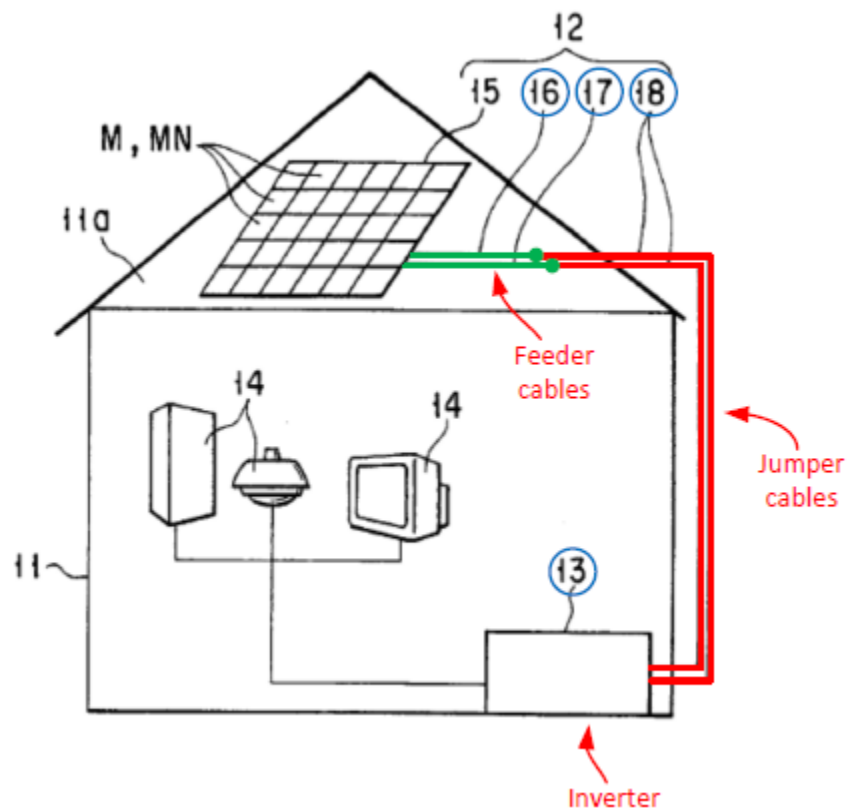
EX1006, 2:44-51.

There is provided a wiring apparatus, whereby the respective output terminals of a plurality of generating sections, each including photovoltaic modules, are connected to one another. The apparatus comprises a trunk cable including a trunk conductor for conducting the respective outputs of the generating sections, a plurality of branch cables diverging individually from a plurality of longitudinally intermediate portions of the trunk cable, each of the branch cables including a branch conductor having one end connected electrically to a longitudinally intermediate portion of the trunk conductor and the other end connected electrically to the output terminal of each corresponding generating section, and branch junctions formed...”

EX1006, 3:16-31.

[0171] Thus, a POSITA familiar with the challenges of bringing many

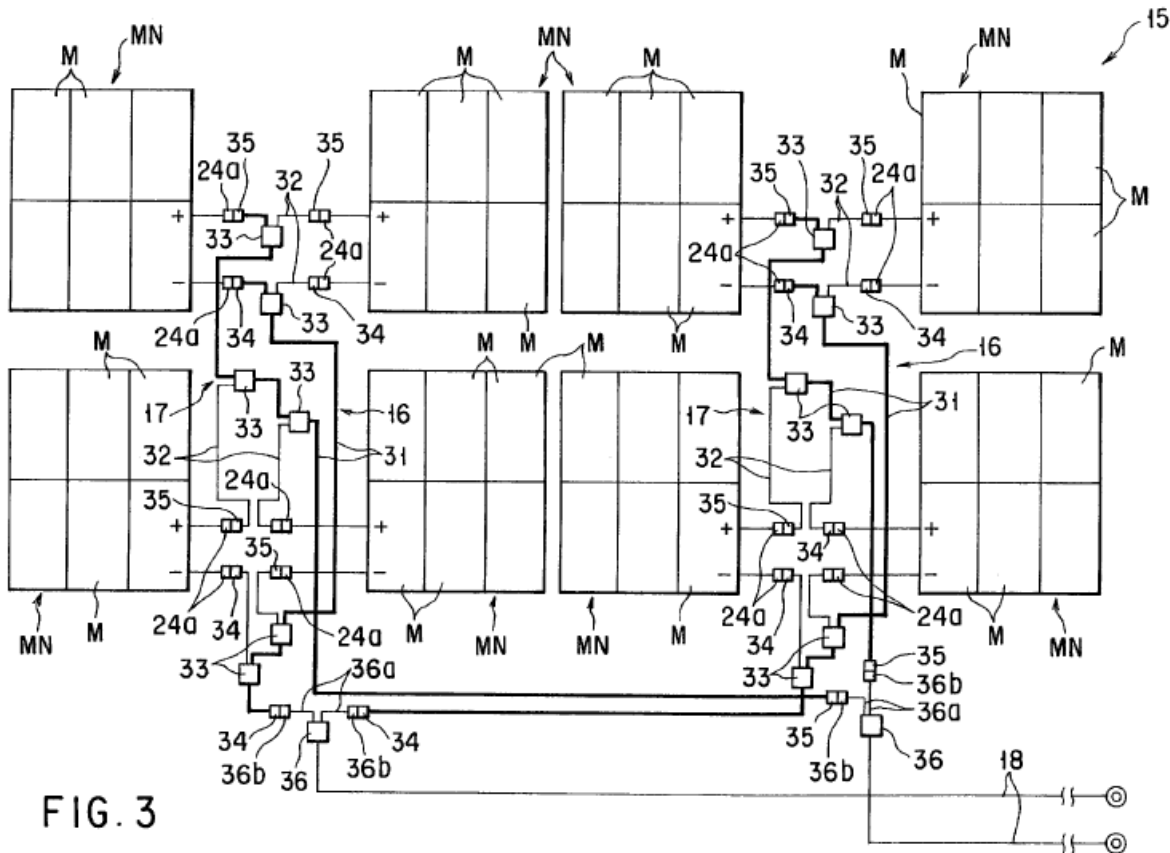
separate wires all the way to a distant junction, such as at a connector box, and appreciating the benefits of a system consisting of a plurality of drop lines being connected to the feeder cables which can feed straight to the inverter and would combine Amphenol as modified by Shao with the teaching from Yamawaki. Yamawaki discloses a solar array with cables being connected directly to an inverter without use of a combiner box in FIG. 1. See EX1006, FIG. 1 (1st-annotation) below.



EX1006, FIG. 1 (1st-annotation)

[0172] Further, in FIG. 3, below, Yamawaki shows an installation with 8 separate solar module units MN, each consisting of a plurality of solar

modules M, where the power is gathered through cables and junctions that are eventually combined to form a single pair of lead-in wires 18 that are connected directly to an inverter as shown in FIG. 1, above. See EX1006, 8:1-11, FIG. 1 (1st -annotation) above, and FIG. 3 (below).



EX1006, FIG. 3

[0173] The resulting system would avoid the problems described by Yamawaki and rely on the branch cables being connected to the trunk cables to implement such a simplified system which brings the power from the solar array directly to the inverter without the need for intervening combiner

boxes. Yamawaki demonstrates that various wiring assemblies, such as a wire harness directly connected to an array of solar panels and a lead assembly between that wire harness and an inverter and/or combiner box, may be connected at multiple different levels of a system hierarchy to aggregate power from the panels in steps. *See id.*, FIGS. 3 and 5-7. The assortment of cables, connectors, junctions, and other elements disclosed by Amphenol would provide the basic structures to achieve such a system, and the improved manufacturing designs and methods disclosed by Shao would improve the performance and reliability of the cable junctions in these systems. A POSITA would have been motivated to combine power from many solar arrays directly to an inverter, as taught by Yamawaki, to provide a simplified system that is easier to install and more reliable (*see* A(vi) ‘Motivation to Combine Amphenol, Shao, and Yamawaki’ further discussed above).

[0174] For these reasons, a POSITA would have found the limitations in claim 1(E)(i) to be obvious in view of Amphenol, Shao, and Yamawaki (to the extent this claim element is found limiting).

ii. wherein said lead assembly has a voltage rating of 1500 VDC.

[0175] Amphenol discloses that the lead assembly has a voltage rating of 1500 VDC (i.e., between 600VDC and 2000VDC). *See* EX1007, p.21 (top).

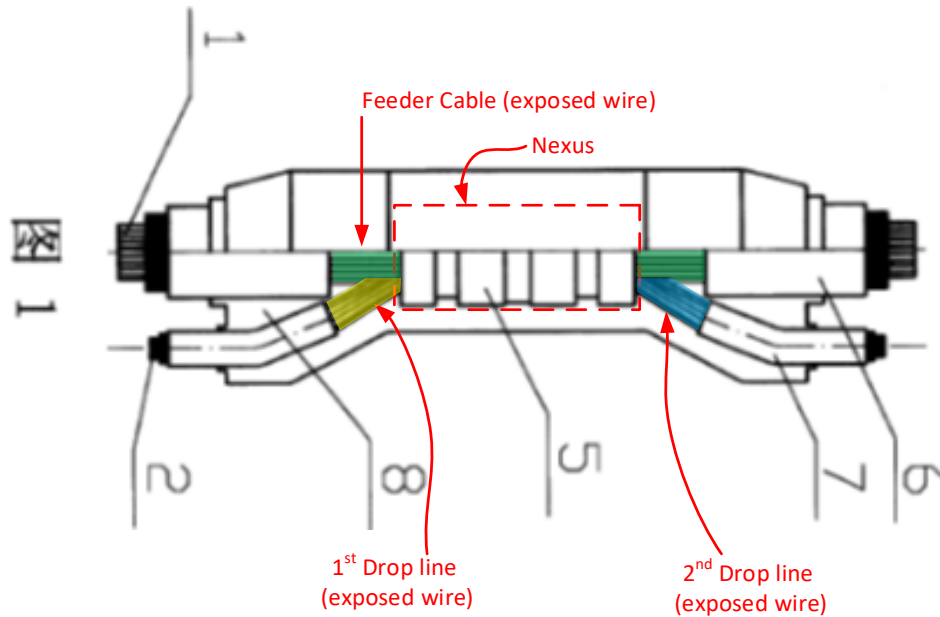
For these reasons, a POSITA would have found the limitations in claim 1(E)(ii) to be obvious in view of Amphenol.

[0176] Accordingly, based on the above, a POSITA would have found claim 1 to be obvious based on the Amphenol-Shao-Yamawaki combination. Accordingly, claim 1 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Shao, and Yamawaki.

2. Claim 2

The lead assembly of claim 1 wherein said first drop line includes a section of exposed wire at said nexus.

[0177] Shao discloses that the first drop line includes a section of exposed wire (colored yellow in the annotation below) at the nexus. *See*, EX1008, ¶28 and FIG. 1 (1st-annotation), below. Shao discloses that, “[o]ne trunk conductor and two branch-line conductors are symmetrically overlapped and crimped by means of the K-shaped branch connector 5 to form one joint and two branch-line conductor out-leads, and directions of the branch-line conductor out-leads are opposite.” EX1008, 6:18-22.



EX1008, FIG. 1 (1st-annotation)

[0178] It would have been obvious to a POSITA to expose wires, such as the drop line wires and the feeder cable wire at a nexus, as taught by Shao, to apply a crimped C-shaped clamp that ensures contact is maintained between the two conductive elements. *See* EX1008, 6:18-22. (*see* A(v) ‘Motivation to Combine Amphenol and Shao,’ further discussed above).

[0179] For these reasons, a POSITA would have found the limitations in claim 2 to be obvious in view of the Amphenol-Shao-Yamawaki combination.

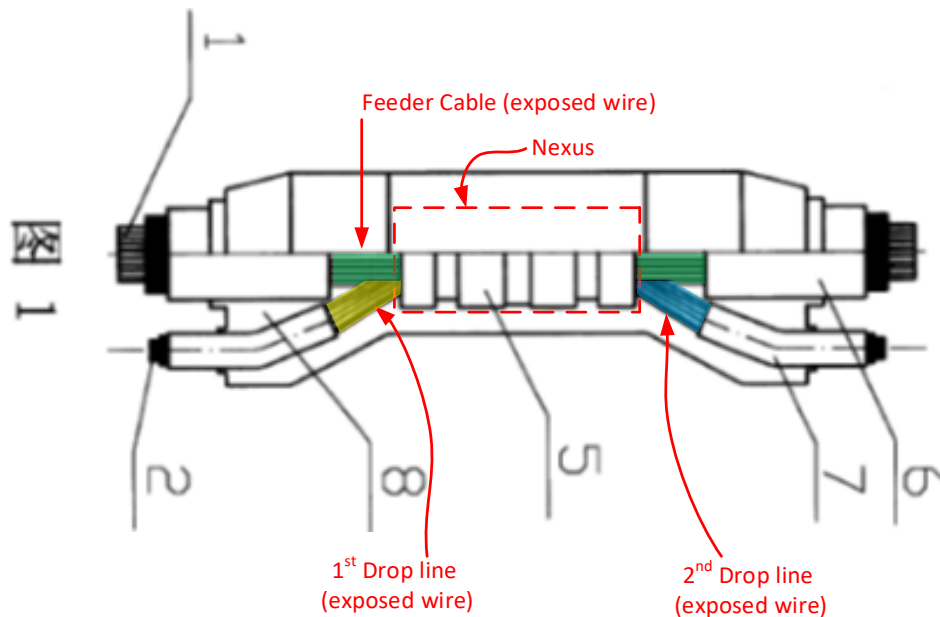
3. Claim 3

The lead assembly of claim 2 wherein said at least one feeder cable includes a section of exposed wire at said nexus.

[0180] Shao discloses that the feeder cable includes a section of exposed wire

(colored green in the annotation below) at the nexus. *See* EX1008, FIG. 1

(1st-annotation), below. As noted above, Shao discloses that the cable of the trunk conductor 1 and the branch conductors 2 have insulation stripped away from sections in order to secure the C-shaped clamp that crimps the conductors together and forms the nexus.



EX1008, FIG. 1 (1st-annotation)

[0181] It would have been obvious to a POSITA to expose wires, such as the drop line wires and the feeder cable wire at a nexus, as taught by Shao, to apply a crimped C-shaped clamp that ensures contact is maintained between the two conductive elements. *See* EX1008, 6:18-22.

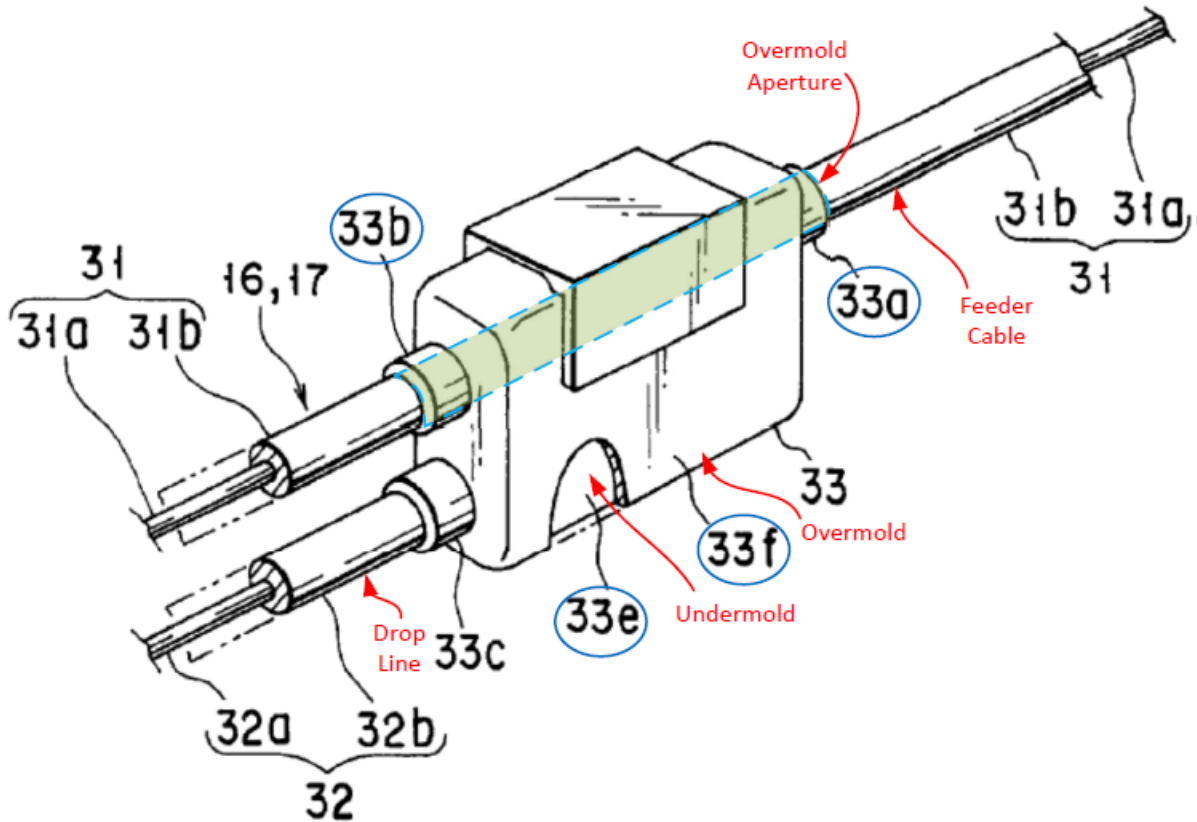
[0182] For these reasons, a POSITA would have found the limitations in claim 3 to be obvious in view of the Amphenol-Shao-Yamawaki

combination.

4. Claim 4

The lead assembly of claim 1 wherein said overmold defines at least one aperture.

[0183] As noted above regarding the claim 1(D)(i) limitation, the specification of the '254 Patent does not explain any details regarding what defines an “aperture.” *See* EX1001, generally. Nonetheless, Yamawaki discloses that the overmold (i.e., the cover member 33f that covers the molded body 33e) defines at least one aperture (e.g., highlighted in green, below) that extends from a cylindrical trunk cable connecting portion 33a on one side to another cylindrical trunk cable connecting portion 33b on the opposed side. *See*, EX1006, col. 10, lines 19-27 and FIG. 9B (2nd-annotation), below.



EX1006, FIG. 9B (2nd-annotation)

[0184] It would have been obvious to a POSITA to use an overmold (i.e., the cover member 33f) with an aperture, as taught by Yamawaki, to encase the assembly and protect the underlying elements from water and improve the reliability (*see* A(vi) ‘Motivation to Combine Amphenol, Shao, and Yamawaki,’ further discussed above).

[0185] For these reasons, a POSITA would have found the limitations in claim 4 to be obvious in view of the Amphenol-Shao-Yamawaki combination.

5. Claim 5

The lead assembly of claim 1 wherein said undermold is injection molded.

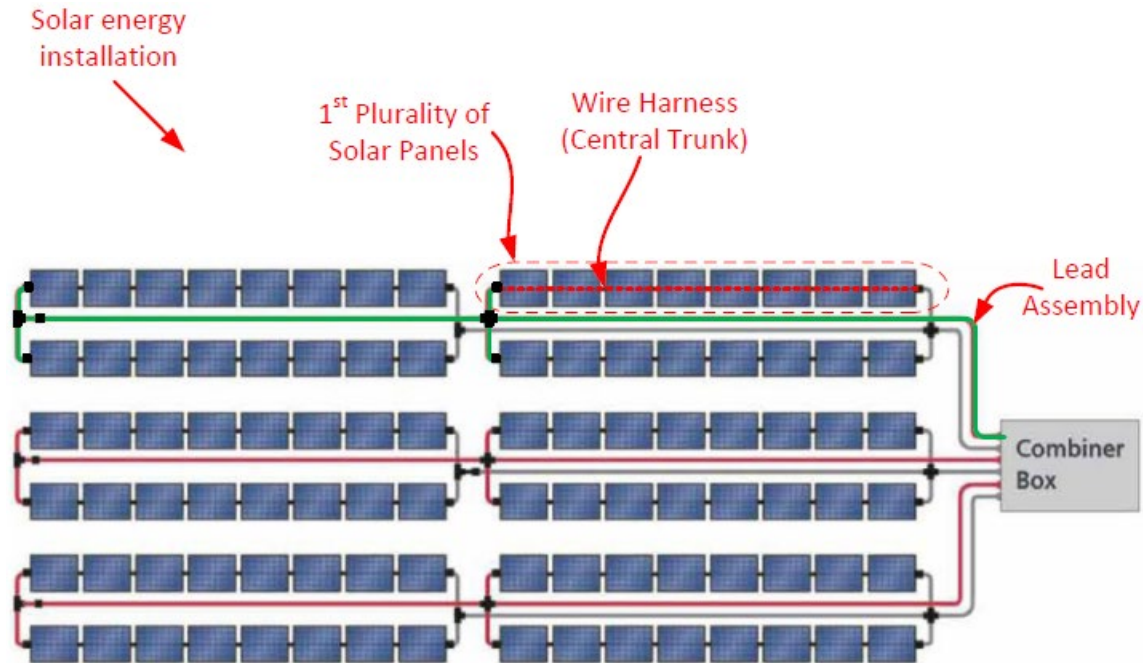
[0186] Shao discloses a feeder cable's electrical coupling to drop lines at a nexus that is covered by a sheath made of injection molding material, which is an undermold that fully encases the nexus. *See* EX1008, 5:16-20. A POSITA would recognize that an injection molded sheath (i.e., an undermold), as taught by Shao, encases the exposed cables and the metal clamp holding them together is better protected from damage and/or exposure (*see* A(v) 'Motivation to Combine Amphenol and Shao,' further discussed above).

[0187] For these reasons, a POSITA would have found the limitations in claim 5 to be obvious in view of the Amphenol-Shao-Yamawaki combination.

6. Claim 7

Preamble. A solar power system comprising:

[0188] Amphenol discloses a solar power system (i.e., a solar energy installation). *See* EX1007, p.6, middle image (1st-annotation), below.



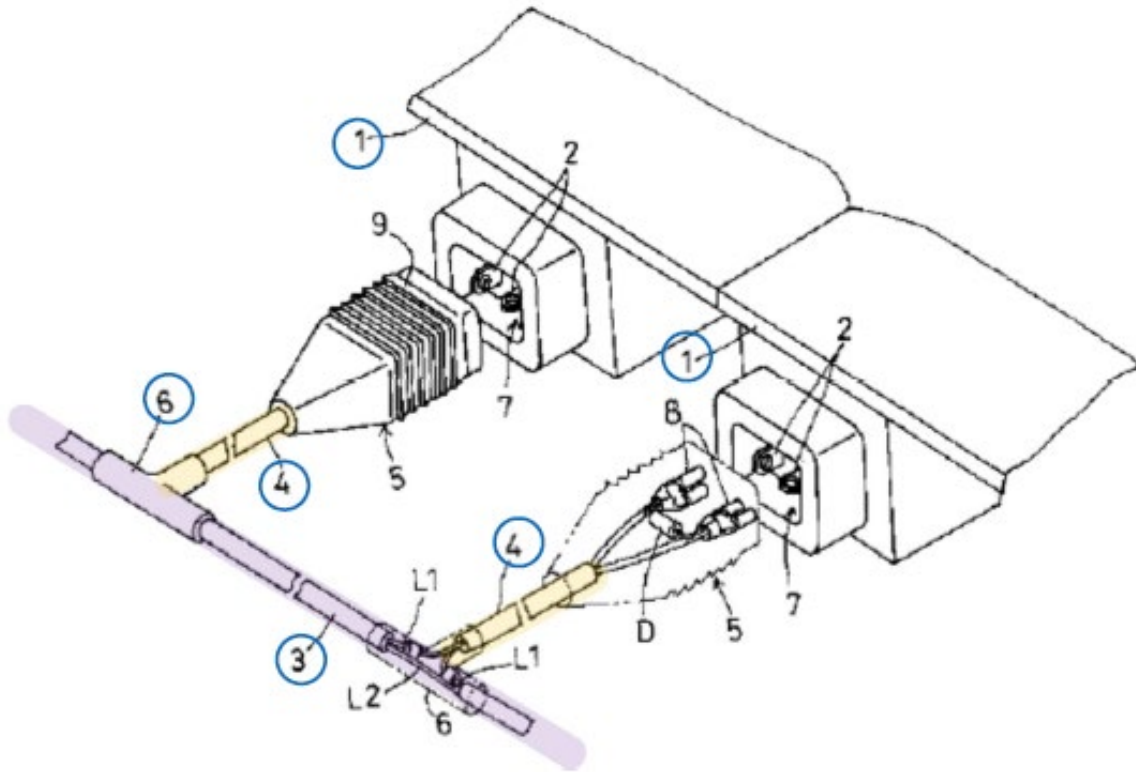
EX1007, p. 6, middle image (1st-annotation)

[0189] For these reasons, a POSITA would have found the limitations in claim 7(Preamble) to be obvious in view of Amphenol.

A. A first plurality of solar panels electrically coupled by a first wire harness to form a first solar array;

[0190] As shown above, Amphenol discloses a first plurality of solar panels (annotated by a **red dotted line oblong circle**, above) electrically coupled by a first wire harness (annotated as a **dotted red line**, above) to form a first solar array. *See* EX1007, p.6, middle image (1st-annotation), above. A POSITA would understand that the first wire harness (e.g., the **red dotted line**, above) is formed as either a serial or parallel connection of a series of solar panel modules. For example, Japanese Patent Application KOKAI Publication No. 7-131045 to Ito (“Ito”), which is cited in the background of

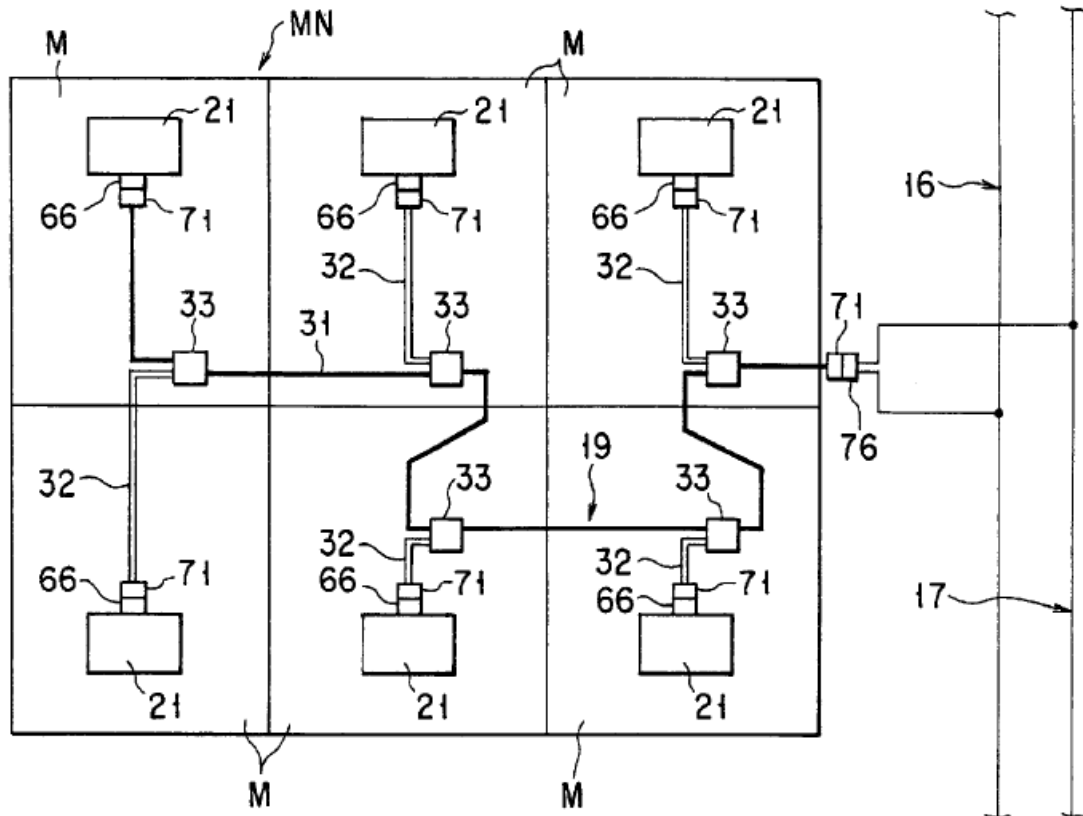
Yamawaki (*see* EX1006, 1:28-33), illustrates just such a wire harness with a central trunk for electrically connecting solar panel units. *See* EX1019, FIG. 1 (1st-annotation), reproduced below.



EX1019, FIG. 1 (1st-annotation)

In particular, Ito illustrates how the central trunk (**trunk line 3**) of the wire harness includes branches (**branch lines 4**) that each electrically connect to a plurality solar panels (solar cell units 1). *See* EX1019, ¶9. Thus, Ito illustrates how the **red dotted line** in Amphenol would represent a wire harness that connects a solar array. *See id.* Similarly in this regard, Yamawaki directly discloses an embodiment with a plurality of solar panels (modules M) electrically coupled by a wire harness (wiring apparatus 19)

with a central trunk (31) and branches (32) that in turn is coupled to a lead assembly (16, 17). EX1006, 17:19-26, FIG. 14, reproduced below.



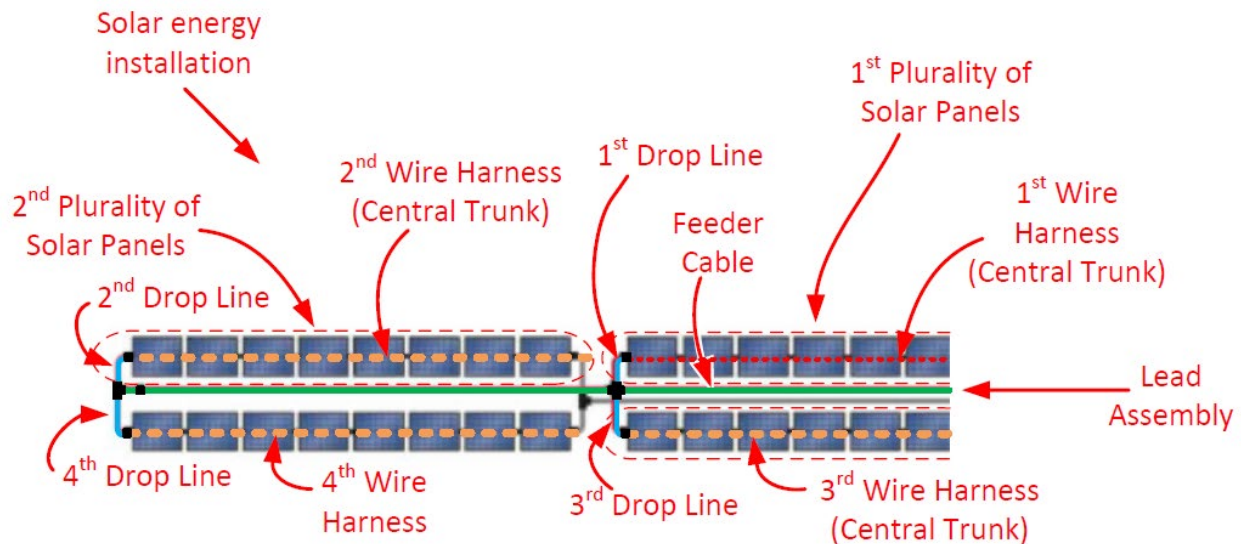
EX1006, FIG. 14

[0191] For these reasons, a POSITA would have found the limitations in claim 7(A) to be obvious in view of Amphenol.

B. A second plurality of solar panels electrically coupled by a second wire harness to form a second solar array;

[0192] Amphenol further discloses several other sets of solar panels (annotated by red dotted line oblong circles and indicated as 1st, 2nd, and 3rd pluralities of solar panels, below), which are each a plurality of solar panels, that are each electrically coupled by a second wire harness (each

annotated as an **orange dotted line**, below) to form a second solar array. *See* EX1007, p.6, middle image (Relief & 2nd-annotation), below.



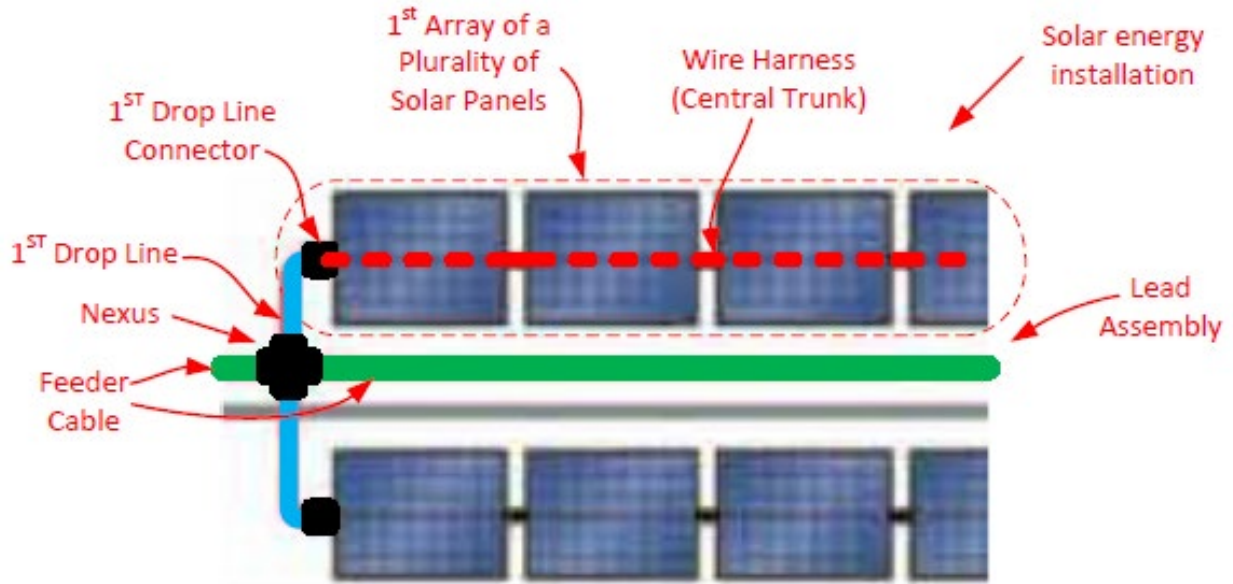
EX1007, p. 6, middle image (Relief & 2nd-annotation)

[0193] For these reasons, a POSITA would have found the limitations in claim 7(B) to be obvious in view of Amphenol.

C. A lead assembly including

- i. a first drop line electrically connected to said first wire harness, and**

[0194] Amphenol discloses a lead assembly with a first drop line electrically connected to the first wire harness. *See* EX1007, p.6, middle image (Relief & 3rd-annotation), below.



EX1007, p. 6, middle image (Relief & 3rd-annotation)

[0195] For these reasons, a POSITA would have found the limitations in claim 7(C)(i) to be obvious in view of Amphenol.

ii. a 30 amp feeder cable electrically connected to a component selected from the group consisting of a trunk buss jumper, an inverter, a connection unit, a recombiner, and a disconnect unit,

[0196] As discussed above, regarding the claim 1(B) limitation, which discussion is incorporated here by reference, a POSITA would recognize that Amphenol discloses at least one 30 amp feeder cable. Additionally, as discussed above regarding the claim 1(E)(i) limitations, which discussion is also incorporated here by reference, a POSITA would recognize that the Photovoltaic Interconnections System of Amphenol is configured to connect to an inverter, either directly or indirectly.

[0197] For these reasons, a POSITA would have found the limitations in

claim 7(C)(ii) to be obvious in view of Amphenol in combination with Shao and Yamawaki.

- iii. said first drop line and said feeder cable electrically connected at a first nexus secured by a compression lug,**
- iv. said compression lug surrounded by an undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said feeder cable, said inner surface surrounding and fully encasing said compression lug,**
- v. said inner surface comprised of a first aperture concentric with said compression lug and said feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter,**
- vi. said feeder cable extending continuously through said first aperture, and**
- vii. a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture,**
- viii. with said undermold surrounded by an overmold and forming an undermold-overmold interface only at said outer surface,**
- ix. wherein said lead assembly has a voltage rating of 1500 VDC; and;**

[0198] The claim 7(C)(iii-ix) limitations are the same as or at least equivalent to the claim 1(B-E) limitations addressed above. Regarding the recitation of a “compression lug” in claim 7(C)(iii-ix), as opposed to the crimped c-shaped clamp discussed above regarding claim 1(C), a POSITA would understand that c-shaped clamps and compression lugs serve as distinct

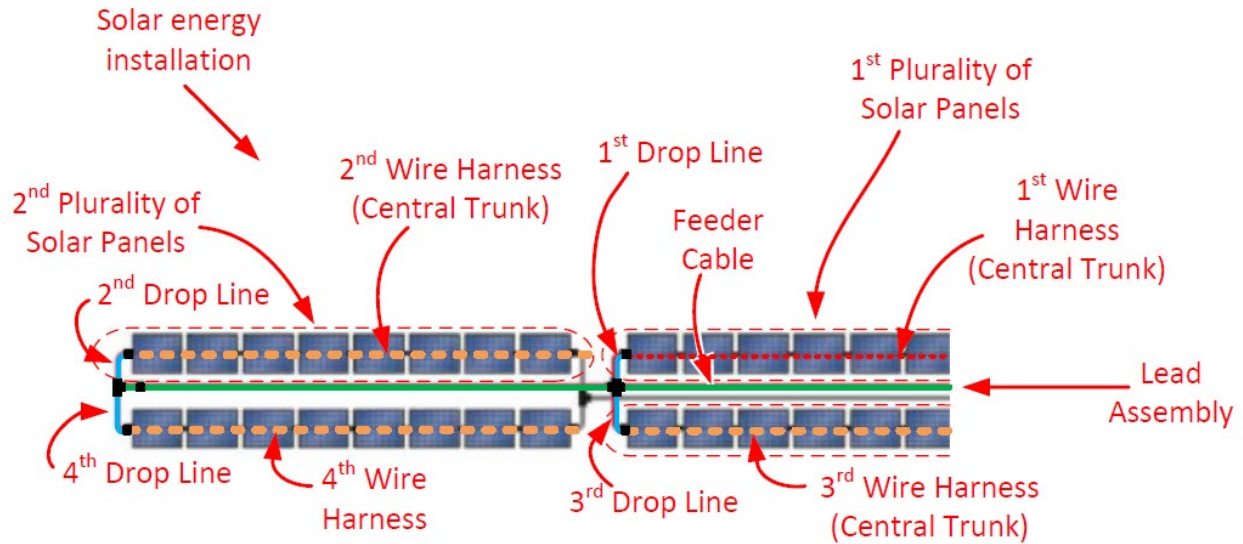
types of connectors for establishing wire/cable connections, each suited to different scenarios and needs. While C-shaped clamps are known for their convenience in quick installation, they may not always provide the most secure connection, particularly in situations involving vibration or movement. In contrast, compression lugs are installed using a specialized tool that compresses the lug tightly around the wires/cables being joined, forging a robust connection. A POSITA would understand that the decision between using a C-shaped clamp, or a compression lug hinges on the specific requirements of the electrical connection, such as wire size, application type, and the need for durability and reliability, as well as the tools and skills available for installation. In this way, a POSITA would understand that a compression lug is an obvious alternative to a c-shaped clamp, particularly for installations requiring a more secure connection between the feeder cable and the branch wire(s).

[0199] For the reasons discussed above regarding the claim 1(B-E) limitations, as well as these additional reasons, a POSITA would have found the limitations of claim 7(C)(iii-ix) to be obvious in view of the Amphenol-Shao-Yamawaki combination.

D. A second drop line electrically connected to said second wire harness,

[0200] Amphenol discloses a second drop line electrically connected to the

second wire harness. *See* EX1007, p.6, middle image (Relief & 3rd-annotation), below.

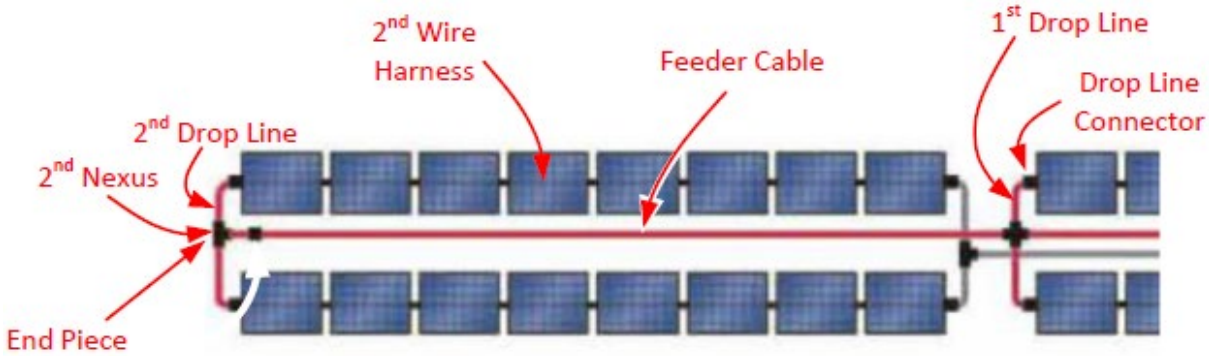


EX1007, p. 6, middle image (Relief & 4th-annotation)

[0201] For these reasons, a POSITA would have found the limitations in claim 7(D) to be obvious in view of Amphenol.

i. said second drop line electrically connected to said feeder cable at a second nexus,

[0202] Amphenol discloses that the second drop line is electrically connected to the feeder cable at a second nexus. *See* EX1007, p.6, middle image (Relief and 5th-annotation), below.



EX1007, p. 6, middle image (Relief and 5th-annotation)

[0203] For these reasons, a POSITA would have found the limitations in claim 7(D)(i) to be obvious in view of Amphenol.

ii. wherein the solar power system doesn't include a combiner box upstream of said component.

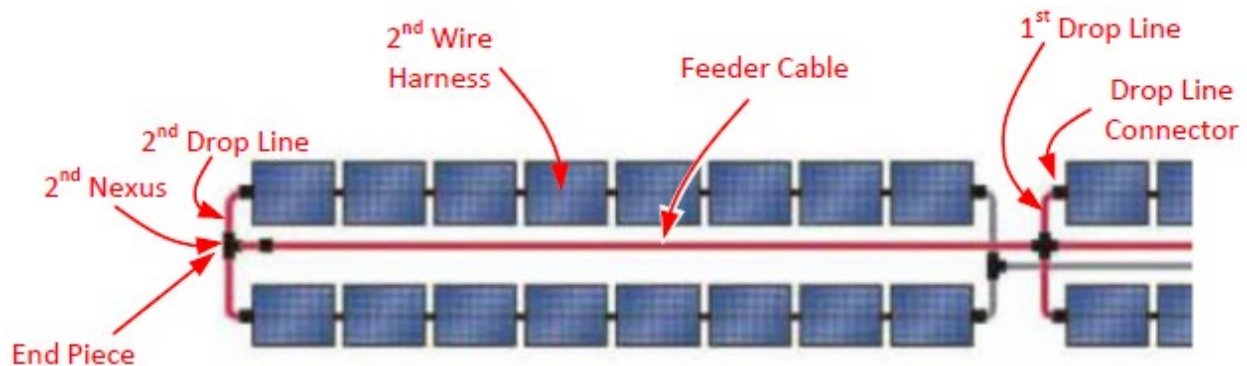
[0204] The claim 7(D)(ii) limitations, are the same as or at least equivalent to the claim 1(E)(i) limitations addressed above, which discussion is incorporated here by reference. With respect to the expression “upstream of said component,” a POSITA would understand this to refer to locations between the component and the solar panels of the installation. Similarly, “downstream” would refer to locations between the component and the inverter. The terms “upstream” and “downstream” are understood to refer to the direction of the flow of power from the solar panels to the inverter in the solar array installation. As presented above regarding the claim 1(E)(i) limitations, a POSITA would have found the claim 7(D)(ii) limitations to be obvious in view of the Amphenol-Shao-Yamawaki combination.

[0205] Accordingly, based on the above, a POSITA would have found claim 7 to be obvious based on the Amphenol-Shao-Yamawaki combination. Accordingly, claim 7 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Shao, and Yamawaki.

7. Claim 8

The solar power system of claim 7 wherein said lead assembly includes an end piece.

[0206] Amphenol discloses that the lead assembly includes an end piece (e.g., the second nexus is an end piece). *See* EX1007, p.6, middle image (Relief & 5th-annotation), below.



EX1007, p. 6, middle image (Relief & 5th-annotation)

[0207] For these reasons, a POSITA would have found the limitations in claim 8 to be obvious in view of Amphenol as part of the Amphenol-Shao-Yamawaki combination.

8. Claim 9

The solar power system of claim 7 wherein said first drop line terminates in a drop line connector.

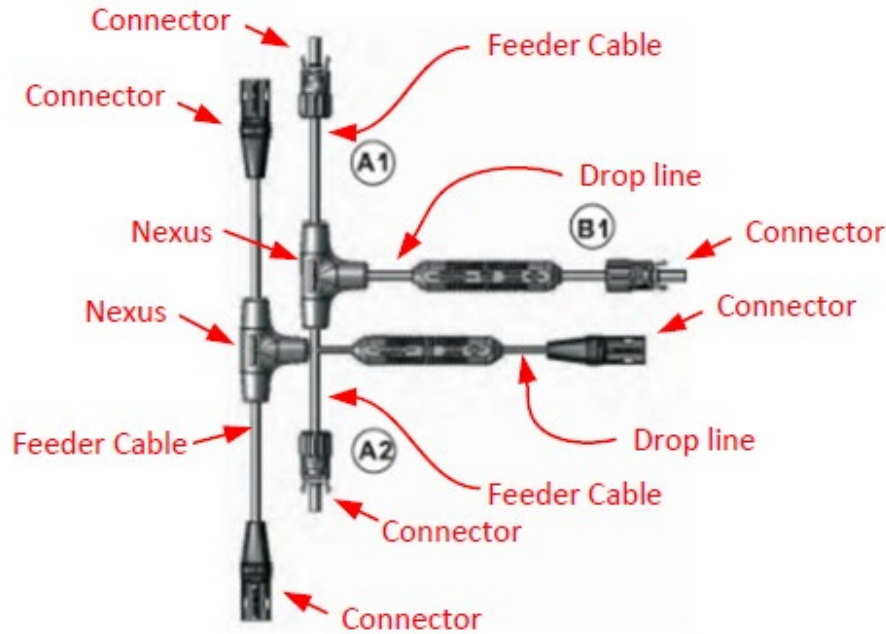
[0208] Amphenol discloses that the first drop line (i.e., branch) terminates in a drop line connector. *See* EX1007, p.6, middle image (Relief & 5th-annotation), above.

[0209] For these reasons, a POSITA would have found the limitations in claim 9 to be obvious in view of Amphenol as part of the Amphenol-Shao-Yamawaki combination.

9. Claim 10

The solar power system of claim 7 wherein said feeder cable terminates in a feeder cable connector.

[0210] As discussed above with regard to the Claim 1(B) limitations, which discussion is incorporated here by reference, Amphenol discloses that the feeder cable terminates in a feeder cable connector. *See* EX1007, p. 21, top image (1st annotation), below.



EX1007, p. 21, top image (1st annotation)

[0211] For these reasons, a POSITA would have found the limitations in claim 10 to be obvious in view of Amphenol as part of the Amphenol-Shao-Yamawaki combination.

10. Claim 11

The solar power system of claim 7 wherein said first drop line includes 18 to 4 gauge wire.

[0212] Amphenol discloses a list of gauges for the drop lines (i.e., the branch cable) that may be selected for a lead assembly, including 8AWG, 10AWG, 12AWG, or 14AWG. *See* EX1007, p. 21 (Branch cable size list). Also, a POSITA would understand that “AWG” refers to American Wire Gauge, which is a standard for designation of wire gauge, which is associated with wire diameter. A POSITA would understand that an appropriate drop line

gauge should be selected for the intended use. In particular, a POSITA would understand that the maximum amount of current to be carried by a cable is an important parameter in selection of the cable diameter and other cable parameters, such as the cable material and the insulation material. In particular, there are well-known guidelines for cable diameter selection for different amounts of maximum current. For example, Table 310.16 of the 2002 Version of the National Electric Code, titled “Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts...” See EX1010, p. 149. This table is a wire ampacity size table with which a POSITA would be familiar and provides a guide for what gauge wire is appropriate for different ampacities of insulated conductors. *See id.* In the table above, wire gauges between 18 AWG and 4 AWG are expected to carry current from 14A to 95A at temperatures up to 90°C, and up to 70A at temperatures up to 60°C. *See id.* A POSITA would understand how to find and use such guides to make decisions about the gauge of different sections of a solar installation. Similar tables are available with information on selection for different voltages, and for resistances.

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13.)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM				
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

EX1010, Table 310.16

[0213] For these reasons, a POSITA would have found the limitations in claim 11 to be obvious in view of Amphenol as part of the Amphenol-Shao-Yamawaki combination.

11. Claim 12

The solar power system of claim 7 wherein said feeder cable includes 6 gauge to 1000 MCM wire.

[0214] Amphenol discloses a list of gauges for the feeder cables (i.e., the Main cable) that may be selected for a lead assembly, including 8AWG,

10AWG, 12AWG, or 14AWG. *See* EX1007, p. 21 (Main cable size list).

[0215] A POSITA would understand that the abbreviation “MCM” stands for “thousands of circular mils,” which defines wire sizes. A typical 250 MCM cable has a diameter of more than 1 cm, and a 1000 MCM cable has a diameter near 2.5 cm. In view of the standard electrical practices defined in the NEC 2002, a POSITA would understand that an appropriate feeder cable gauge should be selected for the intended use based on the projected current and voltages to be conducted by the feeder cable. *See* EX1010, generally. In particular, a POSITA would understand that the maximum amount of current to be carried by a cable is an important parameter in selection of the cable diameter and other cable parameters, such as the cable material and the insulation material. Further, the NEC 2002 provides standard guidelines for cable diameter selection based on maximum current, including Table 310.16 titled “Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts...” that is reproduced below. *See* EX1010, p. 149. This ampacity size table with which a POSITA would be familiar lists the gauge of wire that is appropriate for different ampacities of insulated conductors for different types of wires and different temperature ratings. *See id.*

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13.)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM				
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

EX1010, Table 310.16

[0216] Table 310.16 (reproduced above) includes ampacity values for cables with 250 or 1000 MCM diameter, showing that cables of these diameters are expected to carry current from 215A to 455A. Other than diameter and current carrying capacity, there are no differences between cables from 18 AWG to 1000MCM. A POSITA would understand how to find and use electrical standards and guides such as the NEC 2002 to make decisions about the diameter of wire needed for different sections of the wiring

harness for a solar installation, and to select suitable cables from the catalogs of cable vendors. The NEC 2002 and cable vendor catalogs include similar tables with information for selecting cables for different voltages and resistances. Therefore, a POSITA would understand that the selection of feeder cable size, in the range of 250 MCM to 1000 MCM is an obvious design choice in view of Amphenol and well-known electric codes and standards including the NEC 2002.

[0217] For these reasons, a POSITA would have found the limitations in claim 12 to be obvious in view of Amphenol as part of the Amphenol-Shao-Yamawaki combination.

12. Claim 13

The solar power system of claim 7 wherein said first nexus is surrounded by said compression lug.

[0218] The claim 13 limitations are the same as or at least equivalent to the claim 1(C) and/or the claim 7(C)(iii) limitations addressed above. As presented above regarding the claim 1(C) limitations, a POSITA would have found the claim 13 limitations to be obvious in view of the Amphenol-Shao-Yamawaki combination.

13. Claim 14

Preamble. A method of constructing a solar power installation including the steps of:

[0219] Amphenol discloses a method of construction a solar power

installation in that Amphenol discloses various solar system components, including lead assemblies and connectors in various example installation scenarios. *See* EX1007, generally. As discussed above regarding Ground 1, claim 7(Preamble), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(Preamble) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those must be constructed to form a solar power installation.

[0220] For these reasons, a POSITA would have found the limitations in claim 14(Preamble) to be obvious in view of Amphenol.

A. Connecting a first plurality of solar panels to a first wire harness to form a first solar array;

[0221] As discussed above regarding Ground 1, claim 7(A), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(A) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those elements must be connected.

[0222] For these reasons, a POSITA would have found the limitations in claim 14(A) to be obvious in view of Amphenol.

B. Connecting said first wire harness to a first drop line of a lead assembly;

[0223] As discussed above regarding Ground 1, claim 7(C)(i), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(B) to be obvious in view of Amphenol by

disclosing all the elements and thus illustrating that those elements must be connected.

[0224] For these reasons, a POSITA would have found the limitations in claim 14(B) to be obvious in view of Amphenol.

C. Connecting a second plurality of solar panels to a second wire harness to form a second solar array;

[0225] As discussed above regarding Ground 1, claim 7(B), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(C) to be obvious in view of Amphenol by disclosing all the elements and thus disclosing those elements may be connected.

[0226] For these reasons, a POSITA would have found the limitations in claim 14(C) to be obvious in view of Amphenol.

D. Connecting said second wire harness to a second drop line of said lead assembly; and

[0227] As discussed above regarding Ground 1, claim 7(D), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(D) to be obvious in view of Amphenol by disclosing all the elements and thus disclosing those elements may be connected.

[0228] For these reasons, a POSITA would have found the limitations in claim 14(D) to be obvious in view of Amphenol.

E. Electrically coupling said lead assembly to an inverter without electrically coupling to a combiner box;

[0229] As discussed above regarding Ground 1, claim 1(E)(i), which

discussions are incorporated here by reference, a POSITA would have found the limitations in claim 14(E) to be obvious in view of Amphenol, Shao, and Yamawaki by disclosing all the elements and thus disclosing those elements may be connected. In particular, a POSITA at the time of the filing of the '254 Patent would have been aware of the options for connecting power from elements of a solar array, including use of cable harnesses with junctions, or use of combiner boxes, and would understand that combiner boxes or harnesses with cable junctions are available for use in these systems. To the extent that Amphenol does not explicitly disclose a system without a combiner box, a POSITA would understand from the teachings of Yamawaki that the combiner box may be omitted from solar array installations, such as those discussed by Amphenol and Yamawaki to remove an element (combiner box) and its known function as needed. Thus, a POSITA would have been motivated to combine power from many solar arrays directly to an inverter, as taught by Yamawaki, to provide a simplified system that is easier to install and more reliable (*see A(vi)* 'Motivation to Combine Amphenol, Shao, and Yamawaki further discussed above).

[0230] For these reasons, a POSITA would have found the limitations in claim 14(E) to be obvious in view of the Amphenol-Shao-Yamawaki combination.

i-iii. wherein said lead assembly includes said first drop line electrically connected to said first wire harness, and a 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said feeder cable electrically connected at a first nexus secured by a means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof, said securing means surrounded by an undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said feeder cable, said inner surface surrounding and fully encasing said securing means, said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter, said feeder cable continuously extending through said first aperture, and a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture, with said undermold surrounded by an overmold and forming an undermold-overmold interface only at said outer surface, wherein said lead assembly has a voltage rating of 1500 VDC.

[0231] As discussed above regarding claim 1, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(E)(i) to be obvious in view of the Amphenol-Shao-Yamawaki combination.

[0232] Accordingly, based on the above, a POSITA would have found claim 14 to be obvious based on the Amphenol-Shao-Yamawaki combination. Accordingly, claim 14 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Shao, and Yamawaki.

14. Claim 15

The method of claim 14 wherein said step of electrically coupling said lead assembly to an inverter includes the steps of electrically coupling said feeder cable to said inverter.

[0233] As discussed above regarding the claim 1(E)(i) and claim 7(C)(ii) limitations, which discussion is incorporated here by reference, the Amphenol-Shao-Yamawaki combination teaches electrically coupling a lead assembly to an inverter. For these reasons, a POSITA would have found the limitations in claim 15 to be obvious in view of the Amphenol-Shao-Yamawaki combination.

B. Ground 2: Claim 6 is unpatentable under 35 U.S.C. § 103 as obvious based on Amphenol, Shao, Yamawaki, and Tamura

(i) Tamura

[0234] Tamura is patent JP 4080633, published on August 24, 2001, and is titled “Cable Branch Molding Method.” As described in detail below Tamura discloses, “a molding method suitable for molding a molded structure for a cable branch portion having excellent waterproofing

performance.” Tamura, ¶6.

[0235] I have been informed by counsel that Tamura was not identified to or considered by the Examiner who allowed the ’254 patent.

(ii) Motivation To Combine Amphenol, Shao, Yamawaki, and Tamura

[0236] A POSITA would have been motivated to combine Amphenol, Shao, Yamawaki, and Tamura (i.e., the “Amphenol-Shao-Yamawaki-Tamura combination”) for the reasons set forth below.

[0237] Amphenol, Shao, Yamawaki, and Tamura disclose the design of cable junction elements that can be used to combine electrical power from a source (e.g., a distributed array of solar cells) or distribute power to a central source (e.g., an inverter) that is convenient, reliable, flexible, and low-cost. As discussed previously, the distinction between power combining in a solar array and power splitting in a power distribution system is modest, and the challenge and solutions are broadly applicable, and so a POSITA would consider prior art in all of these domains as applicable to development of improved elements for solar power installations.

[0238] Amphenol discloses a variety of cable junction geometries and provides a process for users to select combinations that are appropriate for their system configuration. *See* EX1007, pp. 6 and 16-36. Shao discloses

designs and manufacturing methods that can be used for joining the main cables and drop lines and providing insulation and molding to protect the junctions. *See* EX1008, 5:31-34, 6:18-30, and 6:40-7:1. Yamawaki discloses photovoltaic modules that may be arranged in various ways to overcome challenges and support the design of a photovoltaic panel array, such as on a home solar energy installation, in addition to improvements to branch junctions that include a molded body (i.e., an undermold) covered by a cover member (i.e., an overmold). *See* EX1006, 7:54-8:11, 10:19-22 and FIG. 9B. Likewise, Tamura is generally directed to cable assemblies that provide “high waterproofing performance.” EX1009, ¶17. In particular, Tamura discloses a “Cable branch molding method.” EX1009, ¶3.

[0239] I believe that Amphenol, Shao, Yamawaki, and Tamura are analogous prior art because they are in the same field of endeavor as the '254 Patent, namely electrical wiring assemblies and connectors. Not only do all those references relate to electrical wiring assemblies and connectors, but more particularly, each of these references are directed to power wiring assemblies like the ones claimed in the '254 Patent.

[0240] Accordingly, all four references may be considered to be useful for developing improvements in the field of solar power installation design. Tamura particularly addresses solutions for electrically coupling a plurality

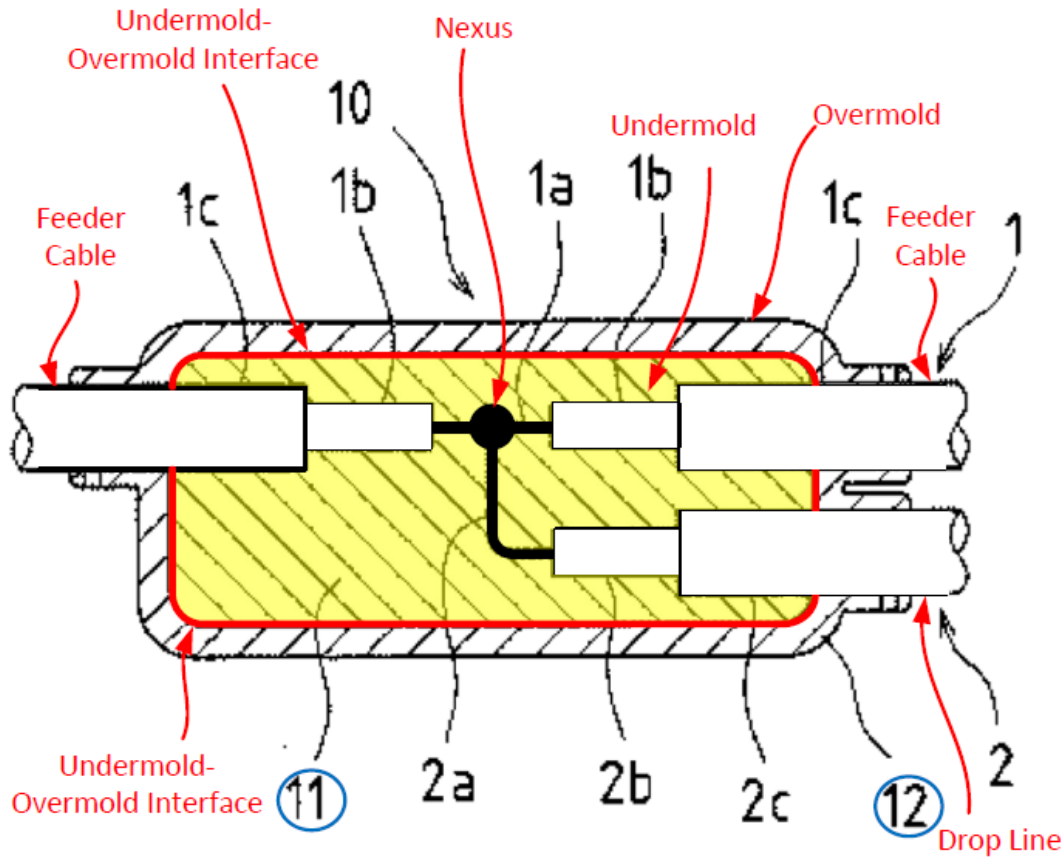
of solar arrays and “arranging multiple solar battery modules comprising a plurality of solar 5 battery cells on a roof or on top of a building and connecting the solar battery modules by means of cables.” EX1009, ¶2.

[0241] Tamura is not cumulative to any of the prior art cited during prosecution, but rather compliments and provides further improvements to Amphenol, Shao, and Yamawaki by providing a 2-layer molding process that offers better reliability and performance because of the selection of “PVC resins” for several of the layers of the assembly, and the use of an inner mold part and an outer mold part which improves adhesion and achieves a “high waterproofing performance by virtue of a double waterproofing effect.” EX1009, ¶17. Tamura explicitly discloses double molded branching cables for solar applications. *See id.*, ¶¶24-25. In the background section, Tamura states “[a] power cable such as a CV cable is used to connect such solar battery modules,” “[t]here are problems with a structure in which the branch portion of the CV cable is molded from PVC (fig. 11) in that high waterproofing performance is not achieved because of poor adhesion between the PVC and the cable conductors,” and “[t]he present invention has been devised in light of this situation...” *See id.*, ¶¶3, 5, 6.

[0242] A POSITA would be motivated to combine the manufacturing

methods of Amphenol, Shao, and Yamawaki with Tamura, and specifically the addition of the two molding steps of Tamura to the basic connector design of Shao, to achieve further improvements in reliability and performance, and to use these detailed designs, processes, and materials, to build the entire catalog of wiring harness components disclosed by Amphenol.

[0243] Tamura describes: “A method for molding a cable branch portion, which is a method for molding a section where a conductor of a branch cable is connected to a conductor of a trunk cable” using a process with an “inside molded portion” is formed over the connection between the branch cable and the trunk cable, and a “outside molded portion” is formed over the inner mold part, covering the inner mold. *See id.*, ¶8. An illustration from Tamura is provided to help describe the disclosure:



EX1009, FIG. 1 (1st-annotation)

[0244] As described by Tamura, “According to this embodiment, the same resin (PE) as that of the insulators 1b, 2b of the CV cable is thus used as the resin of the inside molded portion 11, which therefore improves adhesion between the inside molded portion 11 and the insulators 1b, 2b. Additionally, the same resin (PVC) as that of the sheath materials 1c, 2c of the CV cable is used as the resin of the outside molded portion, which therefore also improves adhesion between the outside molded portion 12 and the sheath materials 1c, 2c. This makes it possible to achieve high

waterproofing performance by virtue of a double waterproofing effect. ”

EX1009, ¶17.

[0245] Tamura explains: “In addition to molding of a branch portion of a CV 30 cable used for connecting solar battery modules, the present invention may also be applied to molding of branch portions for various types of cables used for connecting electrical devices such as modules for snow melting purposes and modules for tape heaters.” EX1009, ¶25.

[0246] Further, Tamura, in the same field of electrical connectors as Amphenol and Shao, discloses a “A method for molding a cable branch portion .” EX1009, ¶57. Tamura also discloses “This makes it possible to achieve high waterproofing performance by virtue of a double waterproofing effect”. *See* EX1009, ¶17.

[0247] In addition, to the combination of Amphenol, Shao, and Yamawaki discussed above, the POSITA would further be motivated to combine the solar power system and connectors as taught by the Amphenol-Shao-Yamawaki combination with the multi-layered protective arrangement taught by Tamura in order to provide a compact, layered casing that better protects the solar power system branch connectors against the elements.

[0248] A POSITA would have an expectation of success in combining the Amphenol-Shao-Yamawaki combination with the teachings of Tamura since

these references complement one another and the double-molding disclosed by Tamura is intended to further protect and strengthen solar power system branch connections. Specifically, Tamura goes on to explain that the double-molding can be applied broadly, “[i]n addition to molding of a branch portion of a CV 30 cable used for connecting solar battery modules, the present invention may also be applied to molding of branch portions for various types of cables used for connecting electrical devices such as modules for snow melting purposes and modules for tape heaters.” EX1009, ¶25. Thereby, Tamura explicitly encourages POSITAs to apply the details disclosed in Tamura broadly, which would motivate and indicate likely success to a POSITA.

[0249] Accordingly, a POSITA would have been motivated to combine the Amphenol-Shao-Yamawaki combination with Tamura. This combination would provide the large set of wiring harnesses and cable assemblies of Amphenol with the benefits of Shao, including “space occupied for mounting is small, and a power distribution line can also be simple and clear,” “the workload of peeling the cable during production can be decreased, the branch connection reliability of the branch lines can also be improved, and the service life of the branch joint can be prolonged,” EX1006, 5:29-34. This combination would also include the benefits of

Yamawaki including that the feeder wire of a wire harness may be directly connected to an inverter and that branch junctions can included an undermold covered by an overmold. *See* EX1006, 7:54-8:11 and 10:19-22. Tamura then provides additional benefits, such as the particular materials used for double molding which provides a “double waterproof effect.” EX1009, ¶17.

[0250] Further, a POSITA would have understood to achieve these advantages, the selection of “PVC resins” for several of the layers of the assembly, and the use of an inner mold part and an outer mold part disclosed by Tamura could be successfully applied to the modified harness of the Amphenol-Shao-Yamawaki combination. The precise technical combination and modifications are described further below.

[0251] For these reasons, I believe a POSITA would be motivated to combine Amphenol, Shao, Yamawaki, and Tamura to arrive at the “Amphenol-Shao-Yamawaki-Tamura combination.”

1. Claim 6

The lead assembly of claim 1, wherein the overmold is applied by injection molding.

[0252] Tamura discloses applying an injection molded overmold over an undermold of a branch cable connection to provide an added layer of waterproofing. *See* EX1009, ¶11, 17. In particular, Tamura discloses

adding an injection-molded outer mold part 12 (i.e., an overmold) over an inner mold part 11 (i.e., an undermold). *See* EX1009, ¶14. Also, by using “the same resin (PVC) as that of the sheath materials 1c, 2c of the CV cable is used as the resin of the outside molded portion, which therefor also improves adhesion between the outside molded portion 12 and the sheath materials 1c, 2c,” which provides a high performance waterproofing. *See id.*, ¶17. It would have been obvious to a POSITA to add an injection molded overmold for added protection against environmental elements, as taught by Tamura (*see* B(iii) ‘Motivation to Combine Amphenol, Shao, Yamawaki, and Tamura’ further discussed above).

[0253] For these reasons, a POSITA would have found the claim 6 limitations to be obvious in view of the Amphenol-Shao-Yamawaki-Tamura combination.

[0254] In accordance with Ground 2, claim 6 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Shao, Yamawaki, and Tamura.

C. Ground 3: Claims 1-15 are unpatentable under 35 U.S.C. § 103 as obvious based on Amphenol, Yu, Yamawaki, and Tamura.

[0255] The disclosures of Amphenol, Yamawaki, and Tamura are discussed above regarding Grounds 1 and 2, which discussions are incorporated here by reference. Basically, Amphenol is a brochure from Amphenol Industrial

Operations that is directed to various solar power system connectors in solar power systems. *See* EX1007, generally. Amphenol recognizes the interchangeability of solar power system elements, such as connectors, to provide solutions that properly configure and customize solar power systems for customers. *See* EX1007, pp. 2-3. Yamawaki discloses photovoltaic modules that may be arranged in various ways to overcome challenges and support the design of a photovoltaic panel array, such as on a home solar energy installation. *See* EX1006, 7:54-8:11. Tamura discloses applying an injection molded overmold over an undermold of a branch cable connection to provide an added layer of waterproofing. *See* EX1009, ¶11, 17.

(i) Yu

[0256] Yu is Chinese Patent No. 102332345, published August 9, 2011. Yu describes improved methods for fabrication of branch cables for use in electrical installations. *See* EX1015, Abstract. As described in detail below, Yu is not cumulative to any of the prior art cited during prosecution, but rather provides further improvements to Amphenol by providing improved cable junctions that provide increased reliability, protection against environment elements, without adding complexity.

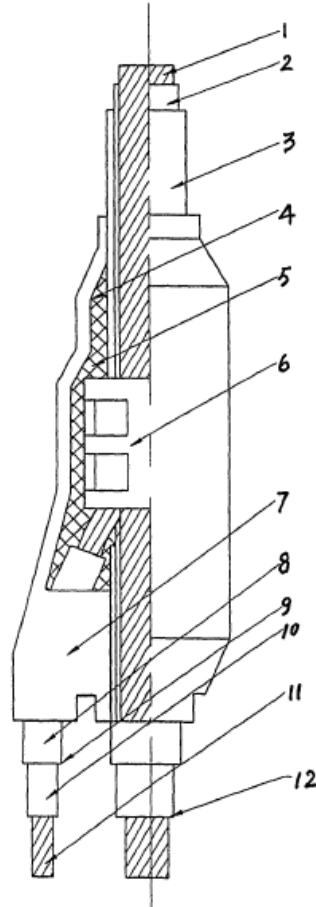
[0257] I have been informed by counsel that Yu was not identified to or considered by the Examiner who allowed the '254 Patent.

[0258] According to Yu, there are limitations associated with conventional cable manufacturing methods:

the main cables and the branch cables shall be insulated using polyvinyl chloride and cross-linked polyethylene, and sheaths are typically polyvinyl chloride sheaths and polyolefin sheaths...The polyvinyl chloride is a thermoplastic material, which has an operating temperature of substantially 65°C or 70°C, and easily absorbs water. Water absorption will cause the insulation resistance of the polyvinyl chloride to drop sharply. In addition, as a thermosetting material, the cross-linked polyethylene has an increased operating temperature, but it is only 90°C. An interface inevitably exists between insulations of the main cable and the branch cable in the connector, so these cables are not suitable for long-term water-immersion, underground or high-humidity environments. Obviously, in an operating environment exceeding 100°C or a long-term humid environment, current branch cables are hard to pass or fail to pass the water-immersion withstand voltage test or the insulation resistance test.

See id., ¶[0002]. To address these problems, Yu provides “a method for manufacturing a prefabricated flexible branch cable. Products produced with the method are resistant to high humidity and high temperature and are completely applied to an operating environment exceeding 100°C but lower than 250°C or a long-term humid environment.” *See id.*, ¶[0003].

[0259] Yu discloses improvements to flexible branch cables. *See id.*, FIG. 1, below.



EX1015, FIG. 1

[0260] In particular, Yu discloses:

The prefabricated flexible branch cable comprises a main cable conductor 1 and a branch cable conductor 11. A main insulation layer 2 and a main outer sheath 3 are sequentially provided outside the main cable conductor 1, a branch insulation layer 10 and a branch outer sheath 8 are sequentially provided outside the branch cable conductor 1, ... the main insulation layer 2, the main outer sheath 3, the branch insulation layer 10 and the branch outer sheath 8 are each peeled off at a joint between the main cable conductor 1 and the branch cable conductor 11, the main cable conductor 1 and the branch cable conductor 11 are crimped by means of a C-shaped clamp 6 with a ridge by an automatic hydraulic machine, after the crimping is completed, injection molding of a connector insulation layer 5 is performed by using a suitable mold, a non-woven fabric is then

wrapped around the formed connector insulation layer 5 to form a non-woven wrapping layer 4, injection molding of a connector outer protective layer 7 is performed again outside the non-woven wrapping layer 4, and the connector insulation layer 5 and the connector outer protective layer 7 jointly constitute a branch cable connector; the main insulation layer 2,...

See id., ¶[0004].

[0261] Yu further describes the branch cable connector:

after the crimping is completed, injection molding of a connector insulation layer (5) is performed by using a suitable mold, a non-woven fabric is then wrapped around the formed connector insulation layer (5) to form a non-woven wrapping layer (4), injection molding of a connector outer protective layer (7) is performed again outside the non-woven wrapping layer (4), and the connector insulation layer (5) and the connector outer protective layer (7) jointly constitute a branch cable connector...

See id.

[0262] Although Yu, like Amphenol, does not explicitly refer to the cables and wiring assemblies as “drop lines,” “a feeder cable,” “lead assembly,” “a wire harness,” or “a central trunk,” as discussed above, which discussion is incorporated here by reference, a POSITA would understand that the disclosed cables and wiring assemblies correspond to and/or analogous to drop lines, a feeder cable, a lead assembly, a wire harness, and/or a central trunk. *See* ‘A(i) Motivation to Combine Amphenol and Shao,’ discussed above.

(ii) Motivation to Combine Amphenol and Yu

[0263] A POSITA would have been motivated to combine the teachings of Amphenol and Yu (i.e., the “Amphenol-Yu combination”) for the reasons set forth below.

[0264] Both Amphenol and Yu address the general problem of providing convenient, flexible, reliable, and low-cost wiring assemblies for power applications. Amphenol is concerned with wire assemblies, cable junctions, connectors, in-line fuses, and other components to be used for combining and distributing power from elements of a solar array installation. *See* EX1007, generally. Yu is also concerned with the field of wires (i.e., cables) and more specifically the detailed design of a flexible branch cable to be used for power distribution. *See* EX1015, generally. These references discuss the design of cable junction elements that can be used to combine or distribute electrical power. The important details disclosed in Amphenol and Yu relate to the formation of a reliable electrical contact between different cables, protecting the connection from environmental factors and damage from handling, and fabricating the electrical contact elements in a way that reduces cost and simplifies the assembly and maintenance of the power facilities. Amphenol focuses on solar array electrical connection systems, and Yu is focused on power distribution connections of cables and

the geometric features and methods of forming molded protection layers of those connections, but the underlying mechanics, materials, assembly processes, molding processes, and other details are similar such that a POSITA would have been motivated to consider both publications in combination. Fundamentally, within a cable junction, the most significant difference between power combining and power distribution is the direction in which that electrons are moving in some parts of the junction. Based on known practices, such as taught in the PSE textbook (EX1011) and the NEC 2002 (EX1010), a POSITA would understand how to apply the teaching of Yu to the wiring assembly disclosed by Amphenol to produce systems with the benefits sought in both references.

[0265] I believe that Amphenol and Yu are in the same field of endeavor as the '254 Patent, and are thus analogous prior art, since both references relate to electrical wiring assemblies and connectors. Additionally, I believe that it would be reasonable and practical for a POSITA working in the field of wiring assemblies for solar energy installations to look outside solar energy applications and to other related and more-established fields, such as electrical wiring and connectors more generally, for ideas that could lead to these sought-after improvements. As discussed above with regard to the motivation to combine Amphenol and Shao, which discussion is

incorporated here by reference, even the Patent Examiner, during the prosecution of the '254 Patent, cited Vander Ploog (EX1023), which like Yu is not explicitly related to photovoltaic power distribution systems, but is related to cables and connectors for cables. *See* EX1002, p.265. *See* A(v) 'Motivation to Combine Amphenol and Shao.'

[0266] As the claims of the '254 Patent are primarily focused on means for forming connections between cables and the geometric features and methods of forming molded protection layers, a POSITA should be interested in looking to established fields where there are similar objectives. As mentioned above, the soldering and crimping methods for forming electrical connections described in the '254 Patent have been established for decades prior to the Critical Date of the '254 Patent. Also, methods for forming molded protection layers for electrical connections had been established decades prior to the Critical Date of the '254 Patent. In my opinion, a POSITA interested in wiring assemblies that achieve the stated objectives of the '254 Patent; namely to provide a device that is "small, inexpensive to manufacture and transport, and easy to use" and are "extremely durable and can be adapted for a variety of circumstances" would look to the established fields of electrical connections, cables and harnesses, and power distribution, as the disclosures available within these related fields would be reasonably

pertinent to addressing the objectives stated by the author of the '254 Patent.

EX1001, 1:50-54.

[0267] Even though Yu does not explicitly disclose combining power in a solar energy installation, a POSITA would appreciate that the means for forming electrical connections between cables, the geometric arrangement and configuration of those cables being connected, and the means for protecting those cables and connections from the environment using injection molding, as described in Yu, could be applied to the products described in Amphenol. Also, these disclosures by Yu would have been reasonably pertinent to the established objectives of Amphenol. A POSITA would expect to be successful in providing improved performance and reliability based on the combination of the Yu and Amphenol references.

[0268] I discuss above, regarding Ground 1, A(v) 'Motivation to Combine Amphenol and Shao,' which discussion I incorporate here by reference, a POSITA familiar with the selection of suitable electrical wiring and connectors (e.g., EX1010, 690.8 Circuit Sizing and Current, p. 546), including photovoltaic wiring and connectors, would understand that the terms "wire harnesses" and "lead assemblies" both refer to wiring assemblies used for organizing and facilitating electrical connections within electrical power systems. Similarly, despite the variations in terminology

commonly used in the field of photovoltaic power systems, a POSITA would appreciate that the basic electrical wiring and connector elements that may be used in photovoltaics may be called different names yet perform similar functions and have similar requirements. A POSITA familiar with the design of electrical wiring and connectors (e.g., EX1010 and EX1011) would have understood that main cables supplying power and carrying higher currents may be called “trunks,” “trunk cables,” “trunk conductors,” “main cables,” “feeder cables,” or the like. Similarly, the smaller diameter cables branching off a main cable and carrying lower currents may be called “branches,” “branch cables,” “branch conductors,” “branch lines,” “drop lines,” or the like. Also, wiring assemblies that join electrical components and/or wires may be called “wire harnesses,” “lead assemblies,” “wiring apparatus,” or the like depending upon local and/or regional parlance.

[0269] A POSITA would have understood how to combine Amphenol with Yu because both references address the same problem of needing improved cable junctions that provide increased reliability, protection against the environment (e.g., moisture or heat), and reduced complexity, and they do so in the same general field of endeavor of electrical systems and in a compatible manner.

[0270] A POSITA would understand that the solar power system components

disclosed by Amphenol could be improved by the flexible, weather resistant branch cable design disclosed by Yu. The solar power system components disclosed in Amphenol are intended for use in outdoor installations, where there is exposure to heat and humidity. A POSITA would understand that the disclosure provided by Yu would provide methods for extending the lifetime and improving the reliability of solar system installations while preserving the versatility and design flexibility provided by all of the system components disclosed by Amphenol. A POSITA would appreciate the manufacturing methods described by Yu lead to a more weather resistant branch connection that could be readily applied to the cable junctions disclosed by Amphenol. Yu discloses that the resulting product of applying its methods would provide better protection against high temperatures and prolonged humidity.

[0271] A POSITA would have appreciated the benefits of using manufacturing methods disclosed by Yu to fabricate improved versions of the cable harnesses and other components described by Amphenol. The details of using crimps to merge the cables, forming an injection-molded insulation layer followed by an injection molded outer protective layer, and use of high-performance materials described by Yu would be applied by a POSITA to manufacture improved versions of the branch line connections

disclosed by Amphenol.

[0272] A POSITA would be familiar with the manufacturing steps discussed by Yu (crimping and multi-layered molding) and would be able to adapt these methods to the geometries of the cable junctions disclosed by Amphenol, to provide improved electrical properties, and increased reliability. A POSITA would understand that the use of these steps from Yu would improve the performance of the designs in Amphenol by providing a robust cable junction with a clamp that is crimped around the exposed cables, and then providing insulation layers and outer protective layers, serving as undermold and overmold.

[0273] A POSITA would have an expectation of success in combining Amphenol and Yu, since Yu complements the disclosure of Amphenol by disclosing insulated connectors and advantages thereof. The specific assembly process disclosed in Yu, including injection molding methods and materials, would be understood by a POSITA as providing an improved method for manufacture of cable junctions. Specifically, as disclosed in Yu, the main cable of the assembly extends through the cable junction, with insulation peeled off at the location of the junction. The branch cable also has insulation removed, and the exposed metallic sections of the main cable and the branch cable are crimped together by a C-shaped clamp, and then

sealed with undermold and overmold. *See* EX1015, ¶4. The resulting cable junction has a main cable extending continuously through the undermold and the branch cable extending partially through the undermold.

[0274] The in-line fuse assembly for solar photovoltaic power generation systems disclosed by Amphenol is intended for a harsh outdoor environment and would benefit from added protection from the heat, water, humidity, and other elements to which outdoor electrical connectors are exposed that are taught by Yu.

[0275] For these reasons, I believe a POSITA would be motivated to combine the teachings of Amphenol and Yu to arrive at the “Amphenol-Yu combination.”

(iii) Motivation to Combine Amphenol, Yu, and Yamawaki

[0276] A POSITA would have been motivated to combine the teachings of Amphenol and Yu with those of Yamawaki (i.e., the “Amphenol-Yu-Yamawaki combination”) for the reasons set forth below.

[0277] As noted above, the Amphenol-Yu combination discloses an enhanced lead assembly with a compact protective insulating case that may be used in a solar energy installation. Similar to Amphenol, in combination with Yu, Yamawaki discloses photovoltaic modules that may be arranged in various ways to overcome challenges and support the design of a

photovoltaic panel array, such as on a home solar energy installation. *See* EX1006, 7:54-8:11. I believe that Amphenol, Yu, and Yamawaki are analogous prior art because they are in the same field of endeavor as the '254 Patent. Not only do all three references relate to electrical wiring assemblies and connectors, but Amphenol and Yamawaki are more particularly directed to solar power wiring assemblies like the ones claimed in the '254 Patent. Within this disclosure, Yamawaki demonstrates that the feeder wire of a wire harness may be directly connected to an inverter. *See* EX1006, 7:54-8:11. Thus, Yamawaki complements the Amphenol-Yu combination by teaching that the structure of photovoltaic power connectors may be directly connected to an inverter.

[0278] Amphenol discloses a variety of cable junction geometries allowing users to select combinations for wire harnesses and cable assemblies that are appropriate for their system configuration. *See* EX1007, pp. 6 and 16-36. Yu discloses a connection arrangement that can be used for joining the main cables and drop lines and providing insulation and molding to protect the junctions. *See* EX1015, ¶[0003]. Yamawaki provides further improvements to branch junctions that include a molded body (i.e., an undermold) covered by a cover member (i.e., an overmold). *See* EX1006, 10:19-22 and FIG. 9B. In addition, Yamawaki discloses that such branch junctions provide water-

resistance and improved reliability. *See id.*, 13:15-18. A POSITA would be motivated to combine the teachings of Amphenol, Yu, and Yamawaki, specifically the addition of the overmold, in the form of a cover member, over an undermold to achieve further improvements in reliability and performance such as the “water-resistance” as described by Yamawaki. Further, a POSITA would have been motivated to use these detailed junction designs, processes, and materials of Yu and Yamawaki, to build the entire catalog of wiring harness components disclosed by Amphenol.

[0279] Although Yamawaki, like Amphenol and Yu, does not explicitly refer to the cables and wiring assemblies as “drop lines,” “a feeder cable,” “lead assembly,” “a wire harness,” or “a central trunk,” as discussed above, a POSITA would understand that the disclosed cables and wiring assemblies correspond to and/or analogous to drop lines, a feeder cable, a lead assembly, a wire harness, and/or a central trunk. *See* ‘C(i) Motivation to Combine Amphenol and Yu,’ discussed above.

[0280] A POSITA would have had an expectation of success in combining the Amphenol-Yu combination with that of Yamawaki because the photovoltaic modules and wiring junctions in Yamawaki are intended for use with solar installations based on standard solar panels that generate similar current and voltage outputs to those disclosed in the Amphenol-Yu

combination. Therefore, a POSITA would expect the electrical and mechanical requirements to be similar.

(iv) Motivation to Combine Amphenol, Yu, Yamawaki, and Tamura

[0281] A POSITA would have been motivated to combine Amphenol, Yu, Yamawaki, and Tamura (i.e., the “Amphenol-Yu-Yamawaki-Tamura combination”) for the reasons set forth below.

[0282] As noted above, Amphenol, Yu, Yamawaki, and Tamura disclose the design of cable junction elements that can be used to combine electrical power from a source (e.g., a distributed array of solar cells) or distribute power to a central source (e.g., an inverter) that is convenient, reliable, flexible, and low-cost. As discussed previously, the distinction between power combining in a solar array and power splitting in a power distribution system is modest, and the challenge and solutions are broadly applicable, and so a POSITA would consider prior art in all of these domains as applicable to development of improved elements for solar power installations.

[0283] Amphenol discloses a variety of cable junction geometries and provides a process for users to select combinations that are appropriate for their system configuration. *See* EX1007, pp. 6 and 16-36. Yu discloses designs and manufacturing methods that can be used for joining the main

cables and drop lines and providing resistant to high humidity and high temperature. *See* EX1015, ¶3. Yamawaki discloses photovoltaic modules that may be arranged in various ways to overcome challenges and support the design of a photovoltaic panel array, such as on a home solar energy installation, in addition to improvements to branch junctions that include a molded body (i.e., an undermold) covered by a cover member (i.e., an overmold). *See* EX1006, 7:54-8:11, 10:19-22 and FIG. 9B. Likewise, Tamura is generally directed to cable assemblies that provide “high waterproofing performance by virtue of a double waterproof effect.” EX1009, ¶17.

[0284] As discussed above regarding combining Tamura with the Amphenol-Shao-Yamawaki combination, I believe that Amphenol, Yu, Yamawaki, and Tamura are similarly analogous prior art because they are in the same field of endeavor as the '254 Patent. *See* B(iii) ‘Motivation to Combine Amphenol, Shao, Yamawaki, and Tamura.’ Not only are Amphenol, Yu, Yamawaki, and Tamura related to electrical wiring assemblies and connectors, but more particularly Amphenol, Yamawaki, and Tamura are directed to solar power wiring assemblies like the ones claimed in the '254 Patent.

[0285] Tamura discloses a “Cable branch molding method.” EX1009, ¶3.

Tamura also discloses a simple double-molded structure that provides improved protection from water. *See* EX1009, ¶17. As described in detail below, Tamura is not cumulative to any of the prior art cited during prosecution, but rather provides further improvements to Amphenol, Yu, and Yamawaki by providing a 2-layer molding process that offers better reliability and performance because of the selection of “PVC resins” for several of the layers of the assembly, and the use of an inner mold part and an outer mold part which improves adhesion and achieves a “high waterproofing performance by virtue of a double waterproofing effect.” EX1009, ¶17.

[0286] Tamura explicitly discloses double molded branching cables for solar applications. *See id.*, ¶¶24-25. In the background section, Tamura states “[a] power cable such as a CV cable is used to connect such solar battery modules,” “[t]here are problems with a structure in which the branch portion of the CV cable is molded from PVC (fig. 11) in that high waterproofing performance is not achieved because of poor adhesion between the PVC and the cable conductors,” and “[t]he present invention has been devised in light of this situation...” *See id.*, ¶¶3, 5, 6.

[0287] Tamura was not identified to or considered by the Examiner who allowed the '254 patent.

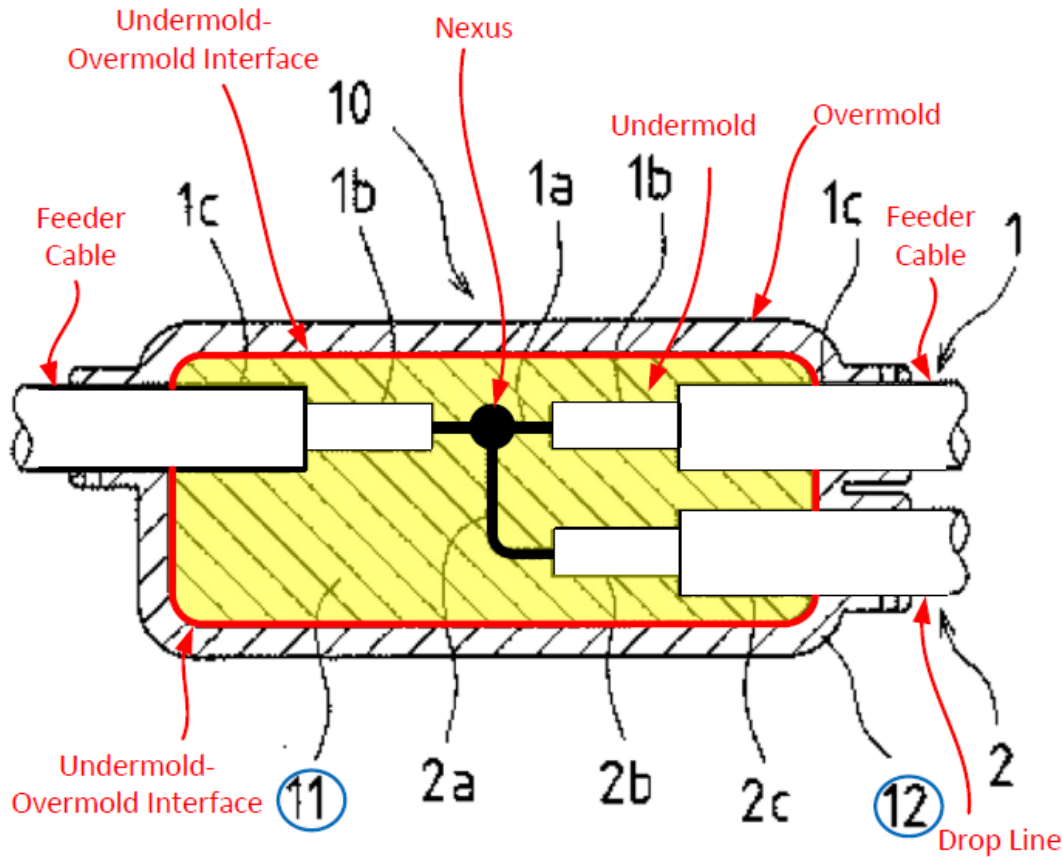
[0288] Although Tamura, like Amphenol, Yu, and Yamawaki, does not explicitly refer to the cables and wiring assemblies as “drop lines,” “a feeder cable,” “lead assembly,” “a wire harness,” or “a central trunk,” as discussed above, a POSITA would understand that the disclosed cables and wiring assemblies correspond to and/or analogous to drop lines, a feeder cable, a lead assembly, a wire harness, and/or a central trunk. *See* ‘A(i) Motivation to Combine Amphenol and Shao,’ discussed above.

[0289] Accordingly, all four references may be considered to be useful for developing improvements in the field of solar power installation design. Tamura particularly addresses solutions for electrically coupling a plurality of solar arrays and “arranging multiple solar battery modules comprising a plurality of solar 5 battery cells on a roof or on top of a building and connecting the solar battery modules by means of cables.” EX1009, ¶2.

[0290] A POSITA would be motivated to combine the manufacturing methods of Amphenol, Yu, and Yamawaki with Tamura, and specifically the addition of the simplified double molded structure taught by Tamura, rather than the multilayered arrangements disclosed by Yu, for insulating and protecting branch couplings against water or humidity with a simpler design. *See* EX1009, ¶9. In this way, the undermold and overmold construction disclosed by Yu and as further modified by Tamura may achieve further

improvements in reliability, performance, simplicity of manufacture, and to use these detailed designs, processes, and materials, to build the entire catalog of wiring harness components disclosed by Amphenol.

[0291] In particular, Tamura describes: “A method for molding a cable branch portion, which is a method for molding a section where a conductor of a branch cable is connected to a conductor of a trunk cable” using a process with an “inside molded portion” is formed over the connection between the branch cable and the trunk cable, and a “outside molded portion” is formed over the inner mold part, covering the inner mold. *See id.*, ¶8. An illustration from Tamura is provided to help describe the disclosure:



EX1009, FIG. 1 (1st-annotation)

[0292] As described by Tamura, “According to this embodiment, the same resin (PE) as that of the insulators 1b, 2b of the CV cable is thus used as the resin of the inside molded portion 11, which therefore provides adhesion between the inside molded portion 11 and the insulators 1b, 2b. Additionally, the same resin (PVC) as that of the sheath materials 1c, 2c of the CV cable is used as the resin of the outside molded portion, which therefore also improves adhesion between the outside molded portion 12 and the sheath materials 1c, 2c. This makes it possible to achieve high

waterproofing performance by virtue of a double waterproofing effect.” *Id.*

¶17.

[0293] Tamura explains: “In addition to molding of a branch portion of a CV 30 cable used for connecting solar battery modules, the present invention may also be applied to molding of branch portions for various types of cables used for connecting electrical devices such as modules for snow melting purposes and modules for tape heaters.” *Id.* ¶25.

[0294] Further, Tamura, in the same field of electrical connectors as Amphenol, Yu, and Yamawaki discloses a “method for molding a cable branch portion.” *Id.*, Title. Tamura also discloses “[t]his makes it possible to achieve high waterproofing performance by virtue of a double waterproofing effect.” *See id.*, ¶17.

[0295] A POSITA would further be motivated to combine the solar power system and connectors as taught by the Amphenol-Yu-Yamawaki combination with the multi-layered protective arrangement taught by Tamura in order to provide a more simple, yet compact, layered casing that still protects the solar power system branch connectors against the elements.

[0296] A POSITA would have an expectation of success in combining the Amphenol-Yu-Yamawaki combination with the teaching of Tamura since these references complement one another and the double-molding disclosed

by Tamura is intended to further protect and strengthen solar power system branch connections. Specifically, Tamura discloses that the double-molding described in this disclosure can be applied broadly, “In addition to molding of a branch portion of a CV 30 cable used for connecting solar battery modules, the present invention may also be applied to molding of branch portions for various types of cables used for connecting electrical devices such as modules for snow melting purposes and modules for tape heaters.” *Id.*, ¶25. Thereby, Tamura is explicitly encouraging POSITAs to apply the details disclosed in Tamura broadly, which would motivate and indicate likely success to a POSITA.

[0297] Accordingly, a POSITA would have been motivated to combine the Amphenol-Yu-Yamawaki combination with Tamura. This combination would provide the large set of wiring harnesses and cable assemblies of Amphenol with the benefits of the manufacturing methods of Yu and Yamawaki, including forming an injection-molded insulation layer followed by an injection molded outer protective layer, and use of high-performance materials configured to resist high temperatures. *See* EX1015, ¶9. Tamura then provides additional benefits, such as a simplified double molding which provides a “double waterproof effect.” EX1009, ¶17.

[0298] Further, a POSITA would have understood to achieve these

advantages, the selection of “PVC resins” for several of the layers of the assembly, and the use of an inner mold part and an outer mold part disclosed by Tamura could be successfully applied to the modified harness of the Amphenol-Yu-Yamawaki combination. The precise technical combination and modifications are described further below.

[0299] For these reasons, I believe a POSITA would be motivated to combine Amphenol, Yu, Yamawaki, and Tamura to arrive at the Amphenol-Yu-Yamawaki-Tamura combination.

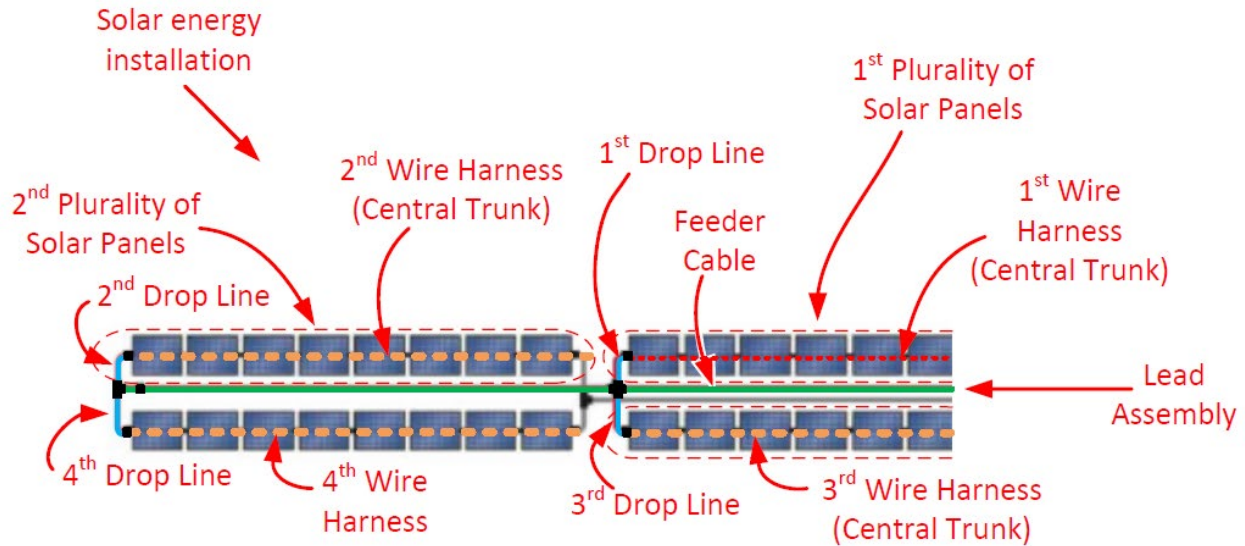
1. Claim 1

Preamble. A lead assembly for use in a solar energy installation including:

[0300] As discussed above regarding Ground 1, claim 1(Preamble), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 1(Preamble) to be obvious in view of Amphenol.

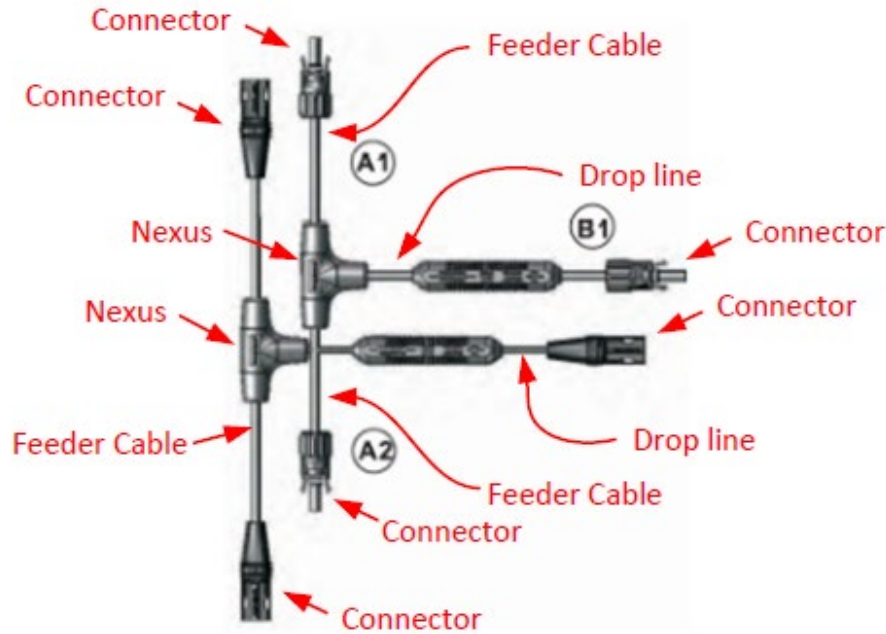
A. A first drop line and a second drop line, said first drop line terminating in a drop line connector;

[0301] Amphenol discloses numerous drop lines (annotated in blue, below) branching from a feeder cable (annotated in green, below) that together form the lead assembly. *See* EX1007, p.6, middle image (Relief & 2nd-annotation), below. As shown, the Amphenol lead assembly includes first and second drop lines, that each terminate in a drop line connector (annotated as small black boxes, below) at the end of each drop line).



EX1007, p. 6, middle image (2nd-annotation)

[0302] Also, in addition to the different configurations of junctions disclosed in Amphenol, discussed above, Amphenol demonstrates that the lead assemblies, which include the diversity junctions include connectors on the ends of the feeder cable and the ends of the drop lines. *See*, EX1007, p. 21, top image (1st annotation), below. A POSITA would understand that the above-noted lead assemblies could be combined in various ways.



EX1007, p. 21, top image (1st-annotation)

[0303] Thus, Amphenol discloses cable junctions with drop lines terminating in a drop line connector. *See*, EX1007, p. 21, top image (1st annotation), above.

[0304] For these reasons, a POSITA would have found the limitations in claim 1(A) to be obvious in view of Amphenol.

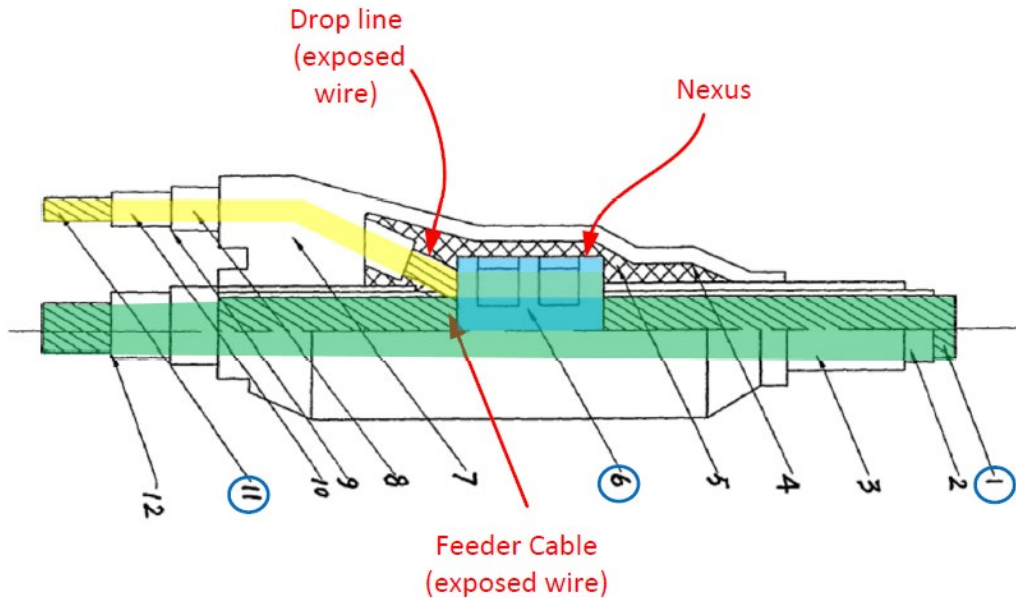
B. At least one 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said at least one feeder cable electrically coupled at a nexus;

[0305] As discussed above regarding Ground 1, claim 1(B), which discussion is incorporated here by reference, a POSITA would recognize that Amphenol discloses at least one 30 amp feeder cable.

[0306] While Amphenol discloses a first drop line and a feeder cable

electrically coupled at a nexus, Amphenol does not illustrate the inside of the molded junction. Yu, however, discloses an example of the details for the design and manufacture of an assembly with the feeder cable electrically coupled to the drop line at a nexus. *See* EX1015, Abstract. Yu, which is in the related field of electrical connectors, discloses a feeder cable (i.e., main cable conductor 1) electrically coupled to a drop line (i.e., a branch cable conductor 11) at a nexus (i.e., a C-shaped clamp 6) that holds the feeder cable and the drop line together. *See*, EX1015, ¶7 and FIG. 1 (1st-annotation), below.

[0307] Yu describes, “the main cable conductor and the branch cable conductor are crimped by means of a C-shaped clamp with a ridge by an automatic hydraulic machine.” *Id.*, 7:22-24.



EX1008, FIG. 1 (1st-annotation)

[0308] It would have been obvious to a POSITA to use a crimped connection using a clamp as taught by Yu, to ensure contact is maintained between the conductive elements of Amphenol, which provides improved reliability. See C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above. Further, it would have been obvious to a POSITA to apply the same crimped connection using a clamp as taught by Yu to attach more than one branch cable. Thus, it would have been obvious to modify the nexus disclosed by Amphenol with the joining technique taught by Yu. A POSITA would be motivated to combine the crimped connection using a clamp as taught by Yu with Amphenol to provide cable junctions that increase reliability, improve resistance to environmental factors, and provide a low profile installation

configuration. (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0309] For these reasons, a POSITA would have found the limitations in claim 1(B) to be obvious in view of the Amphenol-Yu combination.

C. A means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof;

[0310] To the extent that a “means for securing said nexus” refers to the element or elements maintaining the strong electrical and mechanical connection between the feeder cable and the drop lines (*see* Ground 1, claim 1(C) discussion incorporated here by reference), Yu provides a C-shape clamp which is crimped to provide such a means.

[0311] As noted above, Yu discloses a feeder cable (i.e., main cable conductor 10) electrically coupled to a drop line (i.e., a branch cable conductor 11) by a C-shaped clamp (i.e., a C-shaped clamp 6), which forms a nexus that holds the feeder cable and the drop line together. *See*, EX1015, ¶7 and FIG. 1 (1st-annotation), above. As Yu describes, “the main cable conductor and the branch cable conductor are crimped by means of a C-shaped clamp with a ridge by an automatic hydraulic machine.” *Id.*, ¶4. It would have been obvious to a POSITA to use a clamp, as taught by Yu, to ensure contact is maintained between the two conductive elements (*see* C(ii)

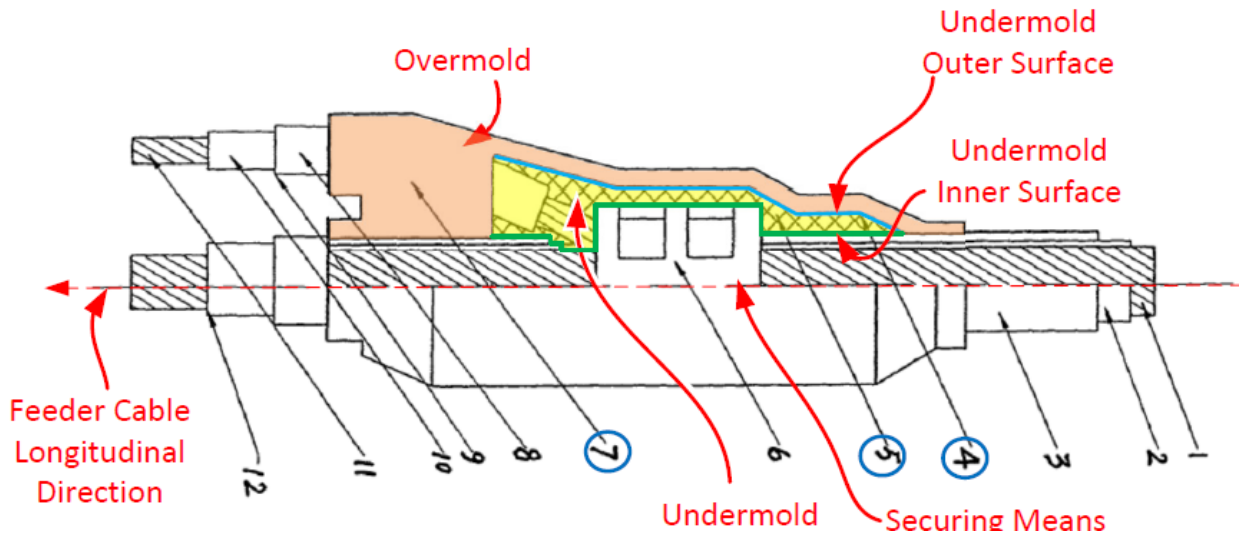
‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0312] For these reasons, a POSITA would have found the limitations in claim 1(C) to be obvious in view of the Amphenol-Yu combination.

D. An undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said at least one feeder cable, said inner surface surrounding and fully encasing said securing means,

[0313] As discussed above with regard to Ground 1, Claim 1(D), which discussion is incorporated here by reference, Amphenol discloses various different types of undermold but does not illustrate a cross-section of the molded junctions. Yu, however, discloses the claimed undermold, including the inner and outer surfaces, as well as additional features of an electrical connector.

[0314] In particular, Yu discloses an undermold (i.e., connector insulation layer 5) that fully encases the nexus. *See*, EX1015, p.7:25-30 and *see* EX1015, FIG. 1 (2nd-annotation), below.



EX1008, FIG. 1 (2nd-annotation)

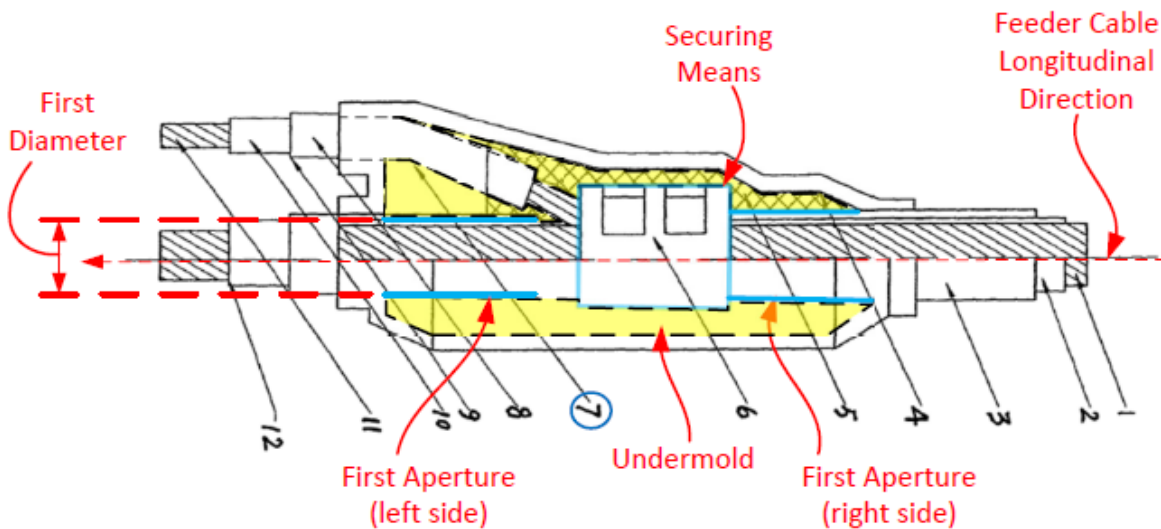
[0315] As described by Yu, “after the crimping is completed, injection molding of a connector insulation layer is performed by using a suitable mold.” EX1015, Abstract. Yu also discloses that the undermold (i.e., connector insulation layer 5) includes portions of inner and outer surfaces that extend in a longitudinal direction of the feeder cable, with the inner surface surrounding and fully encasing the securing means. *See* EX1015, FIG. 1 (2nd-annotation), above.

[0316] It would have been obvious to a POSITA to use an undermold (i.e., a connector cover), as taught by Yu, to encase the exposed cables and the clamp holding the feeder and branch cables together and protect those elements from damage and/or exposure (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0317] For these reasons, a POSITA would have found the limitations in claim 1(D) to be obvious in view of the Amphenol-Yu combination.

i. said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter,

[0318] Yu discloses an undermold (i.e., connector insulation layer 5) that includes an inner surface defined by a first aperture that extends in the longitudinal direction of the feeder cable and that is substantially concentric with the securing means (C-shaped clamp 6) and the feeder cable (i.e., the main cable conductor 1). *See EX1015, FIG. 5 (3rd-annotation), below.*



EX1008, FIG. 1 (3rd-annotation)

Also, in Yu the first aperture extends continuously through the undermold (i.e., connector insulation layer 5) in the longitudinal direction and has a first diameter. *See* EX1015, FIG. 1 (3rd-annotation), above.

[0319] It would have been obvious to a POSITA to use an undermold (i.e., a connector cover), as taught by Yu, to encase the exposed cables and the clamp holding the feeder and branch cables together and protect those elements from damage and/or exposure (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0320] For these reasons, a POSITA would have found the limitations in claim 1(D)(i) to be obvious in view of the Amphenol-Yu combination.

ii. said at least one feeder cable continuously extending through said first aperture, and

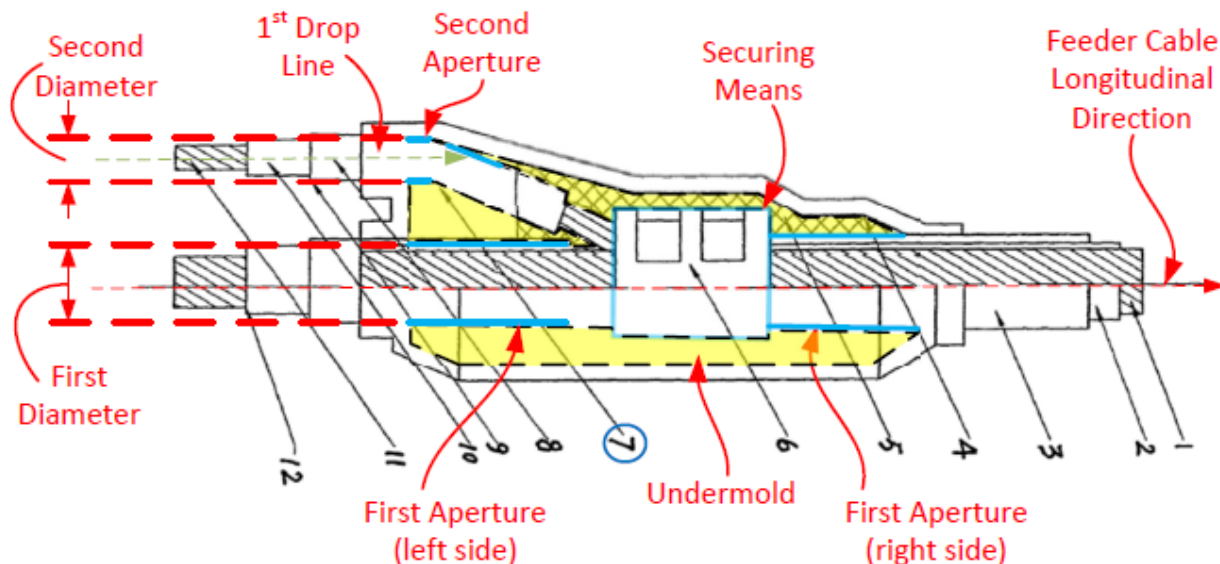
[0321] Yu discloses a feeder cable (i.e., main cable conductor 1) continuously extending through the first aperture. *See* EX1015, FIG. 1 (3rd-annotation), above. It would have been obvious to a POSITA to use the configuration of a feeder cable and the associated aperture in the undermold, as taught by Yu, since it is the most natural arrangement of elements. Additionally, a POSITA would understand that using the cable junction design taught by Yu would increase reliability, improved resistance to environmental factors, and would be easy to install. (*see* C(ii) ‘Motivation to

Combine Amphenol and Yu,' further discussed above).

[0322] For these reasons, a POSITA would have found the limitations in claim 1(D)(ii) to be obvious in view of the Amphenol-Yu combination.

iii. a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture; and

[0323] Yu discloses a second aperture concentric with said first drop line (i.e., the branch cable conductor 11) and parallel to said first aperture. *See* EX1015, FIG. 1 (4th-annotation), below.



EX1008, FIG. 1 (4th-annotation)

Additionally, in Yu the second aperture only partially extends through the undermold in the longitudinal direction, while also having a second diameter

that is smaller than the first diameter of the first aperture and having the first drop line extend therefrom. *See* EX1015, FIG. 1 (4th-annotation), above.

[0324] It would have been obvious to a POSITA to use an undermold (i.e., a connector insulation layer 5), as taught by Yu, to encase the exposed cables and the clamp holding the feeder and drop lines (i.e., branch cables) together and protect those elements from damage and/or exposure (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0325] For these reasons, a POSITA would have found the limitations in claim 1(D)(iii) to be obvious in view of the Amphenol-Yu combination.

E. An overmold surrounding said undermold and forming an undermold-overmold interface only at said outer surface,

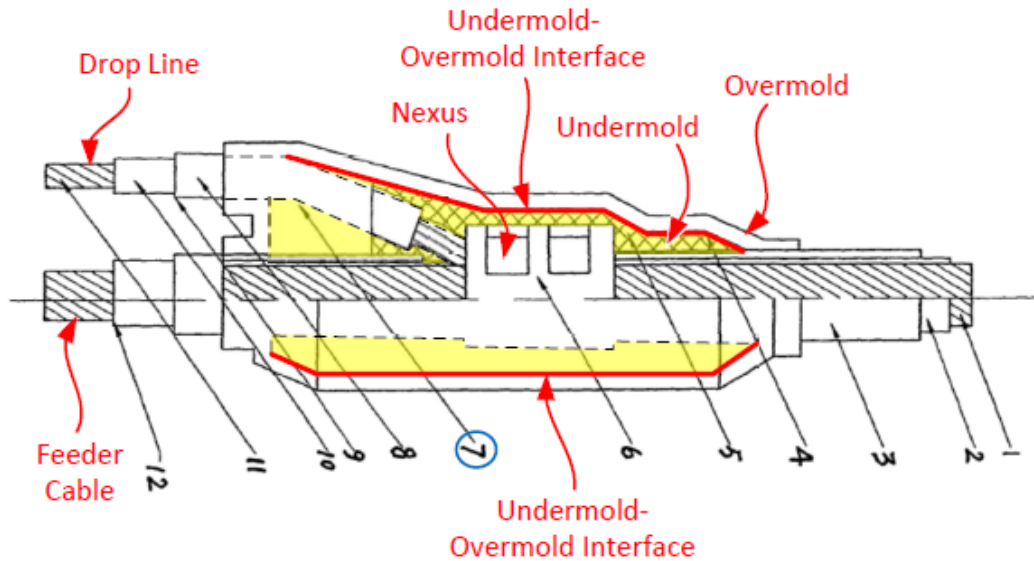
[0326] The ’254 Patent does not define the term “undermold-overmold interface” in “an undermold-overmold interface only at said outer surface [of said undermold],” as recited in claims 1(E), 7(C)(viii), and 14(E)(ii).

EX1001, generally. A POSITA would understand that the term could be understood as the undermold-overmold interface referring to an intermediate medium or layer between the undermold and overmold, or alternatively understood as the undermold-overmold interface existing between the overmold and only the outer surface of the undermold without an intermediate medium or layer therebetween. As discussed below, Yu discloses a layered configuration that meets the earlier interpretation of

undermold-overmold interface. Also, as discussed below, Tamura discloses an alternative layered configuration that meets the later interpretation of the undermold-overmold interface, which a POSITA would have been motivated to use in combination with the Amphenol-Yu-Yamawaki combination.

[0327] Also, as noted above regarding Ground 1, claim 1(E) the recitation of “forming an undermold-overmold interface *only at* said outer surface [of the undermold,” as recited in claim 1(E), refers to the undermold-overmold interface existing between the overmold and only the outer surface of the undermold, as opposed to the inner surface of the undermold.

[0328] Yu discloses an undermold (i.e., connector insulation layer 5), which includes an outer surface, a portion of which extends longitudinally. *See* EX1015, ¶5, FIG. 1 (5th-annotation), below. Additionally, Yu discloses an overmold (i.e., connector outer protective layer 7) that surrounds the undermold and forms an undermold-overmold interface only on the outer surface. *See id.*



EX1008, FIG. 1 (5th-annotation)

[0329] In Yu, the undermold-overmold interface between the undermold (i.e., the connector insulation layer 5) and the overmold (i.e., the connector outer protective layer 7) is further enhanced by providing a non-woven fabric that forms an intermediate non-woven wrapping layer 4, that is provided “to avoid adhesion between the connector insulation layer 5 and the connector outer protective layer 7.” See EX1015, ¶¶9 and 10. A POSITA would understand the benefits of avoiding adhesion between layers including improved flexibility and better accommodation of thermal expansion/contraction differences between the layers to provide an enhanced undermold-overmold interface.

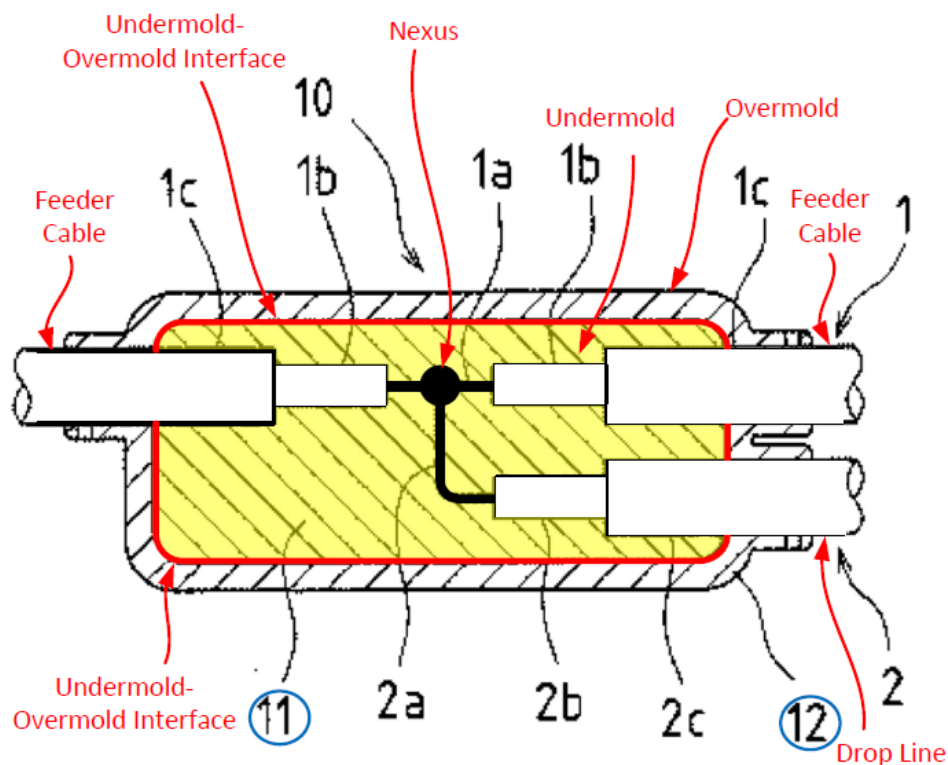
[0330] It would have been obvious to a POSITA to use an overmold (i.e., connector outer protective layer 7), as taught by Yu, to encase the

assemblies of Amphenol and protect those elements from high-humidity and/or high-temperatures (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above) *See* EX1015¶5. As discussed earlier, Amphenol discloses cable junctions with an undermold (i.e., a molded junctions) to provide some measure of protection from external environmental factors. As disclosed by Yu, an additional molded branch outer sheath can provide further improvements in protection from environmental factors. A POSITA would understand that the disclosure of the undermold and overmold in Yu could be applied to the structures with an undermold disclosed by Amphenol and provide additional protection from environmental factors.

[0331] Tamura discloses applying an injection molded overmold directly over an undermold of a branch cable connection to provide an added layer of waterproofing. *See* EX1009, ¶11, 17. In particular, Tamura discloses adding an injection-molded outer mold part 12 (i.e., an overmold) directly over an inner mold part 11 (i.e., an undermold) without an intermediate layer therebetween, which together form an undermold-overmold interface only at the outer surface of the undermold. *See* EX1009, ¶14 and Fig. 1 (1st-annotation).

[0332] Alternatively, a POSITA would appreciate that the approach of Yu

could be simplified according to the teaching of Tamura, where the undermold can be fully formed prior to the formation of the overmold because of the use of dissimilar materials and other processing choices that allow the undermold to be fully formed before construction of the overmold. Thus, a POSITA considering Yu and Tamura would appreciate that the use of dissimilar materials enables the undermold to be fully formed so that an intermediate layer of woven fabric is not necessary, and the overmold can be formed over the undermold using standard injection molding processes which are well-established, inexpensive, and reliable.



EX1009, Fig. 1 (1st-annotation)

[0333] It would have been obvious to a POSITA to add an injection molded

overmold for added protection against environmental elements directly over the undermold, as taught by Tamura.

[0334] For these reasons, a POSITA would have found the limitations in claim 1(E) to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

i. wherein said lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between said solar arrays and said inverter, and

[0335] As discussed above regarding Ground 1, claim 1(E)(i), which discussion is incorporated here by reference, a POSITA familiar with the challenges of bringing many separate wires all the way to a connector box and appreciating the benefits of a system consisting of a plurality of drop lines being connected to the feeder cables which can feed straight to the inverter and would combine Amphenol with the teaching from Yamawaki. A POSITA would be similarly motivated to combine Amphenol, as modified by Yu, with Yamawaki to provide a simplified system that brings the power from the solar array directly to the inverter without the need for intervening combiner boxes (*see* C(iii) ‘Motivation to Combine Amphenol, Yu, and Yamawaki,’ further discussed above). For these reasons, a POSITA would have been motivated to use lead assembly from the Amphenol-Yu combination to transmit power to an inverter in a solar energy installation

lacking a combiner box between solar arrays and the inverter, as taught by Yamawaki, in the manner described in this claim limitation, thus rendering the claim limitation obvious.

[0336] For these reasons, a POSITA would have found the limitations in claim 1(E)(i) to be obvious in view of Amphenol, Yu, Yamawaki, and Tamura (to the extent this claim element is found limiting).

ii. wherein said lead assembly has a voltage rating of 1500 VDC.

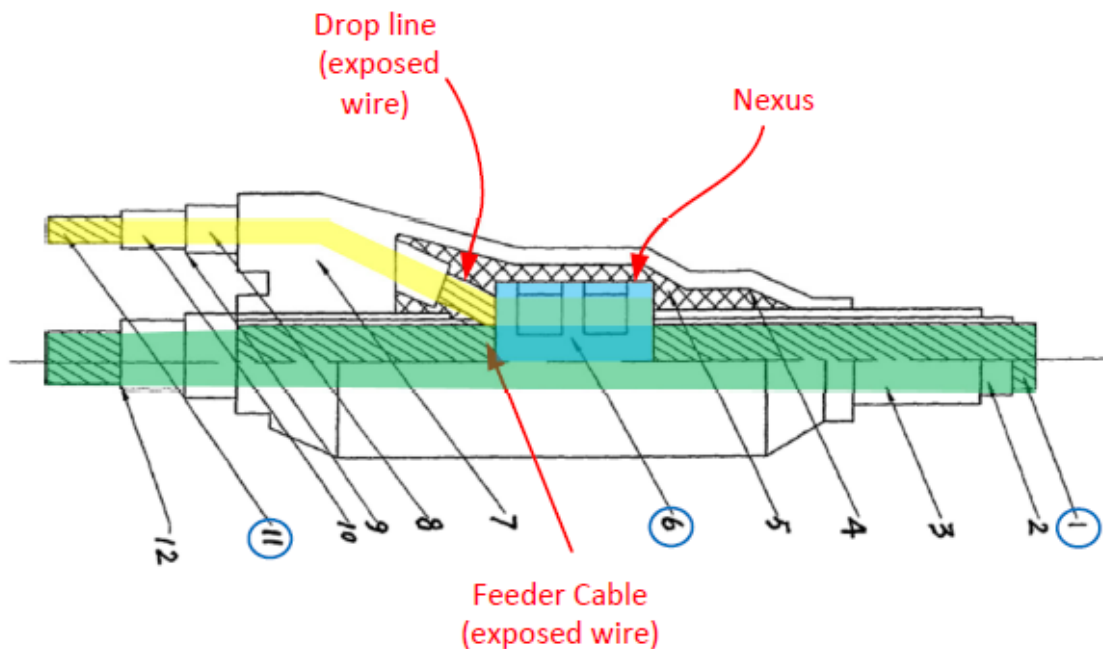
[0337] As discussed above regarding Ground 1(E)(ii), which discussion is incorporated here by reference, a POSITA would have found the limitations in Ground 3, claim 1(E)(ii) to be obvious in view of the Amphenol. Accordingly, claim 1 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Yu, Yamawaki, and Tamura.

[0338] Accordingly, based on the above, a POSITA would have found claim 1 to be obvious based on the Amphenol-Yu-Yamawaki-Tamura combination. Accordingly, claim 1 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Yu, Yamawaki, Tamura.

2. Claim 2

The lead assembly of claim 1 wherein said first drop line includes a section of exposed wire at said nexus.

[0339] Yu discloses that the first drop line includes a section of exposed wire at the nexus. *See*, EX1015, ¶28 and FIG. 5 (1st-annotation), below.



EX1015, FIG. 1 (1st-annotation)

[0340] It would have been obvious to a POSITA to expose wires, such as the drop line wire and the feeder cable wire at a nexus, as taught by Yu, to ensure contact is maintained between the two conductive elements when held together by the C-shaped clamp (*see* C(ii) 'Motivation to Combine Amphenol and Yu,' further discussed above).

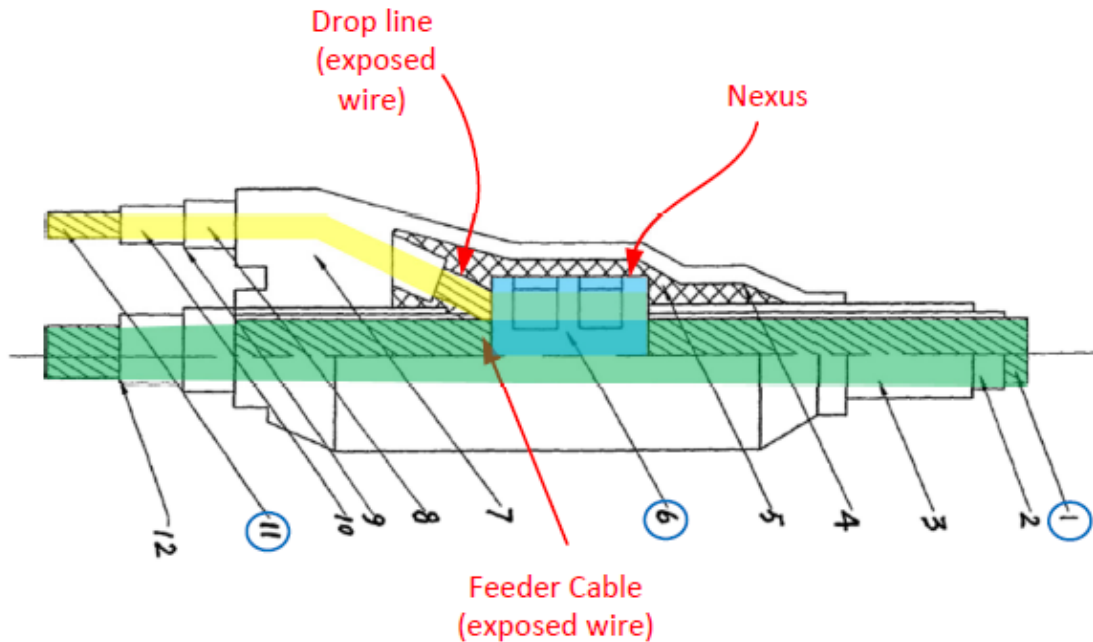
[0341] For these reasons, a POSITA would have found the limitations in

claim 2 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

3. Claim 3

The lead assembly of claim 2 wherein said at least one feeder cable includes a section of exposed wire at said nexus.

[0342] Yu discloses that the feeder cable includes a section of exposed wire at the nexus. *See* EX1015, p.7:18-23 (“the main insulation layer 2, the main outer sheath 3, the branch insulation layer 10 and the branch outer sheath 8 are each peeled off at a joint between the main cable conductor 1 and the branch cable conductor 11, the main cable conductor 1 and the branch cable conductor 11 are crimped by means of a C-shaped clamp 6”) and *see* FIG. 1 (1st-annotation), below.



EX1015, FIG. 1 (1st-annotation)

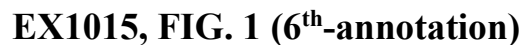
[0343] It would have been obvious to a POSITA to expose wires to each other, such as the drop line wire and the feeder cable wire at a nexus, as taught by Yu, to ensure contact is maintained between the two conductive elements (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0344] For these reasons, a POSITA would have found the limitations in claim 3 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

4. Claim 4

The lead assembly of claim 1 wherein said overmold defines at least one aperture.

[0345] Yu discloses that the overmold (i.e., connector outer protective layer



[0347] For these reasons, a POSITA would have found the limitations in

claim 4 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

5. Claim 5

The lead assembly of claim 1 wherein said undermold is injection molded.

[0348] Yu discloses that the undermold (i.e., connector insulation layer 5) is injection molded. *See*, EX1015, p.7:25-26.

[0349] It would have been obvious to a POSITA to use the undermold (i.e., connector insulation layer 5) formed by injection molding with suitable flame retardant materials, as taught by Yu, to ensure the assembly is suitable for high temperature and/or high humidity environments (*see* C(ii) ‘Motivation to Combine Amphenol and Yu,’ further discussed above).

[0350] For these reasons, a POSITA would have found the limitations in claim 5 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

6. Claim 6

The lead assembly of claim 1 wherein said overmold is injection molded.

[0351] Tamura discloses that the overmold (i.e., outside molded portion 12) is injection molded directly over the undermold (i.e., inside molded portion 11). *See*, EX10009, ¶22,23.

[0352] It would have been obvious to a POSITA to use the overmold (i.e.,

outside molded portion 12) formed by injection molding with suitable insulating and protecting materials, as taught by Tamura, to ensure the assembly is suitable for protecting a section where a conductor of a branch cable is connected to a conductor of a trunk cable (*see* C(iv) ‘Motivation to Combine Amphenol, Yu, Yamawaki, and Tamura,’ further discussed above).

[0353] For these reasons, a POSITA would have found the limitations in claim 6 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

7. Claim 7

Preamble. A solar power system comprising:

[0354] As discussed above regarding Ground 1, claim 7(Preamble), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 7(Preamble) to be obvious in view of Amphenol.

A. A first plurality of solar panels electrically coupled by a first wire harness to form a first solar array;

B. A second plurality of solar panels electrically coupled by a second wire harness to form a second solar array;

C. A lead assembly including

i. a first drop line electrically connected to said first wire harness, and

ii. a 30 amp feeder cable electrically connected to a component selected from the group consisting of a trunk buss jumper, an inverter, a connection unit, a recombiner, and a disconnect unit,

[0355] As discussed above regarding Ground 1, claim 7(A)-claim 7(C)(ii), which discussions are incorporated here by reference, a POSITA would have

found the limitations in claim 7(A)-claim 7(C)(ii) to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

- iii. said first drop line and said feeder cable electrically connected at a first nexus secured by a compression lug,**
- iv. said compression lug surrounded by an undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said feeder cable, said inner surface surrounding and fully encasing said compression lug,**
- v. said inner surface comprised of a first aperture concentric with said compression lug and said feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter,**
- vi. said feeder cable extending continuously through said first aperture, and**
- vii. a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture,**
- viii. with said undermold surrounded by an overmold and forming an undermold-overmold interface only at said outer surface,**
- ix. wherein said lead assembly has a voltage rating of 1500 VDC; and;**

[0356] The Ground 3, Claim 7(C)(iii-ix) limitations are the same as or at least

equivalent to the Ground 3, Claim 1(B-E) limitations addressed above.

Additionally, as discussed above regarding the Ground 1, claim 7(C)(iii-ix) limitations, which discussions are incorporated here by reference, a POSITA would understand that a compression lug is an obvious design choice

alternative to a C-shaped clamp, particularly for installations requiring a more secure connection between the feeder cable and the branch wire(s). As presented above regarding the Ground 3, claim 1(B-E) limitations, as well as the Ground 1, claim 7(C)(iii-ix) limitations, a POSITA would have found the Ground 3, claim 7(C)(iii-ix) limitations to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

D. A second drop line electrically connected to said second wire harness,

- i. said second drop line electrically connected to said feeder cable at a second nexus,**
- ii. wherein the solar power system doesn't include a combiner box upstream of said component.**

[0357] As discussed above regarding Ground 1, claim 1(E)(i) and claim 7(D), which discussions are incorporated here by reference, a POSITA would have found the limitations in Ground 3, claim 7(D) to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination. Accordingly, claim 7 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Yu, Yamawaki, and Tamura.

[0358] Accordingly, based on the above, a POSITA would have found claim 7 to be obvious based on the Amphenol-Yu-Yamawaki-Tamura combination. Accordingly, claim 7 should be found invalid under 35 U.S.C. § 103 based on Amphenol, Yu, Yamawaki, and Tamura.

8. Claim 8

The solar power system of claim 7 wherein said lead assembly includes an end piece.

[0359] As discussed above regarding Ground 1, claim 8, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 8 to be obvious in view of Amphenol in the Amphenol-Yu-Yamawaki-Tamura combination.

9. Claim 9

The solar power system of claim 7 wherein said first drop line terminates in a drop line connector.

[0360] As discussed above regarding Ground 1, claim 9, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 9 to be obvious in view of Amphenol in the Amphenol-Yu-Yamawaki-Tamura combination.

10. Claim 10

The solar power system of claim 7 wherein said feeder cable terminates in a feeder cable connector.

[0361] As discussed above regarding Ground 1, claim 10, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 10 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

11. Claim 11

The solar power system of claim 7 wherein said first drop line includes 18 to 4 gauge wire.

[0362] As discussed above regarding Ground 1, claim 11, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 11 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

12. Claim 12

The solar power system of claim 7 wherein said feeder cable includes 6 gauge to 1000 MCM wire.

[0363] As discussed above regarding Ground 1, claim 12, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 12 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

13. Claim 13

The solar power system of claim 7 wherein said first nexus is surrounded by said compression lug.

[0364] The claim 13 limitations are the same as or at least equivalent to the claim 1(C) and/or the claim 7(C)(iii) limitations addressed above. As presented above regarding the claim 1(C) limitations, which discussion is incorporated here by reference, a POSITA would have found the claim 13 limitations to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

14. Claim 14

Preamble. A method of constructing a solar power installation including the steps of:

[0365] As discussed above regarding the Ground 1, claim 7(Preamble), which discussion is incorporated here by reference, a POSITA would have found the limitations in the claim 14(Preamble) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those must be constructed to form a solar power installation.

A. Connecting a first plurality of solar panels to a first wire harness to form a first solar array;

[0366] As discussed above regarding the Ground 1, claim 7(A), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(A) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those elements must be connected.

B. Connecting said first wire harness to a first drop line of a lead assembly;

[0367] As discussed above regarding the Ground 1, claim 7(C)(i), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(B) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those elements must be connected.

C. Connecting a second plurality of solar panels to a second wire harness to form a second solar array;

[0368] As discussed above regarding the Ground 1, claim 7(B), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(C) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those elements must be connected.

D. Connecting said second wire harness to a second drop line of said lead assembly; and

[0369] As discussed above regarding the Ground 1, claim 7(D), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(D) to be obvious in view of Amphenol by disclosing all the elements and thus illustrating that those elements must be connected.

E. Electrically coupling said lead assembly to an inverter without electrically coupling to a combiner box;

[0370] As discussed above regarding the Ground 1, claim 1(E)(i) and Ground 3, claim 1(E)(i), which discussions are incorporated here by reference, a POSITA would have found the limitations in claim 14(E) to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination by disclosing all the elements and thus illustrating that those elements must be electrically coupled.

i-iii. wherein said lead assembly includes said first drop line electrically connected to said first wire harness, and a 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said feeder cable electrically connected at a first nexus secured by a means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof, said securing means surrounded by an undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said feeder cable, said inner surface surrounding and fully encasing said securing means, said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter, said feeder cable continuously extending through said first aperture, and a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture, with said undermold surrounded by an overmold and forming an undermold-overmold interface only at said outer surface, wherein said lead assembly has a voltage rating of 1500 VDC.

[0371] As discussed above regarding Ground 3, claim 1, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(E)(i) to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

[0372] Accordingly, based on the above, a POSITA would have found claim 14 to be obvious based on the Amphenol-Yu-Yamawaki-Tamura

combination. Accordingly, claim 14 should be found invalid under 35

U.S.C. § 103 based on Amphenol, Yu, Yamawaki, Tamura.

15. Claim 15

The method of claim 14 wherein said step of electrically coupling said lead assembly to an inverter includes the steps of electrically coupling said feeder cable to said inverter.

[0373] As discussed above regarding the Ground 1, claim 1(E)(i) and claim 7(C)(ii), and Ground 3, claim 1(E)(i) limitations, which discussions are incorporated here by reference, Yamawaki as part of the Amphenol-Yu-Yamawaki-Tamura combination teaches electrically coupling a lead assembly to an inverter.

[0374] For these reasons, a POSITA would have found the limitations in claim 15 to be obvious in view of the Amphenol-Yu-Yamawaki-Tamura combination.

D. Ground 4: Claims 1-5 and 7-15 are unpatentable under 35 U.S.C. § 103 as obvious in view of Yamawaki and Shao.

(i) Motivation to Combine Yamawaki and Shao

[0375] A POSITA would have been motivated to combine the teachings of Yamawaki with those of Shao (i.e., the “Yamawaki-Shao combination”) for the reasons set forth below.

[0376] Yamawaki and Shao are both concerned with wire harnesses, cable junctions, connectors, and other components to be used for combining power

from elements of a solar array installation. Yamawaki is concerned with photovoltaic modules that may be arranged in various ways to overcome challenges and support the design of a photovoltaic panel array, such as on a home solar energy installation. EX1006, 7:54-8:11. Shao is concerned with the detailed design of a cable junction, including the connections therein and the geometric features that can be included, to be used for power distribution in a facility. EX1008, Abstract. These references discuss the design of cable junction elements that can be used to combine or distribute electrical power including solving the same problems as the '254 Patent including forming a reliable electrical contact between different cables, protecting the connection from environmental factors and damage, and providing the structures in a way that reduces cost and simplifies the assembly and maintenance of the power facilities. These references discuss the design of cable junction elements that can be used to combine or distribute electrical power and are, thus, in the same field of endeavor as the '254 Patent.

[0377] I believe that Yamawaki and Shao are in the same field of endeavor as the '254 Patent, and are thus analogous prior art, since both references relate to electrical wiring assemblies and connectors. Additionally, I believe that it would be reasonable and practical for a POSITA working in the field of wiring assemblies for solar energy installations, and concerned with cost,

simplicity, performance, and reliability to look outside solar energy applications and to other related and more-established fields, such as electrical wiring and connectors more generally, for ideas that could lead to these sought-after improvements. As discussed above with regard to the motivation to combine Amphenol and Shao, which discussion is incorporated here by reference, even the Patent Examiner, during the prosecution of the '254 Patent, cited Vander Ploog (EX1023), which like Shao is not explicitly related to photovoltaic power distribution systems, but is related to cables and connectors for cables. *See* EX1002, p.265. *See* A(v) 'Motivation to Combine Amphenol and Shao.'

[0378] Even though Shao does not explicitly disclose combining power in a solar energy installation, a POSITA would appreciate that the means for forming electrical connections between cables, the geometric arrangement and configuration of those cables being connected, and the means for protecting those cables and connections from the environment using injection molding, as described in Shao, could be applied to the system described in Yamawaki. Also, these disclosures by Shao would work in concert with the objectives of Yamawaki. For example, Yamawaki discloses that an "object of the invention is to provide a wiring apparatus, in which junction cables can be connected to branch junctions to improve the

maintainability of photovoltaic modules and cope with extension or modification of the photovoltaic modules,” and the bidirectional K-shaped branch disclosed by Shao provides a compact and effective way to form a branch junction, which works well to achieve the goal disclosed by Yamawaki. *See* EX1006, 2:57-61 and EX1008, Abstract. A POSITA would expect to be successful in providing improved performance and reliability based on the combination of the Yamawaki and Shao references.

[0379] As noted above in Ground 1, Yamawaki, in some later embodiments (referred to therein as “fifth embodiment” and “sixth embodiment”) discloses some additional details relating to the connections that may be formed at various points in the trunk cables to improve flexibility and adaptability of the system design. *See id.*, 18:6-15 and FIGS. 18A, 18B, 19A, and 19B (fifth embodiment) and 19:45-55 and FIGS. 20 and 21 (sixth embodiment). The details provided in these later embodiments do not limit the broader scope of the disclosure of Yamawaki with respect to the apparatuses shown in FIGS. 1, 3, and 14. For Example, Yamawaki explicitly states that, “[f]or other functions and effects than those described above, the fifth embodiment resembles the first embodiment...” *Id.* 19:40-42. Therefore, in as much as Yamawaki describes features with respect to the fifth and sixth embodiments that might require use of pre-fabricated

consistent cables of consistent size throughout portions of the apparatus, the first embodiment of Yamawaki clearly contemplates combining currents from small to medium to large scale, and a POSITA would understand that the cables used at various locations throughout a system like this could use a variety of cable diameters at different stages to minimize cost and weight. *See id.*, generally.

[0380] During the prosecution of the patent application that resulted in the '254 Patent, in an Office Action, dated September 24, 2018, the first time the Examiner cited Yamawaki it was used as a tertiary reference teaching “a mold (element 33e of Figs. 9) within which a nexus is formed between cables and lines (31), which is an undermold having an outer surface (partially exposed in Fig. 9B) is surrounded by an overmold (33f), forming an undermold-overmold interface at the outer surface.” EX1002, pp.219-220. In a “Response to Final Office Action and Request for Continued Examination” filed June 6, 2018, Applicant amended the claims to recite that the “lead assembly has a voltage rating selected from the group consisting of 600 VDC, 1000 VDC, 1500 VDC and combinations thereof.” *Id.*, p. 198. In that Response Applicant did not rebut the Examiner’s contention regarding the elements taught by Yamawaki, for which Yamawaki was cited, but rather argued that Yamawaki should be distinguished since it

allegedly pertains to residential type photovoltaic systems, rather than commercial system. *See id.*, pp. 201-202. In the subsequent non-final Office Action, dated September 24, 2018, the Examiner maintained the rejections based on Jonczyk, Avrutsky, and Yamawaki in spite of Applicant's amendments and arguments. *See id.*, pp. 177-179. In a "Response to Non-Final Office Action" filed March 25, 2019, Applicant further amended the claims to add that the feeder cable is "a 30 amp feeder cable" and that the "lead assembly has a voltage rating of 1500 VDC." *See id.*, p. 166. Applicant never rebutted the previous arguments presented by the Examiner in that or any later response. *See id.*, pp. 163-171. In the subsequent final Office Action, dated June 11, 2019, the Examiner maintained the rejections based on Jonczyk, Avrutsky, Yamawaki in spite of Applicant's amendments and arguments and added "Applicant's arguments with respect to claims 1-3, 5, 6, 9-14, 19, and 20 have been considered but are not found persuasive." *See id.*, pp. 143-145, 151. In addition, the Examiner added:

Applicant has identified the claimed voltage rating to not be found in the prior art. However, as noted above, it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to vary the voltage rating of the lead assembly according to the ultimate electrical requirements of the system. Applicant has not presented or identified evidence in the original specification which show the criticality of the lead assembly having a voltage

rating of 1500 VDC.

Id., p. 151, last paragraph.

[0381] A POSITA would have been motivated to combine Yamawaki with Shao (the “Yamawaki-Shao combination”) because both references address the general problem of providing convenient, flexible, reliable, and low-cost wiring harnesses. EX1006, 2:64-65. Shao more specifically teaches that “the connection reliability of the branch joint is improved compared with an existing product; the joint has good sealing performance, and is moisture-proof, waterproof, maintenance-free and stable in performance.” EX1008, 5:38-41. Also, Shao teaches improvements to branch junctions that can provide, “[t]he branch lines no longer need to be bent and turned, so that one branch joint can be omitted, a space occupied for mounting is small, and a line can also be simple and clear.” EX1008, Abstract.

[0382] Shao is not cumulative to any of the prior art cited during prosecution. In combination with Yamawaki, Yamawaki focuses on cable assemblies, connectors, and configurations thereof and Shao addresses the details of the cable junctions. In particular, the benefits of the undermold of Shao include “improved reliability”, prolonged “service life”, with “good sealing performance”; and the benefits of the cover member (overmold) of Yamawaki include “...it is so water resistant that the reliability of the wiring

apparatus 16 and 17 to resist penetration of water can be improved.”

EX1008, 5:28-32; EX1006, 13:15-18. A POSITA would understand that the combination of the undermold of Shao and the overmold of Yamawaki would provide complimentary and additive benefits, and that the sum of the benefits of the individual molds would lead to an improved product. In this way, Shao teaches branch junctions that provide an undermold configuration that a POSITA would have been motivated to incorporate into Yamawaki by replacing the protective sheath of Yamawaki to provide better sealing and a smaller profile for installation. Further, unlike Vander Ploog cited during prosecution, Shao discloses a third aperture and second drop line, as further detailed below.

[0383] Yamawaki is focused on solar arrays and Shao is focused on power distribution, so a POSITA would have understood that the underlying mechanics, materials, assembly processes, molding processes, and other details that are compatible and familiar elements in the art. Therefore, a POSITA would have an expectation of success in combining the teachings of Yamawaki and Shao because the components are versions of well-known wiring components designed for use in the field and do not involve unpredictable technology. Shao complements the disclosure of Yamawaki by disclosing design and materials that are appropriate choices for these

junctions while also providing alternative connector configurations and advantages thereof. A POSITA that selects components for a solar energy installation and performs the installation would be familiar with the families of components, wire harnesses and lead assemblies disclosed in Yamawaki, and would appreciate the benefits of the details provided by Shao in design and manufacturing of reliable and easily utilized branch structures. Further, the K-shaped branch connectors disclosed by Shao could be spliced into cables and wire harnesses of Yamawaki using the assembly processes taught in Shao as well as ordinary electrical practices.

[0384] A POSITA would understand that the solar power system connectors disclosed by Yamawaki could be designed and manufactured using the materials, design, and processes disclosed by Shao, such as the details associated with overlapping and crimping the cable and drop lines within the assembly, which ensures contact (i.e., conductivity) between the feeder cable and the drop lines. Additionally, Shao discloses using insulation layers and injection molding to form the packaging around the nexus of the cables. The wire harness and lead assembly designs disclosed by Yamawaki would obviously benefit from the features disclosed by Shao, as related to the design and manufacture of the K-shaped branch structure shown in FIG. 1 from Shao, which provide “good insulation performance, heat resistance

stability and overheating aging performance.” *See* EX1008, 6:40-7:1. A POSITA would consider the use of details provided by Shao to form the branch elements in the broader variety of cable assemblies disclosed by Yamawaki in order to capture the features and benefits of the Shao junctions throughout the harnesses of Yamawaki. In particular, the details in Shao associated with overlapping and crimping the cable and drop lines within the assembly and using insulation layers and injection molding to form the packaging around the nexus of the cables would be understood to provide a concise installation with increased service life.

[0385] As described by Shao, the K-shaped branch connector structure “can realize double branch power distribution via a single branch joint. The branch wire respectively outgoes in two opposite directions of the branch joint and can respectively lead to two floor distribution boxes. The bending and turning of the branch wire is unnecessary, which causes one branch joint to be reduced, the installation space occupation to be little and the wire to be concise.” EX1008, Abstract. A POSITA would appreciate that the structure of the K-shaped branch connector provides useful additional benefits that could be incorporated by modifying Yamawaki to include the K-shaped connectors disclosed by Shao.

[0386] Also, a POSITA would have an expectation of success in combining

Yamawaki and Shao, since Shao complements the disclosure of Yamawaki by disclosing design and materials that are appropriate choices for these junctions while also providing alternative connector configurations and advantages thereof. A POSITA that selects components for a solar energy installation and performs the installation would be familiar with the families of components, wire harnesses and lead assemblies disclosed in Yamawaki, and would appreciate the benefits of the details provided by Shao in design and manufacturing of reliable and easily utilized branch structures.

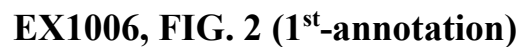
[0387] The solar photovoltaic power generation systems disclosed by Yamawaki are intended for use in a harsh outdoor environment and would benefit from added protection from the elements and improved reliability for the branch structures provided by the design and manufacturing processes disclosed in Shao.

[0388] For these reasons, I believe a POSITA would be motivated to combine the teachings of Yamawaki and Shao to arrive at the Yamawaki-Shao combination.

1. Claim 1

Preamble. A lead assembly for use in a solar energy installation including:

[0389] Yamawaki discloses a lead assembly (e.g., wiring apparatus 16, annotated in green and blue below) for use in a solar energy installation. *See*



Voltage, LLC
EX1003-200

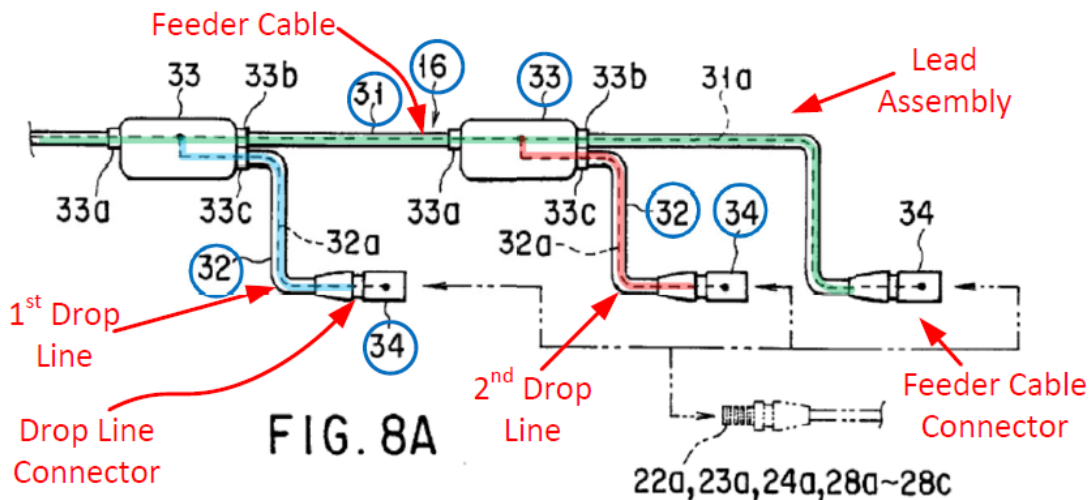
that a feeder cable is used to supply power from one point to another.

Yamawaki discloses a lead assembly (annotated in green above) for use in a solar energy installation. *Id.*

[0391] For these reasons, a POSITA would have found the limitations in claim 1(Preamble) to be obvious based on Yamawaki.

A. A first drop line and a second drop line, said first drop line terminating in a drop line connector;

[0392] Yamawaki discloses, and shows in an illustration reproduced below, a first drop line (e.g., branch cable 32 – annotated in blue, below) and a second drop line (e.g., branch cable 32 – annotated in red, below). *See* EX1006, 11:3-11 and FIG. 8A (1st-annotation), above. The first drop line terminating in a drop line connector (e.g., connector 34). *See id.*

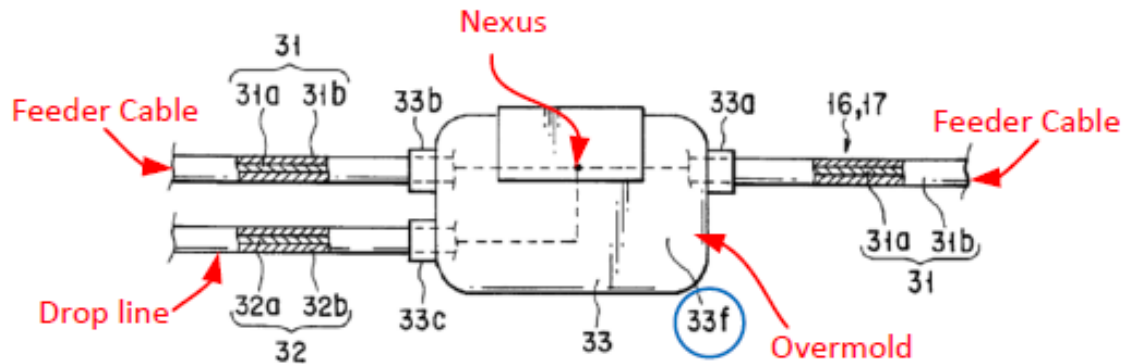


EX1006, FIG. 8A (1st-annotation)

[0393] For these reasons, a POSITA would have found the limitations in claim 1(A) to be obvious based on Yamawaki.

B. At least one 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said at least one feeder cable electrically coupled at a nexus;

[0394] Yamawaki discloses a feeder cable (i.e., trunk cable 31) terminating in a feeder cable connector (i.e., connector 34). See EX1006, FIG. 8A (1st-annotation), above, and FIG. 9A (1st-annotation), below.



EX1006, FIG. 9A (1st-annotation)

[0395] To the extent that Yamawaki does not explicitly disclose that the feeder cable is rated for 30 amps, a POSITA would understand that the selection of feeder cable amperage capacity, of at least 30 amps, is an obvious design choice in view of well-known electric codes and standards. For example, a POSITA would understand that the maximum amount of current to be carried by a cable is an important parameter in selection of the cable diameter and other cable parameters, such as the cable material and the insulation material. Further, well-known electrical standards and guides such as the NEC 2002 provide standard guidelines for cable diameter selection based on maximum current, including Table 310.16 titled

“Allowable Ampacities of Insulated Conductors Rated 0 Through 2000

Volts...” that is reproduced below. *See* EX1010, p. 149. This ampacity size table with which a POSITA would be familiar lists the gauge of wire that is appropriate for different ampacities of insulated conductors for different types of wires and different temperature ratings. *See id.*

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13.)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

EX1010, Table 310.16

[0396] Table 310.16 (reproduced above) includes ampacity values for cables ranging from 18 AWG to 2000 MCM diameter, showing that cables of these

diameters are expected to carry current from nominal values to 560A. Other than diameter and current carrying capacity, there is little difference between cables from 18 AWG to 2000MCM. A POSITA would understand how to find and use electrical standards and guides such as the NEC 2002 to make decisions about the gauge (i.e., diameter) of wire needed for different sections of the wiring harness for a solar installation, and to select suitable cables from the catalogs of cable vendors. The NEC 2002 and cable vendor catalogs include similar tables with information for selecting cables for different voltages and resistances. Therefore, a POSITA would understand that the selection of feeder cable amperage capacity, of at least 30 amps, is an obvious design choice in view of well-known electric codes and standards including the NEC 2002.

[0397] For these reasons, a POSITA would have found the limitations in claim 1(b) to be obvious based on Yamawaki.

C. A means for securing said nexus, said securing means selected from the group consisting of compression lug, soldering, splicing, crimping, and combinations thereof;

[0398] To the extent that a “means for securing said nexus” refers to the element or elements maintaining the strong electrical and mechanical connection between the feeder cable and the drop lines, Shao provides a C-shape clamp which is crimped and is thus a means for securing the nexus.

EX1008, 5:10-13.

[0399] Shao discloses a feeder cable (i.e., a trunk conductor 1) electrically coupled to a drop line (i.e., a branch-line conductor 2) by a securing means in the form of a c-shaped clamp (i.e., a connector 6), which forms a nexus that holds the feeder cable and the drop line together. *See*, EX1008, 3:15-18 and FIG. 1 (1st-annotation), above. In particular, Shao describes, “[a]n elongated copper C-shaped clamp is used to form a K-shaped branch connector 5.” *Id.* Shao further describes, “The joint is formed by symmetrical overlapping and crimping of one trunk conductor and two branch-line conductors.” *Id.* 5:11-13. Therefore, it would have been obvious to a POSITA to use a clamp, as taught by Shao, to ensure contact is maintained between the three conductive elements (*see* E(i) ‘Motivation to Combine Yamawaki and Shao,’ further discussed above).

[0400] For these reasons, a POSITA would have found the limitations in claim 1(C) to be obvious in view of the Yamawaki-Shao combination.

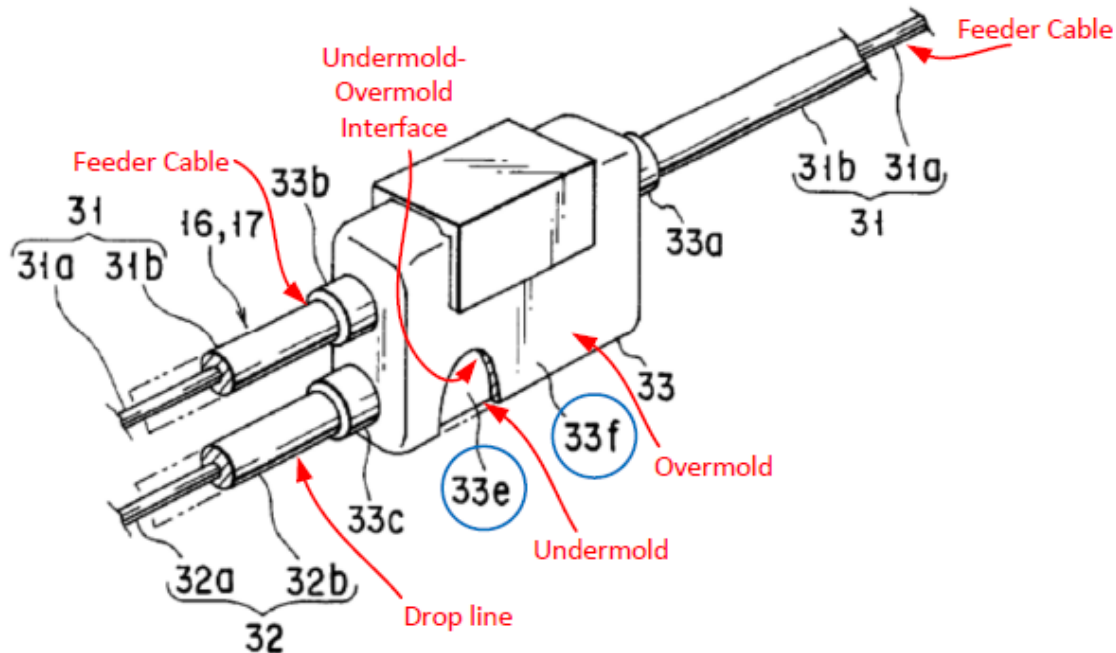
D. An undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said at least one feeder cable, said inner surface surrounding and fully encasing said securing means,

“Undermold”

[0401] As discussed above in Ground 1, Claim 1(D), which discussion is incorporated here by reference, the specification of the ’254 Patent does not

define the term “undermold,” thus, an ordinary and customary meaning, as understood by a POSITA, of the term "undermold" would have been a “material molded over a piece or part that seals against environmental factors and is surrounded by an ‘overmold’.” *See* EX1001, FIGS. 48, 54, 55, 60 and generally.

[0402] Yamawaki discloses an undermold (i.e., molded body 33e) that fully encases the nexus, discussed above regarding claim 1(b). *See* EX1006, 10:19-32 and 13:15-18. In particular, Yamawaki discloses that “each junction 33 includes a molded body 33e of an electrically insulating synthetic resin material and a cover member 33f that covers the outer surface of the body 33e. ... In each branch junction 33, the trunk conductor 31a and the branch conductor 32a are connected electrically to each other.” *Id.* This disclosure is supported by FIG. 9B, an annotated version of which is reproduced below. *See* EX1006, FIGS. 9B (1st-annotation), below.



EX1006, FIG. 9B (1st-annotation)

[0403] Yamawaki discloses an undermold (i.e., molded body 33e) that inherently has inner and outer surfaces, including portions thereof that extend in a longitudinal direction of the feeder cable, with the inner surface surrounding and fully encasing the securing means. *See id.*, above. A POSITA would understand that the structures shown by Yamawaki represent components in which electrical cables enter at the ports on opposite sides of the molded structure and are electrically connected in the interior of the junction. In this regard, a POSITA would understand that the undermold covers over and seals these wires, and that there is necessarily an inner surface that must exist at the interface between the mold and the enclosed cables and nexus.

[0404] For these reasons, a POSITA would have found the limitations in claim 1(D) to be obvious in view of the Yamawaki.

i. said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter,

(1) “Said Inner Surface”

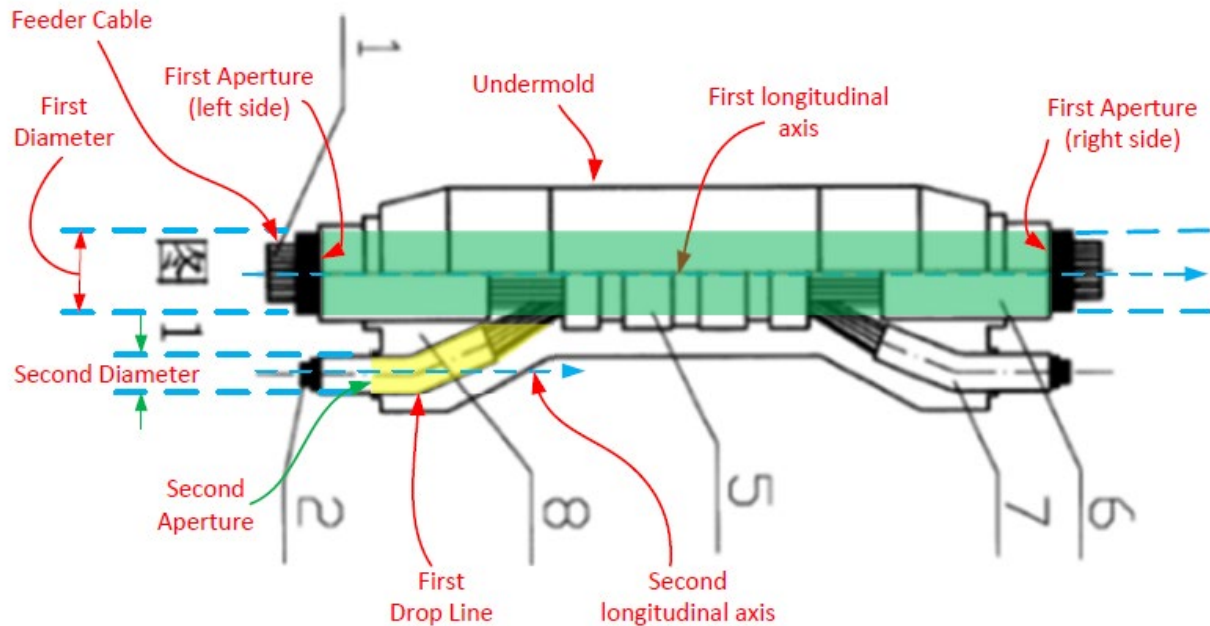
[0405] As discussed above in Ground 1, Claim 1(D)(i)(1), which discussion is incorporated here by reference, as best understood by a POSITA, the expression “said inner surface comprised of a first aperture,” means “said inner surface is **defined by** a first aperture,” which refers to the passages that extends completely through the undermold (22) in the longitudinal direction. *See*, EX1001, generally.

(2) “Concentric”

[0406] As discussed above in Ground 1, Claim 1(D)(i)(2), which discussion is incorporated here by reference, as best understood by a POSITA, the term “concentric” as used in claim 1 must reasonably be interpreted as meaning “substantially concentric.” *See* EX1001, FIG. 7.

[0407] Shao discloses an undermold (i.e., connector outer sheath 8) that includes an inner surface defined by a first aperture that extends in the

longitudinal direction of the feeder cable (i.e., the direction of trunk conductor 1) and that is substantially concentric with the securing means (i.e., C-shaped clamp 5) and the feeder cable. *See* EX1008, FIG. 1 (1st-annotation), below.



EX1008, FIG. 1 (1st-annotation)

Also, in Shao the first aperture extends continuously through the undermold (i.e., connector outer sheath 8) in the longitudinal direction and has a first diameter. *See* EX1008, FIG. 1 (1st-annotation), above.

[0408] It would have been obvious to a POSITA to use an undermold (i.e., a connector outer sheath), as taught by Shao, to encase the exposed cables and the clamp holding the feeder and branch cables together and protect those

elements from damage and/or exposure (*see* E(i) ‘Motivation to Combine Yamawaki and Shao,’ further discussed above).

[0409] For these reasons, a POSITA would have found the limitations in claim 1(D)(i) to be obvious in view of the Yamawaki-Shao combination.

ii. said at least one feeder cable continuously extending through said first aperture, and

[0410] Shao discloses a feeder cable (i.e., trunk conductor 1) continuously extending through the first aperture. *See* EX1008, FIG. 1 (3rd-annotation), above. It would have been obvious to a POSITA to use the configuration of one continuous feeder cable and the associated aperture in the undermold, as taught by Shao, since it is the most natural arrangement of elements. Additionally, a POSITA would understand that using the cable junction design taught by Shao would increase reliability, improved resistance to environmental factors, provide a low profile installation configuration, and would be easy to install. (*see* E(i) ‘Motivation to Combine Yamawaki and Shao,’ further discussed above).

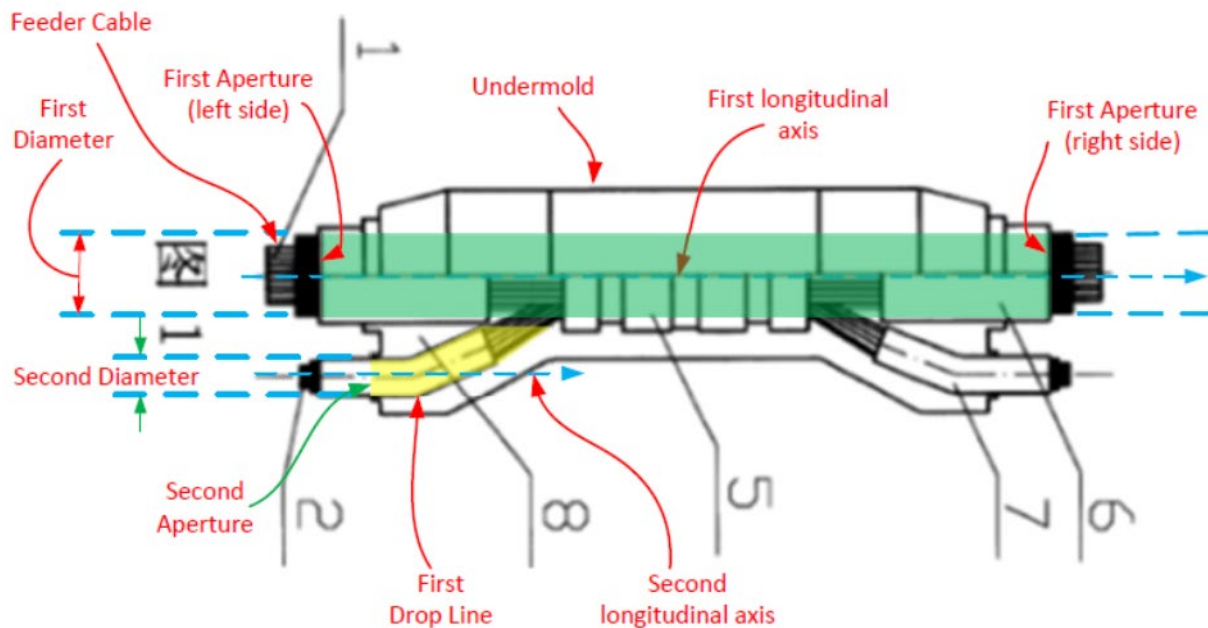
[0411] For these reasons, a POSITA would have found the limitations in claim 1(D)(ii) to be obvious in view of the Yamawaki-Shao combination.

iii. a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture; and

[0412] Shao discloses a second aperture concentric with said first drop line

(i.e., the branch line conductor 3) and parallel to said first aperture. *See*

EX1008, FIG. 1 (4th-annotation), below.



EX1008, FIG. 1 (1st-annotation)

Additionally, in Shao the second aperture only partially extends through the undermold in the longitudinal direction, while also having a second diameter that is smaller than the first diameter of the first aperture and having the first drop line extend therefrom. *See* EX1008, FIG. 1 (1st-annotation), above.

Shao describes “One trunk conductor and two branch-line conductors are symmetrically overlapped and crimped by means of the K-shaped branch connector 5 to form one joint and two branch- line conductor out-leads.”

This description indicates that there is a single trunk conductor extending all the way through the junction, and there are also two branch line conductors that are separate cables prior to the assembly. At the conclusion of the assembly, each of the branch line conductors begins within the nexus and extends outward through the undermold (e.g., outer sheath 8). Apertures are formed by the cables extending completely through the undermold, and by the conductors extending partially through the undermold from the nexus through the undermold.

[0413] As shown in Shao, FIG. 1, annotated above, the trunk conductor has a first diameter, and the branch line conductors have a second diameter that is smaller than the first diameter, and that the aperture associated with the trunk conductor has a first diameter, while that the apertures associated with the branch lines have a smaller diameter. Further, as shown, the apertures are parallel to each other.

[0414] It would have been obvious to a POSITA to use an undermold (i.e., outer sheath 8), as taught by Shao to encase the exposed cables and the clamp holding the feeder and drop lines (i.e., trunk conductor and branch

line conductor) together to better protect those elements from damage and/or exposure (*see* E(i) ‘Motivation to Combine Yamawaki and Shao,’ further discussed above).

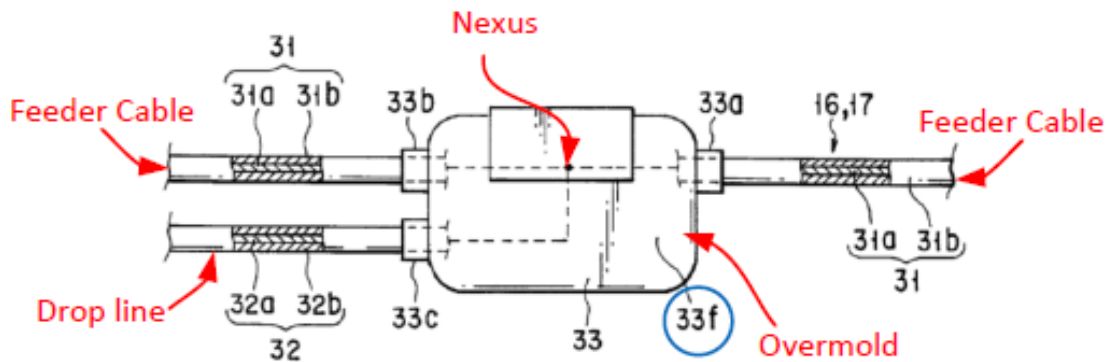
[0415] For these reasons, a POSITA would have found the limitations in claim 1(D)(iii) to be obvious in view of the Yamawaki-Shao combination.

E. An overmold surrounding said undermold and forming an undermold-overmold interface only at said outer surface,

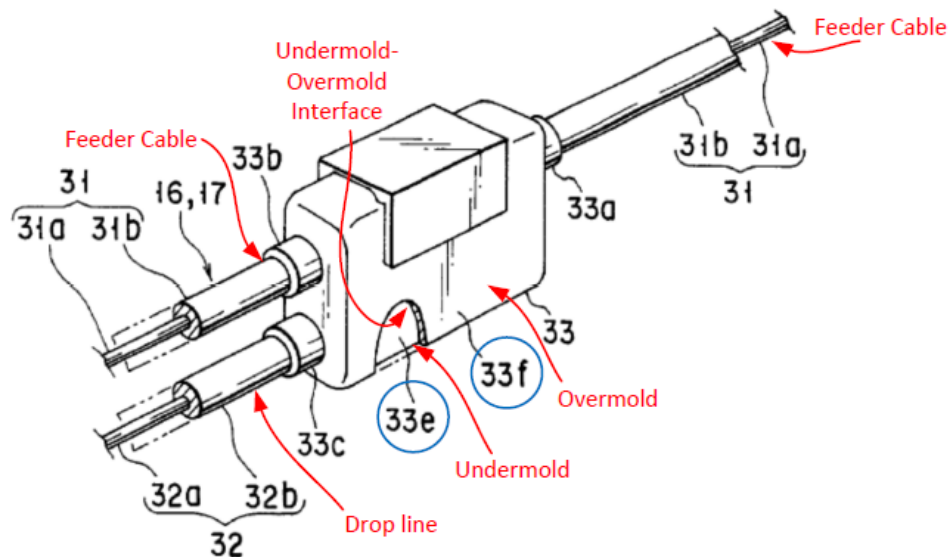
[0416] I have been informed by Counsel that the recitation of “said outer surface,” as recited in the claim 1(E) limitation, applying antecedent basis rules, refers to the recitation of “An undermold having an inner surface and an outer surface,” as recited in the claim 1(D) limitation, above. As best understood by a POSITA, I submit that the ordinary and customary meaning of the term “only” in the recitation of “forming an undermold-overmold interface *only at* said outer surface,” as recited in claim 1(E), refers to the undermold-overmold interface existing between the overmold and only the outer surface of the undermold, as opposed to the inner surface of the undermold.

[0417] Yamawaki teaches applying an overmold over an undermold of a branch cable connection to provide an added layer of waterproofing. *See* EX1006, 10:19-22; 13:15-18. In particular, Yamawaki discloses applying a covering member 33f (i.e., an overmold) over the molded underbody 33e

(i.e., an undermold) covering a branch junction (i.e., a nexus) of cables (i.e., a feeder cable and a branch cable). *See id.*, FIGS. 9A (1st-annotation) and 9B (1st-annotation), below.



EX1006, FIG. 9A (1st-annotation)



EX1006, FIG. 9B (1st-annotation)

[0418] A POSITA considering Yamawaki and Shao would appreciate that these two disclosures describe methods for encasing cable junctions with insulating layers that can provide protection from the environment and other

benefits discussed earlier with respect to Yamawaki (*see* E(i) ‘Motivation to Combine Yamawaki and Shao further discussed above). A POSITA considering Yamawaki and Shao would have found it obvious to apply the overmold taught by Yamawaki to the undermold disclosed by Shao in order to maintain the added protection against environmental elements (e.g., waterproofing), as taught by Yamawaki (*see* E(i) ‘Motivation to Combine Yamawaki and Shao further discussed above).

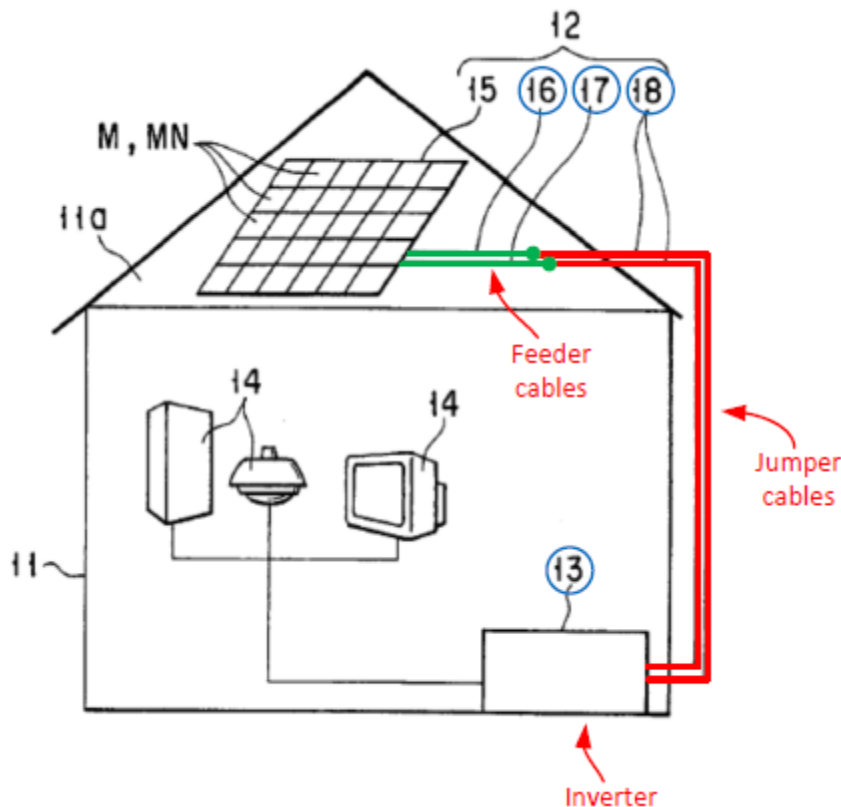
[0419] For these reasons, a POSITA would have found the limitations in claim 1(E) to be obvious in view of the Yamawaki-Shao combination.

i. wherein said lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between said solar arrays and said inverter, and

[0420] I have been informed by counsel that during the prosecution of the ’254 Patent, the Examiner, in the 05/30/2017 Office Action, indicated that the limitations that “the lead assembly combines power from a plurality of solar arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between the solar arrays and the inverter” is an intended use limitation. EX1002, pp. 259-260. This assertion by the Examiner was not rebutted by the Applicant. *See id.*, pp. 239-250. In particular, this portion of the claim recites a feature (i.e., “said lead assembly”) by what it does (i.e., combines power from a plurality of solar

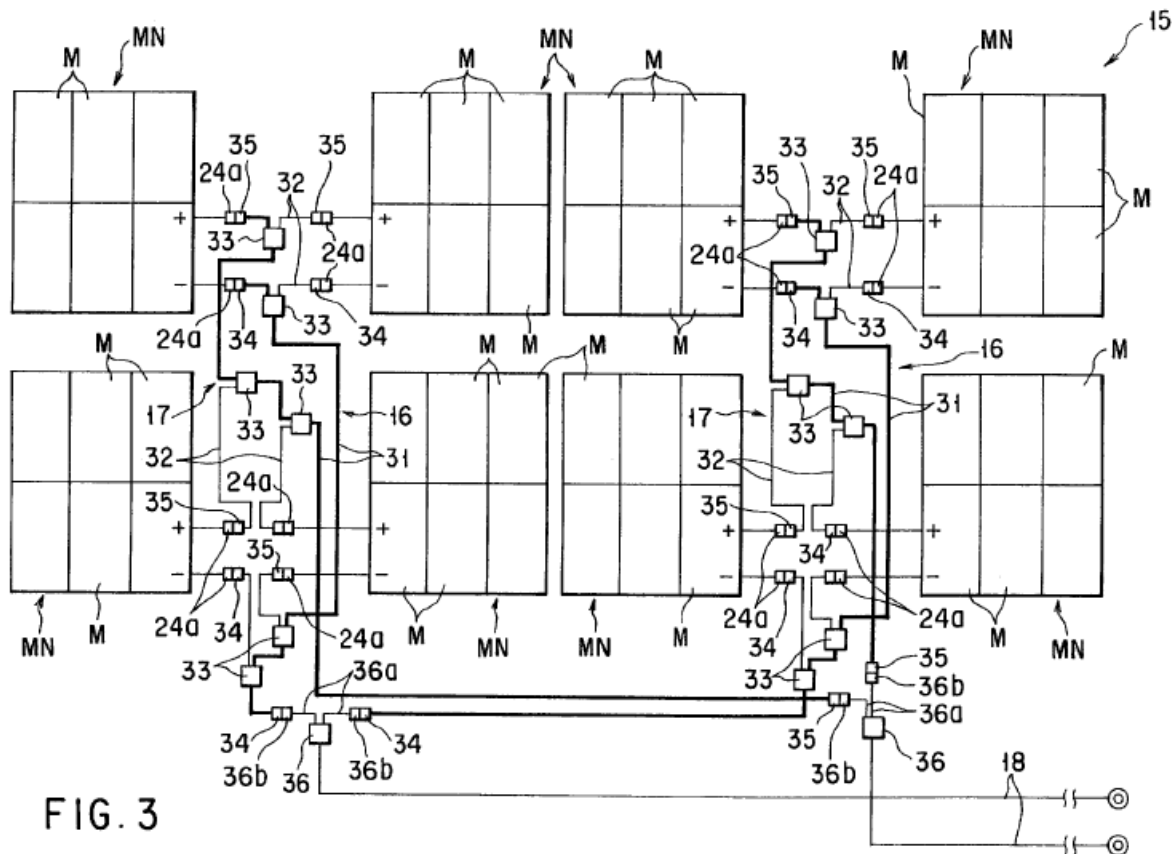
arrays and transmits that power to an inverter in a solar energy installation lacking a combiner box between said solar arrays and said inverter) rather than what it is.

[0421] Nonetheless, Yamawaki discloses, and shows in the illustration reproduced below, a lead assembly (i.e., wiring apparatus 16) that combines power from a plurality of solar arrays (photovoltaic modules M, photovoltaic module units MN) and transmits that power to an inverter (inverter unit 13) in a solar energy installation lacking a combiner box between said solar arrays and said inverter. *See* Yamawaki, 7:46-8:11 and FIG. 1 (1st-annotation), reproduced below.



EX1006, FIG. 1 (1st-annotation)

[0422] Further, in FIG. 3, below, Yamawaki shows an installation with 8 separate solar module units MN, each consisting of a plurality of solar modules M, where the power is gathered through cables and junctions that are eventually combined to form a single pair of lead-in wires 18 that are connected directly to an inverter as shown in FIG. 1, above. *See* EX1006, 8:1-11, FIG. 1 (1st -annotation) above, and FIG. 3 (below).



EX1006, FIG. 3

[0423] The resulting system would avoid the problems described by

Yamawaki and rely on the branch cables being connected to the trunk cables to implement such a simplified system which brings the power from the solar array directly to the inverter without the need for intervening combiner boxes. The improved manufacturing designs and methods disclosed by Shao would improve the performance and reliability of the cable junctions in the systems disclosed by Yamawaki. A POSITA would have been motivated to combine power from many solar arrays directly to an inverter, as taught by Yamawaki, to provide a simplified system that is easier to install and more reliable (*see* E(i) ‘Motivation to Combine Yamawaki and Shao’ further discussed above).

[0424] For these reasons, a POSITA would have found the limitations in claim 1(E)(i) to be obvious in view of Yamawaki and Shao (to the extent this claim element is found limiting).

ii. wherein said lead assembly has a voltage rating of 1500 VDC.

[0425] As discussed above, during the prosecution of the patent application that resulted in the ’254 Patent, the Examiner specifically addressed the limitations related to the voltage rating of 1500 VDC recited in the claims.

See EX1002, p. 151. In particular, the Examiner maintained that:

Applicant has identified the claimed voltage rating to not be found in the prior art. However, as noted above, it would have been obvious as of the effective filing date of the claimed invention for a person having ordinary skill in the art to vary

the voltage rating of the lead assembly according to the ultimate electrical requirements of the system. Applicant has not presented or identified evidence in the original specification which show the criticality of the lead assembly having a voltage rating of 1500 VDC.

Id., p. 151, last paragraph. I agree with this conclusion by the Examiner.

[0426] As discussed above regarding Ground 4, claim 1(B), which discussion is incorporated here by reference, to the extent that Yamawaki does not explicitly disclose that the lead assembly has a particular voltage rating, a POSITA would understand that the selection of feeder and/or branch cable sizes is an obvious design choice in view of well-known electric codes and standards. Therefore, a POSITA would understand that the selection of load capacity of the cables and branch joints forming a feeder cable is an obvious design choice in view of well-known electric codes and standards including the NEC 2002.

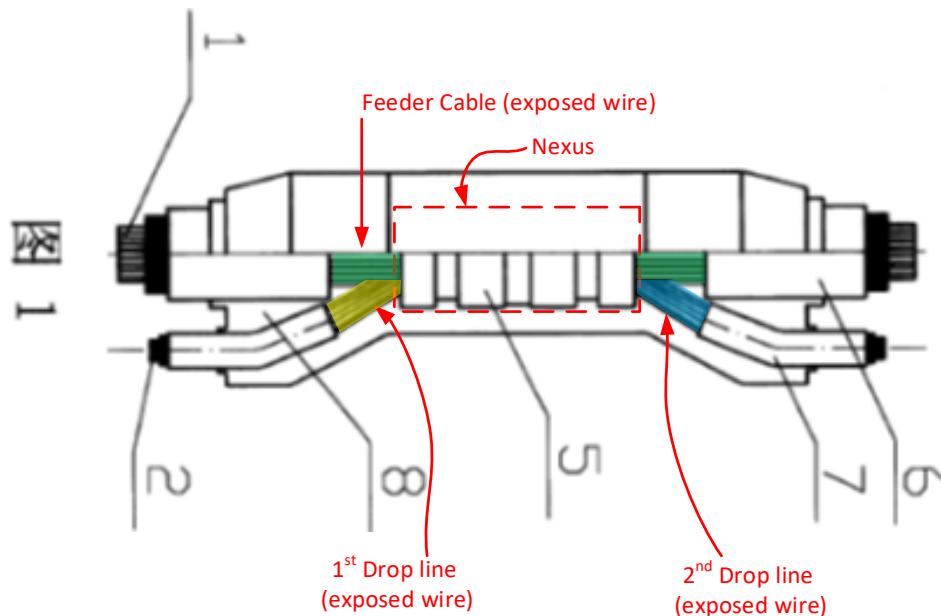
[0427] For these reasons, a POSITA would have found the limitations in claim 1(E)(ii) to be obvious in view of Yamawaki and Shao.

[0428] Accordingly, based on the above, a POSITA would have found claim 1 to be obvious based on the Yamawaki-Shao combination. Accordingly, claim 1 should be found invalid under 35 U.S.C. § 103 based on Yamawaki and Shao.

15. Claim 2

The lead assembly of claim 1 wherein said first drop line includes a section of exposed wire at said nexus.

[0429] Shao discloses that the first drop line includes a section of exposed wire (colored yellow in the annotation below) at the nexus. *See*, EX1008, ¶28 and FIG. 1 (1st-annotation), below. Shao discloses that, “[o]ne trunk conductor and two branch-line conductors are symmetrically overlapped and crimped by means of the K-shaped branch connector 5 to form one joint and two branch-line conductor out-leads, and directions of the branch-line conductor out-leads are opposite.” EX1008, 6:18-22.



EX1008, FIG. 1 (1st-annotation)

[0430] It would have been obvious to a POSITA to expose wires, such as the drop line wires and the feeder cable wire at a nexus, as taught by Shao, to

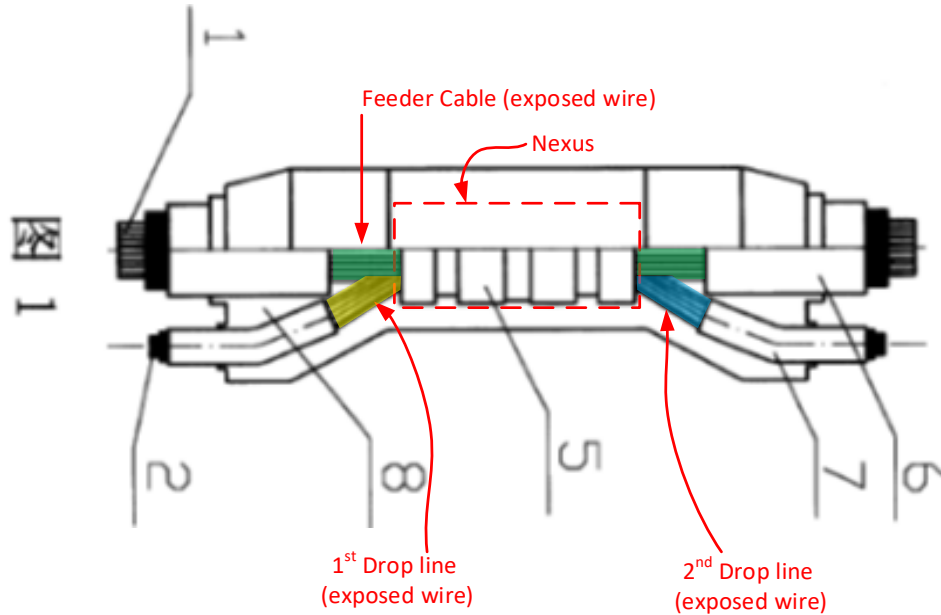
apply a crimped C-shaped clamp that ensures contact is maintained between the two conductive elements. *See* EX1008, 6:18-22. (*see* E(i) ‘Motivation to Combine Yamawaki and Shao,’ further discussed above).

[0431] For these reasons, a POSITA would have found the limitations in claim 2 to be obvious in view of the Yamawaki-Shao combination.

16. Claim 3

The lead assembly of claim 2 wherein said at least one feeder cable includes a section of exposed wire at said nexus.

[0432] Shao discloses that the feeder cable includes a section of exposed wire (colored green in the annotation below) at the nexus. *See* EX1008, FIG. 1 (1st-annotation), below. As noted above, Shao discloses that the cable of the trunk conductor 1 and the branch conductors 2 have insulation stripped away from sections in order to secure the C-shaped clamp that crimps the conductors together and forms the nexus. EX1008, 5:30-34.



EX1008, FIG. 1 (1st-annotation)

[0433] It would have been obvious to a POSITA to expose wires, such as the drop line wires and the feeder cable wire at a nexus, as taught by Shao, to apply a crimped C-shaped clamp that ensures contact is maintained between the two conductive elements. *See* EX1008, 6:18-22.

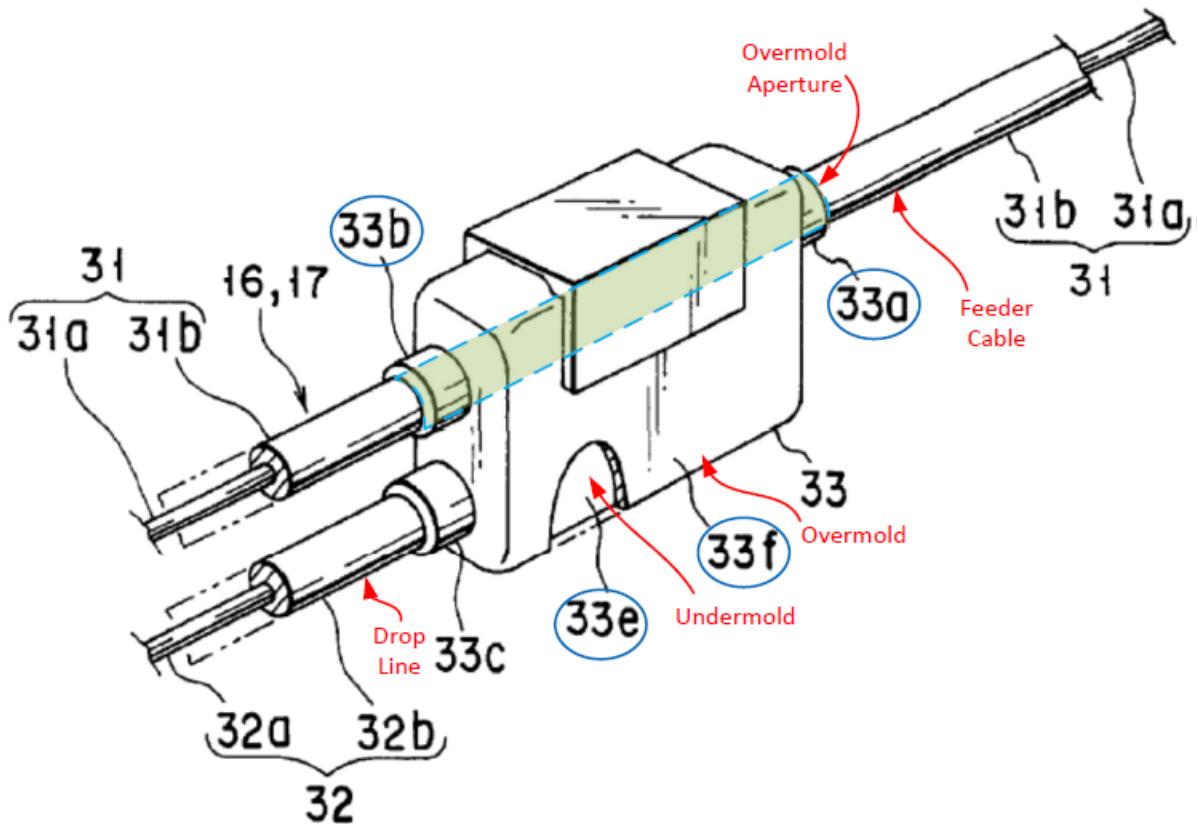
[0434] For these reasons, a POSITA would have found the limitations in claim 3 to be obvious in view of the Yamawaki-Shao combination.

17. Claim 4

The lead assembly of claim 1 wherein said overmold defines at least one aperture.

[0435] As noted above regarding the Ground 1, claim 1(D)(i) limitation, which discussion is incorporated here by reference, the specification of the '254 Patent does not explain any details regarding what defines an

“aperture.” *See* EX1001, generally. Nonetheless, Yamawaki discloses that the overmold (i.e., the cover member 33f that covers the molded body 33e) defines at least one aperture (e.g., highlighted in green, below) that extends from a cylindrical trunk cable connecting portion 33a on one side to another cylindrical trunk cable connecting portion 33b on the opposed side. *See*, EX1006, col. 10, lines 19-27 and FIG. 9B (2nd-annotation), below.



EX1006, FIG. 9B (2nd-annotation)

[0436] For these reasons, a POSITA would have found the limitations in claim 4 to be obvious in view of the Yamawaki-Shao combination.

18. Claim 5

The lead assembly of claim 1 wherein said undermold is injection molded.

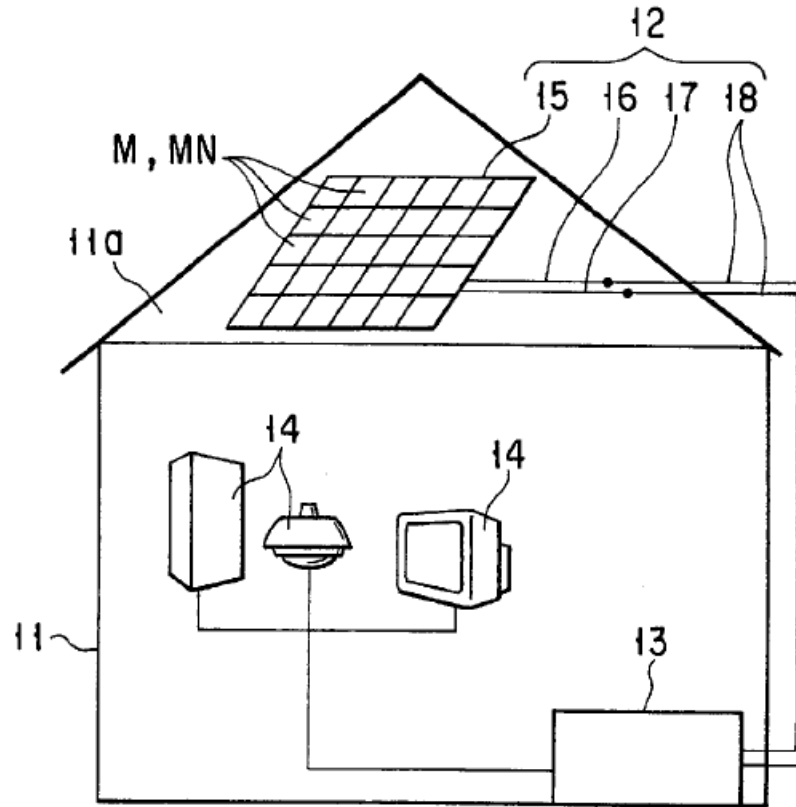
[0437] Shao discloses a feeder cable's electrical coupling to drop lines at a nexus that is covered by a sheath made of injection molding material, which is an undermold that fully encases the nexus. *See* EX1008, 5:16-20. A POSITA would recognize that an injection molded sheath (i.e., an undermold), as taught by Shao, encases the exposed cables and the metal clamp holding them together is better protected from damage and/or exposure (*see* E(i) 'Motivation to Combine Yamawaki and Shao,' further discussed above).

[0438] For these reasons, a POSITA would have found the limitations in claim 5 to be obvious in view of the Yamawaki-Shao combination.

19. Claim 7

Preamble. A solar power system comprising:

[0439] Yamawaki discloses a solar power system (i.e., a photovoltaic generation system). *See* EX1006, 3:9-11 and FIG. 1, below.

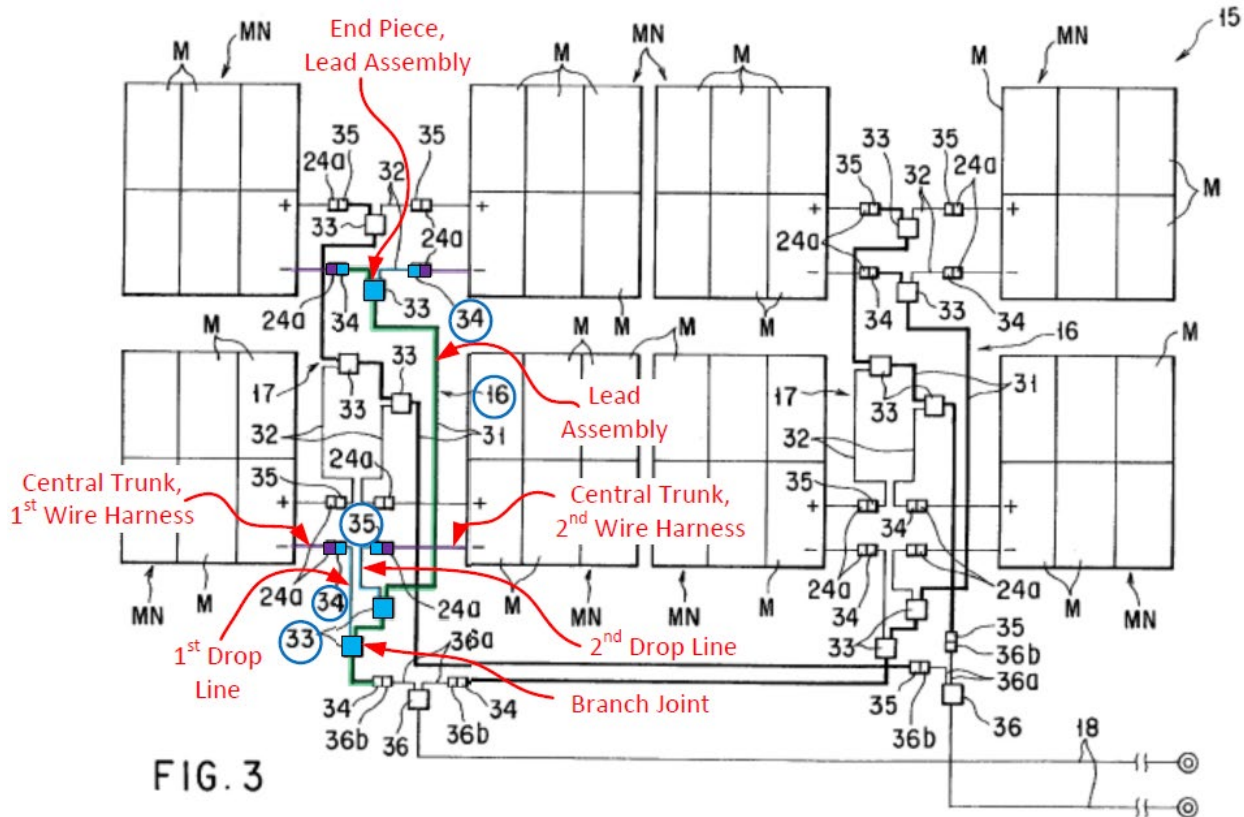


EX1006, FIG. 1

[0440] For these reasons, a POSITA would have found the limitations in claim 7(Preamble) to be obvious in view of Yamawaki.

A. A first plurality of solar panels electrically coupled by a first wire harness to form a first solar array;

[0441] Yamawaki discloses a first plurality of solar panels (e.g., photovoltaic modules M – the set of six modules M shown in the bottom left corner of the illustration from Yamawaki below) electrically coupled by a first wire harness (e.g., - in purple below, labeled as “Central Trunk, 1st Wire Harness”) to form a first solar array (i.e., a photovoltaic module units MN).
See EX1006, 8:12-26, 11:43-55, and FIG. 3 (1st-annotation), below.



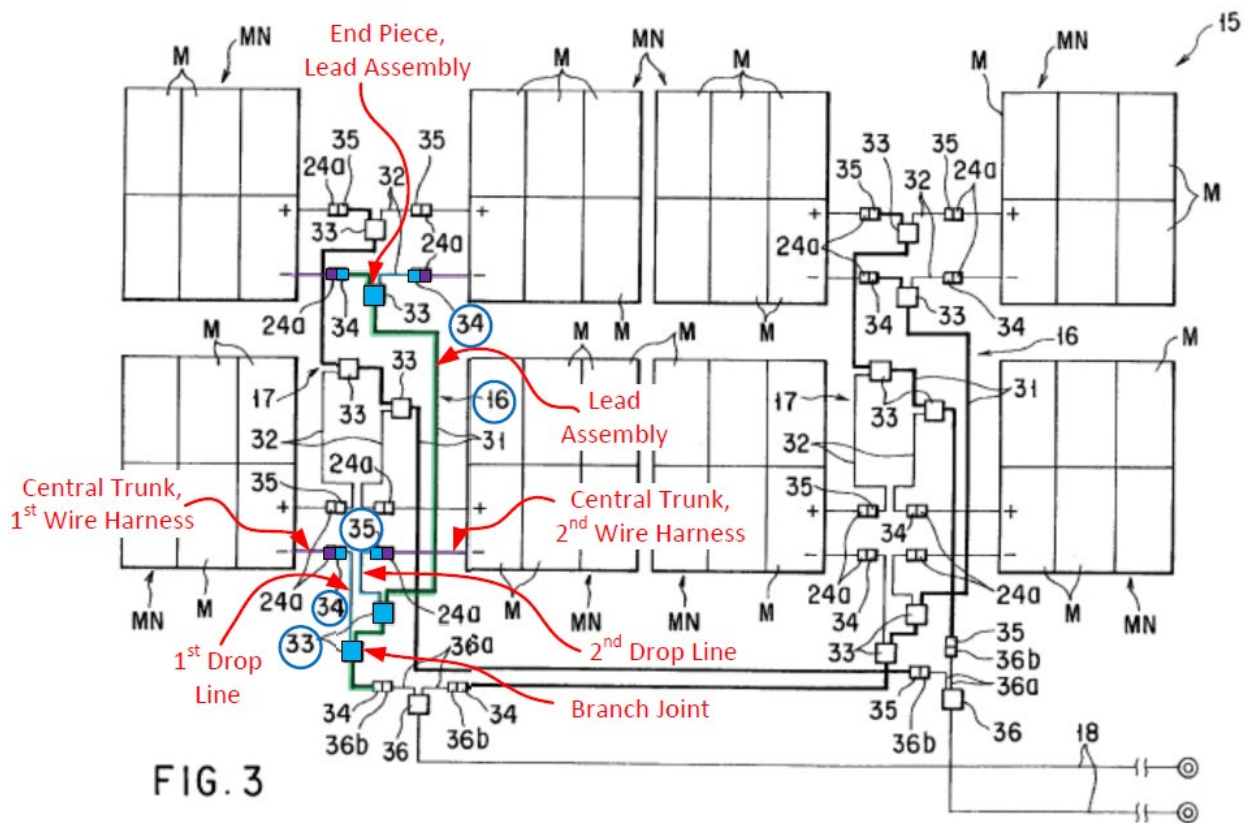
EX1006, FIG. 3 (1st-annotation)

[0442] For these reasons, a POSITA would have found the limitations in claim 7(A) to be obvious in view of Yamawaki.

B. A second plurality of solar panels electrically coupled by a second wire harness to form a second solar array;

[0443] Yamawaki discloses a second plurality of solar panels (e.g., photovoltaic modules M – the set of six modules M shown in the left, bottom, middle of the illustration from Yamawaki below) electrically coupled by a second wire harness (e.g., - in purple below, labeled as “Central Trunk, 2nd Wire Harness”) to form a second solar array (i.e., a photovoltaic module units MN). See EX1006, 8:12-26, 11:43-55, and FIG. 3

(1st-annotation), below.



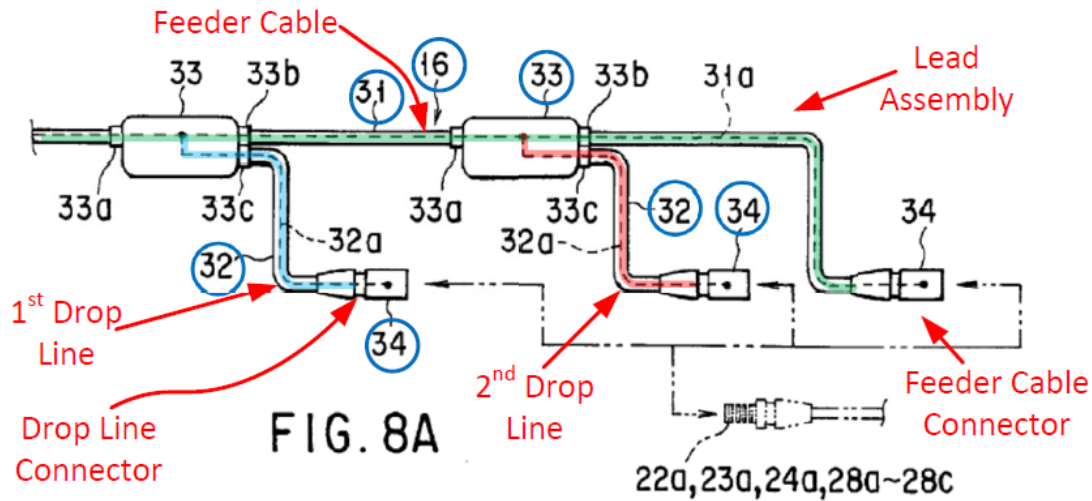
EX1006, FIG. 3 (1st-annotation)

[0444] For these reasons, a POSITA would have found the limitations in claim 7(B) to be obvious in view of Yamawaki.

C. A lead assembly including

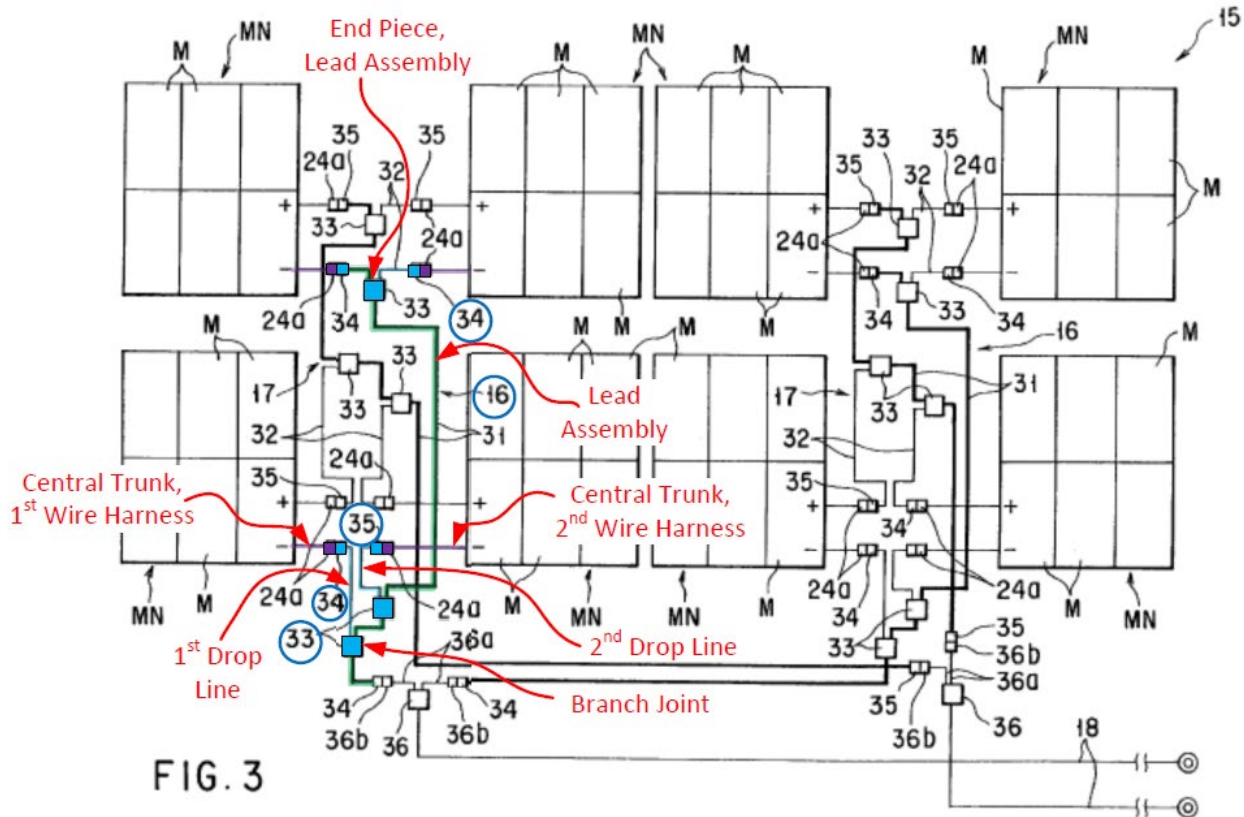
- i. a first drop line electrically connected to said first wire harness, and**

[0445] Yamawaki discloses, and shows in an illustration reproduced below, a first drop line (e.g., branch cable 32 – annotated in blue, below) that ends in a drop line connector (e.g., connector 34). See EX1006, 11:3-11 and FIG. 8A (1st-annotation), above.



EX1006, FIG. 8A (1st-annotation)

[0446] Additionally, Yamawaki discloses that the first drop line (e.g., branch cable 32 – in blue below, labeled as “1st Drop Line”) is electrically connected to said first wire harness (e.g., - in purple below, labeled as “Central Trunk, 1st Wire Harness”). See EX1006, 8:12-26 and FIG. 3 (1st-annotation), below.



EX1006, FIG. 3 (1st-annotation)

[0447] For these reasons, a POSITA would have found the limitations in claim 7(C)(i) to be obvious in view of Yamawaki.

ii. a 30 amp feeder cable electrically connected to a component selected from the group consisting of a trunk buss jumper, an inverter, a connection unit, a recombiner, and a disconnect unit,

[0448] As discussed above, regarding the Ground 4, claim 1(B) limitation, which discussion is incorporated here by reference, a POSITA would understand that the selection of feeder cable amperage capacity, of at least 30 amps, is an obvious design choice in view of well-known electric codes and standards. Additionally, as discussed above regarding the claim 1(E)(i) limitations, which discussion is incorporated here by reference, Yamawaki

discloses the feeder cable is connected to an inverter. *See* EX1006, 8:1-11, FIG. 1 (1st-annotation), and FIG. 3 (1st-annotation), above.

[0449] For these reasons, a POSITA would have found the limitations in claim 7(C)(ii) to be obvious in view of Yamawaki and Shao.

iii. said first drop line and said feeder cable electrically connected at a first nexus secured by a compression lug,

iv. said compression lug surrounded by an undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said feeder cable, said inner surface surrounding and fully encasing said compression lug,

v. said inner surface comprised of a first aperture concentric with said compression lug and said feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter,

vi. said feeder cable extending continuously through said first aperture, and

vii. a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture,

viii. with said undermold surrounded by an overmold and forming an undermold-overmold interface only at said outer surface,

ix. wherein said lead assembly has a voltage rating of 1500 VDC; and;

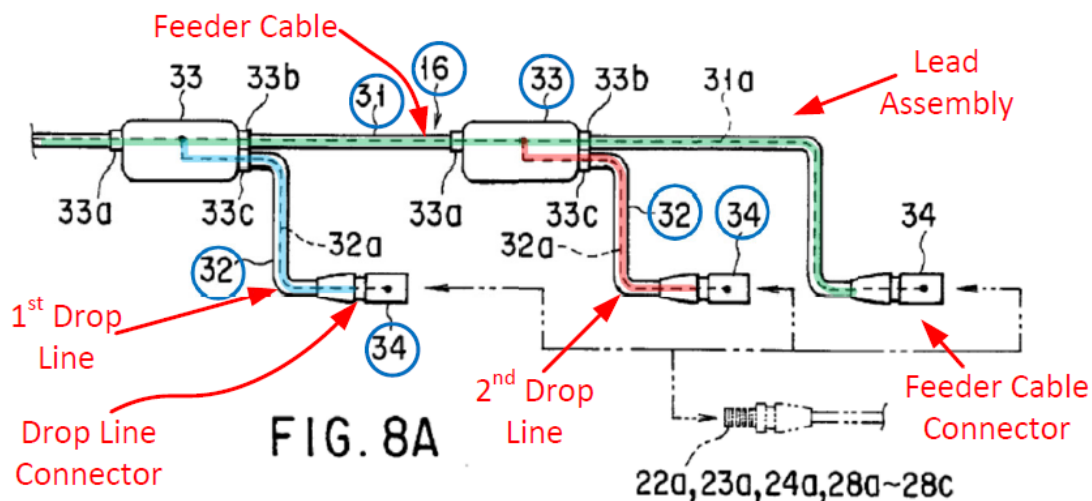
[0450] The claim 7(C)(iii-ix) limitations are the same as or at least equivalent to the Ground 4, claim 1(B-E) limitations addressed above, which discussion is incorporated here by reference. Regarding the recitation of a “compression lug” in claim 7(C)(iii-ix), as opposed to the crimped c-shaped

clamp discussed above regarding claim 1(C), a POSITA would understand that c-shaped clamps and compression lugs serve as distinct types of connectors for establishing wire/cable connections, each suited to different scenarios and needs. While C-shaped clamps are known for their convenience in quick installation, they may not always provide the most secure connection, particularly in situations involving vibration or movement. In contrast, compression lugs are installed using a specialized tool that compresses the lug tightly around the wires/cables being joined, forging a robust connection. A POSITA would understand that the decision between using a C-shaped clamp, or a compression lug hinges on the specific requirements of the electrical connection, such as wire size, application type, and the need for durability and reliability, as well as the tools and skills available for installation. In this way, a POSITA would understand that a compression lug is an obvious alternative to a c-shaped clamp, particularly for installations requiring a more secure connection between the feeder cable and the branch wire(s).

[0451] For the reasons discussed above regarding the claim 1(B-E) limitations, as well as these additional reasons, a POSITA would have found the limitations of claim 7(C)(iii-ix) to be obvious in view of the Yamawaki-Shao combination.

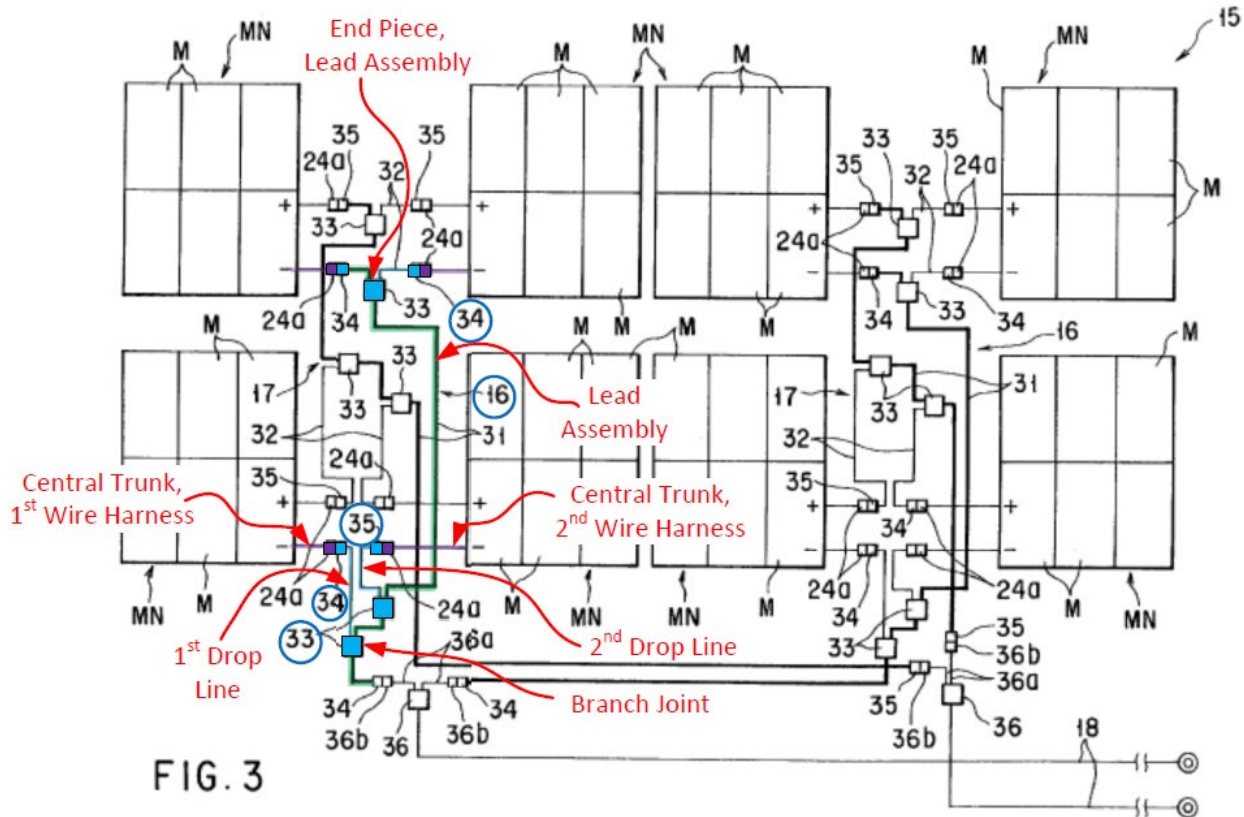
D. A second drop line electrically connected to said second wire harness,

[0452] Yamawaki discloses, and shows in an illustration reproduced below, a second drop line (e.g., branch cable 32 – annotated in red, below) that ends in a drop line connector (e.g., connector 34). See EX1006, 11:3-11 and FIG. 8A (1st-annotation), above.



EX1006, FIG. 8A (1st-annotation)

[0453] Additionally, Yamawaki discloses that the second drop line (e.g., branch cable 32 – in blue below, labeled as “2nd Drop Line”) is electrically connected to a second wire harness (e.g., - in purple below, labeled as “Central Trunk, 2nd Wire Harness”). See EX1006, 8:12-26 and FIG. 3 (1st-annotation), below.

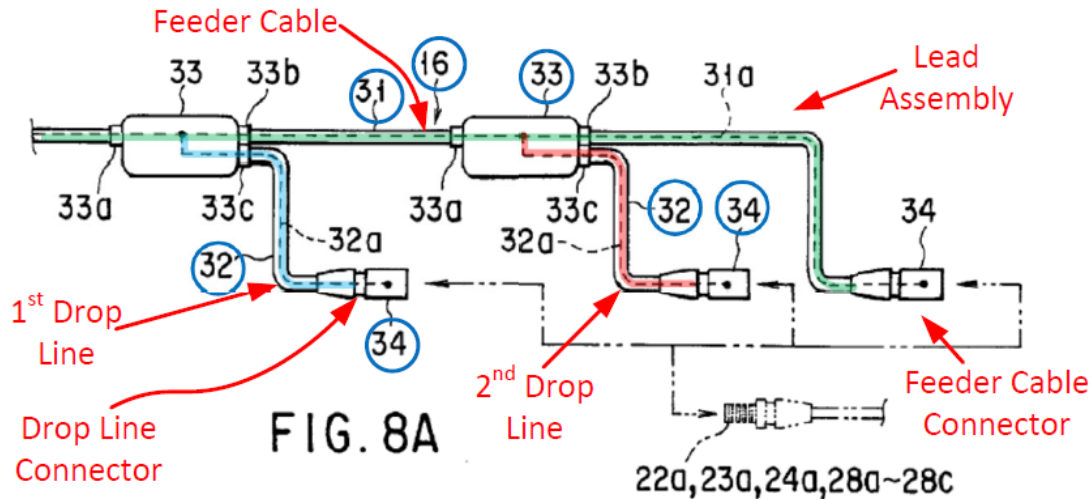


EX1006, FIG. 3 (1st-annotation)

[0454] For these reasons, a POSITA would have found the limitations in claim 7(D) to be obvious in view of Yamawaki.

i. said second drop line electrically connected to said feeder cable at a second nexus,

[0455] Yamawaki discloses, and shows in an illustration reproduced below, said second drop line (e.g., branch cable 32 – annotated in red, below) electrically connected to said feeder cable (i.e., trunk cable 31) at a second nexus (e.g., the intersection of the green line with the red line). *See* EX1006, 11:3-11 and FIG. 8A (1st-annotation), above.

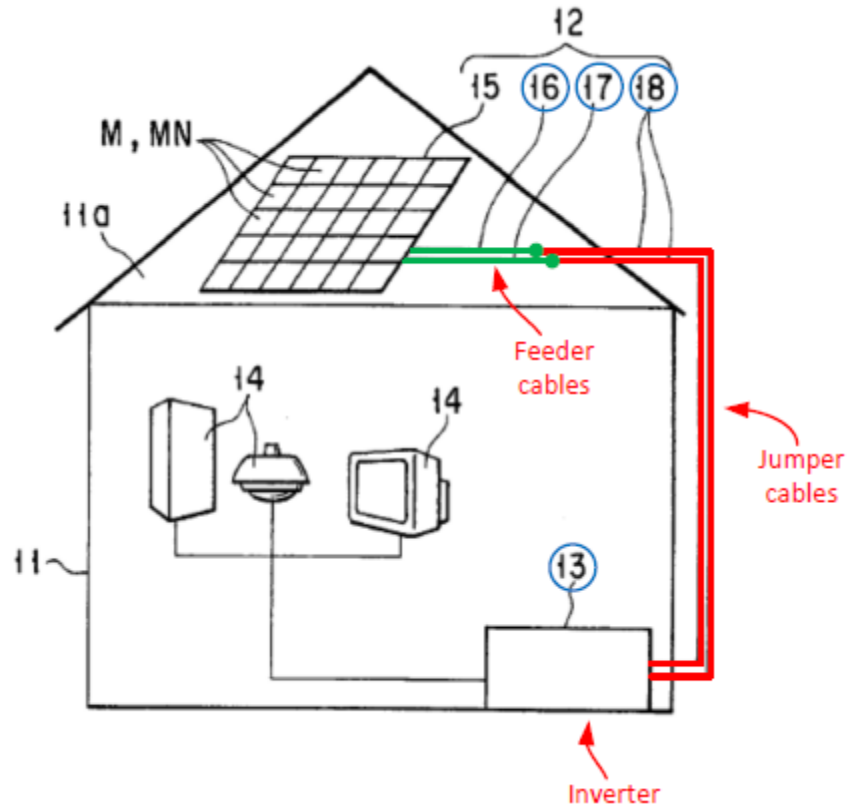


EX1006, FIG. 8A (1st-annotation)

[0456] For these reasons, a POSITA would have found the limitations in claim 7(D)(i) to be obvious in view of Yamawaki.

ii. wherein the solar power system doesn't include a combiner box upstream of said component.

[0457] Yamawaki discloses a solar array with cables being connected directly to an inverter without use of a combiner box in FIG. 1. *See* EX1006, FIG. 1 (1st-annotation) below.



EX1006, FIG. 1 (1st-annotation)

[0458] With respect to the expression “upstream of said component,” a POSITA would understand this to refer to locations between the component and the solar panels of the installation. Similarly, “downstream” would refer to locations between the component and the inverter. The terms “upstream” and “downstream” are understood to refer to the direction of the flow of power from the solar panels to the inverter in the solar array installation. As shown above, Yamawaki discloses that the solar power system doesn't include a combiner box upstream of said component. *Id.*

[0459] A POSITA would have found the claim 7(D)(ii) limitations to be

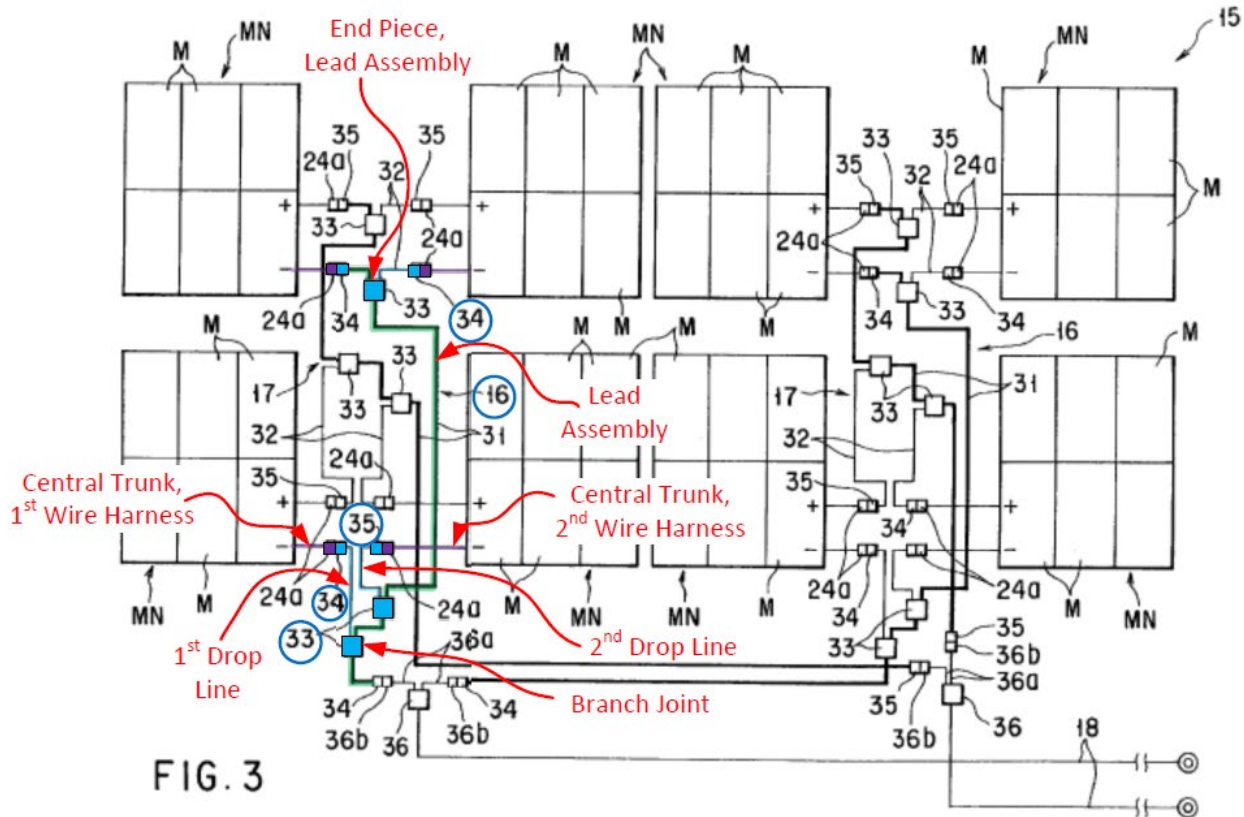
obvious in view of the Yamawaki-Shao combination.

[0460] Accordingly, based on the above, a POSITA would have found claim 7 to be obvious based on the Yamawaki-Shao combination. Accordingly, claim 7 should be found invalid under 35 U.S.C. § 103 based on Yamawaki and Shao.

20. Claim 8

The solar power system of claim 7 wherein said lead assembly includes an end piece.

[0461] Yamawaki discloses that the lead assembly (e.g., wiring apparatus 16) includes an end piece (e.g., the ending branch junction 33, labeled as “End Piece, Lead Assembly” below). *See* EX1006, 12:54-67 and FIG. 3 (1st-annotation), below.



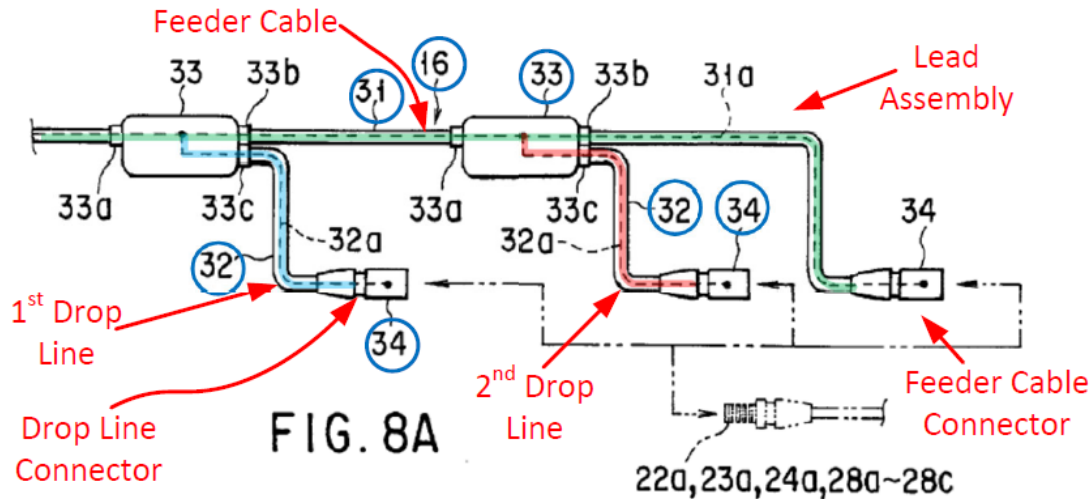
EX1006, FIG. 3 (1st-annotation)

[0462] For these reasons, a POSITA would have found the limitations in claim 8 to be obvious in view of the Yamawaki-Shao combination.

21. Claim 9

The solar power system of claim 7 wherein said first drop line terminates in a drop line connector.

[0463] Yamawaki discloses, and shows in an illustration reproduced below, a first drop line (e.g., branch cable 32 – annotated in blue, below) terminating in a drop line connector (e.g., connector 34). See EX1006, 11:3-11 and FIG. 8A (1st-annotation), below.



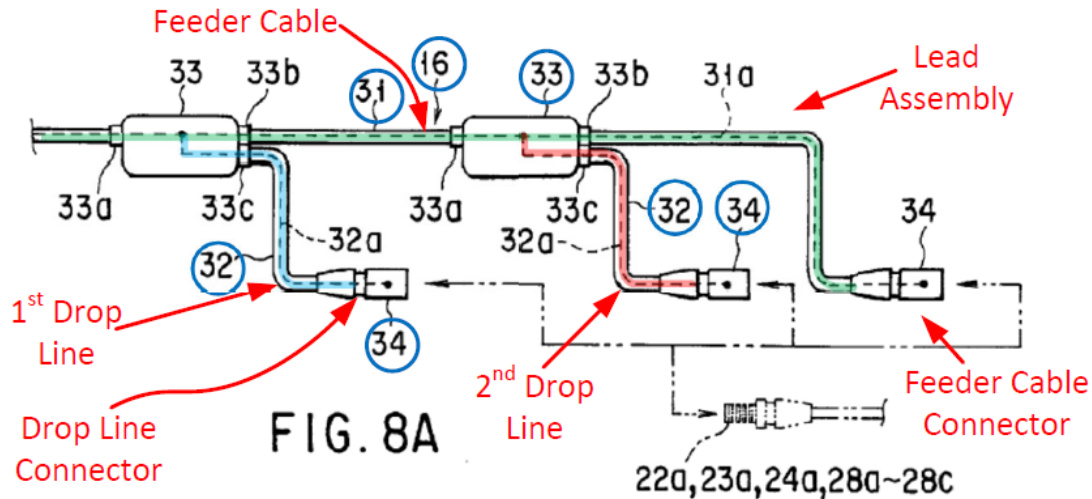
EX1006, FIG. 8A (1st-annotation)

[0464] For these reasons, a POSITA would have found the limitations in claim 9 to be obvious in view of the Yamawaki-Shao combination.

22. Claim 10

The solar power system of claim 7 wherein said feeder cable terminates in a feeder cable connector.

[0465] Yamawaki discloses, and shows in an illustration reproduced below, the feeder cable (i.e., trunk cable 31) terminating in a feeder cable connector (e.g., connector 34). See EX1006, 11:3-11 and FIG. 8A (1st-annotation), below.



EX1006, FIG. 8A (1st-annotation)

[0466] For these reasons, a POSITA would have found the limitations in claim 10 to be obvious in view of the Yamawaki-Shao combination.

23. Claim 11

The solar power system of claim 7 wherein said first drop line includes 18 to 4 gauge wire.

[0467] As discussed above regarding Claim 1(B) and the amperage rating of the feeder cable, which discussion is incorporated here by reference, to the extent that Yamawaki does not explicitly disclose that the drop lines are 18 to 4 gauge wire, a POSITA would understand that the selection of drop line gauge, from 18 to 4, is an obvious design choice in view of well-known electric codes and standards. For example, a POSITA would understand that the maximum amount of current to be carried by a cable is an important parameter in selection of the cable diameter and other cable parameters, such as the cable material and the insulation material. Further, the NEC 2002

provides standard guidelines for cable diameter selection based on maximum current, including Table 310.16 titled “Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts...” that is reproduced below. *See* EX1010, p. 149. This ampacity size table with which a POSITA would be familiar lists the gauge of wire that is appropriate for different ampacities of insulated conductors for different types of wires and different temperature ratings. *See id.*

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13.)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM				
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

EX1010, Table 310.16

[0468] Table 310.16 (reproduced above) includes wire gauge sizes ranging from 18 AWG to 2000 MCM diameter, showing that cables of these diameters are expected to carry current from nominal values to 560A. Other than diameter and current carrying capacity, there is little difference between cables from 18 AWG to 2000MCM. A POSITA would understand that the abbreviation “MCM” stands for “thousands of circular mils,” which defines wire sizes. A POSITA would also understand how to find and use electrical standards and guides such as the NEC 2002 to make decisions about the gauge (i.e., diameter) of wire needed for different sections of the wiring harness for a solar installation, and to select suitable cables from the catalogs of cable vendors. The NEC 2002 and cable vendor catalogs include similar tables with information for selecting cables for different voltages and resistances. Therefore, a POSITA would understand that the selection of drop line gauge, from 18 to 4, is an obvious design choice in view of well-known electric codes and standards including the NEC 2002.

[0469] For these reasons, a POSITA would have found the limitations in claim 11 to be obvious in view of the Yamawaki-Shao combination.

24. Claim 12

The solar power system of claim 7 wherein said feeder cable includes 6 gauge to 1000 MCM wire.

[0470] As discussed above regarding Claim 1(B), which discussion is

incorporated here by reference, a POSITA would understand that the selection of feeder cable gauge, which is related to amperage capacity, of from 6 to 1000 MCM, is an obvious design choice in view of well-known electric codes and standards including the NEC 2002.

[0471] A POSITA would understand that the abbreviation “MCM” stands for “thousands of circular mils,” which defines wire sizes. A typical 250 MCM cable has a diameter of more than 1 cm, and a 1000 MCM cable has a diameter near 2.5 cm. In view of the standard electrical practices defined in the NEC 2002, a POSITA would understand that an appropriate feeder cable gauge should be selected for the intended use based on the projected current and voltages to be conducted by the feeder cable. *See* EX1010, generally. In particular, a POSITA would understand that the maximum amount of current to be carried by a cable is an important parameter in selection of the cable diameter and other cable parameters, such as the cable material and the insulation material. Further, the NEC 2002 provides standard guidelines for cable diameter selection based on maximum current, including Table 310.16 titled “Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts...” that is reproduced below. *See* EX1010, p. 149. This ampacity size table with which a POSITA would be familiar lists the gauge of wire that is appropriate for different ampacities of insulated conductors for different

types of wires and different temperature ratings. *See id.*

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13.)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM				
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14*	20	20	25	—	—	—	—
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

EX1010, Table 310.16

[0472] Table 310.16 (reproduced above) includes ampacity values for cables with 250 or 1000 MCM diameter, showing that cables of these diameters are expected to carry current from 215A to 455A. Other than diameter and current carrying capacity, there are no differences between cables from 18 AWG to 1000MCM. A POSITA would understand how to find and use electrical standards and guides such as the NEC 2002 to make decisions

about the diameter of wire needed for different sections of the wiring harness for a solar installation, and to select suitable cables from the catalogs of cable vendors. The NEC 2002 and cable vendor catalogs include similar tables with information for selecting cables for different voltages and resistances. Therefore, a POSITA would understand that the selection of feeder cable size, in the range of 250 MCM to 1000 MCM is an obvious design choice in view of Yamawaki and well-known electric codes and standards including the NEC 2002.

[0473] For these reasons, a POSITA would have found the limitations in claim 12 to be obvious in view of the Yamawaki-Shao combination.

25. Claim 13

The solar power system of claim 7 wherein said first nexus is surrounded by said compression lug.

[0474] The claim 13 limitations are the same as or at least equivalent to the claim 7(C)(iii-ix) limitations addressed above. As discussed above regarding the claim 7(C)(iii-ix) limitations, which discussion is incorporated here by reference, a POSITA would have found the claim 13 limitations to be obvious in view of the Yamawaki-Shao combination.

26. Claim 14

Preamble. A method of constructing a solar power installation including the steps of:

[0475] Yamawaki discloses a method of construction a solar power

installation in that Yamawaki discloses various solar system components and configurations, including lead assemblies and connectors in various example installation scenarios. *See* EX1006, generally. As discussed above regarding Ground 4, claim 7(Preamble), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(Preamble) to be obvious in view of Yamawaki by disclosing all the elements and thus illustrating that those must be constructed to form a solar power installation.

[0476] For these reasons, a POSITA would have found the limitations in claim 14(Preamble) to be obvious in view of Yamawaki.

A. Connecting a first plurality of solar panels to a first wire harness to form a first solar array;

[0477] As discussed above regarding Ground 4, claim 7(A), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(A) to be obvious in view of Yamawaki by disclosing all the elements and thus illustrating that those elements must be connected.

[0478] For these reasons, a POSITA would have found the limitations in claim 14(A) to be obvious in view of Yamawaki.

B. Connecting said first wire harness to a first drop line of a lead assembly;

[0479] As discussed above regarding Ground 4, claim 7(C)(i), which discussion is incorporated here by reference, a POSITA would have found

the limitations in claim 14(B) to be obvious in view of Yamawaki by disclosing all the elements and thus illustrating that those elements must be connected.

[0480] For these reasons, a POSITA would have found the limitations in claim 14(B) to be obvious in view of Yamawaki.

C. Connecting a second plurality of solar panels to a second wire harness to form a second solar array;

[0481] As discussed above regarding Ground 4, claim 7(B), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(C) to be obvious in view of Yamawaki by disclosing all the elements and thus disclosing those elements may be connected.

[0482] For these reasons, a POSITA would have found the limitations in claim 14(C) to be obvious in view of Yamawaki.

D. Connecting said second wire harness to a second drop line of said lead assembly; and

[0483] As discussed above regarding Ground 4, claim 7(D), which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(D) to be obvious in view of Yamawaki by disclosing all the elements and thus disclosing those elements may be connected.

[0484] For these reasons, a POSITA would have found the limitations in claim 14(D) to be obvious in view of Yamawaki.

E. Electrically coupling said lead assembly to an inverter without electrically coupling to a combiner box;

[0485] As discussed above regarding Ground 4, claim 1(E)(i), which discussions are incorporated here by reference, a POSITA would have found the limitations in claim 14(E) to be obvious in view of Yamawaki and Shao by disclosing all the elements and thus disclosing those elements may be connected. In particular, a POSITA at the time of the filing of the '254 Patent would have been aware of the options for connecting power from power generating elements, such as elements of a solar array, including use of cable harnesses with junctions, or use of combiner boxes, and would understand that combiner boxes or harnesses with cable junctions are available for use in these systems. A POSITA would understand from the teachings of Yamawaki that the combiner box may be omitted from solar array installations to remove an element (combiner box) and its known function as needed.

[0486] For these reasons, a POSITA would have found the limitations in claim 14(E) to be obvious in view of the Yamawaki-Shao combination.

i-iii. wherein said lead assembly includes said first drop line electrically connected to said first wire harness, and a 30 amp feeder cable terminating in a feeder cable connector, said first drop line and said feeder cable electrically connected at a first nexus secured by a means for securing said nexus, said securing means selected from the group consisting of compression lug,

soldering, splicing, crimping, and combinations thereof, said securing means surrounded by an undermold having an inner surface and an outer surface, both surfaces extending in a longitudinal direction of said feeder cable, said inner surface surrounding and fully encasing said securing means, said inner surface comprised of a first aperture concentric with said securing means and said at least one feeder cable, said first aperture extending continuously through said undermold in said longitudinal direction and having a first diameter, said feeder cable continuously extending through said first aperture, and a second aperture concentric with said first drop line and parallel to said first aperture, said second aperture only partially extending through said undermold in said longitudinal direction, said second aperture having a second diameter smaller than said first diameter, said first drop line extending from said second aperture, with said undermold surrounded by an overmold and forming an undermold-overmold interface only at said outer surface, wherein said lead assembly has a voltage rating of 1500 VDC.

[0487] As discussed above regarding claim 1, which discussion is incorporated here by reference, a POSITA would have found the limitations in claim 14(E)(i) to be obvious in view of the Yamawaki-Shao combination.

[0488] Accordingly, based on the above, a POSITA would have found claim 14 to be obvious based on the Yamawaki-Shao combination. Accordingly, claim 14 should be found invalid under 35 U.S.C. § 103 based on Yamawaki and Shao.

27. Claim 15

The method of claim 14 wherein said step of electrically coupling said lead assembly to an inverter includes the steps of electrically coupling said feeder cable to said inverter.

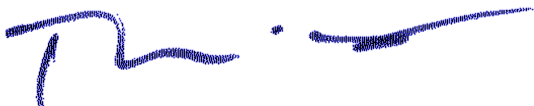
[0489] As discussed above regarding claim 1(E)(i) and claim 7(C)(ii), which discussions are incorporated here by reference, the Yamawaki-Shao combination teaches electrically coupling the feeder cable of a lead assembly to an inverter. For these reasons, a POSITA would have found the limitations in claim 15 to be obvious in view of Yamawaki and Shao.

VI. CONCLUSION

[0490] I reserve the right to supplement my opinions to address any information obtained, or positions taken, based on any new information introduced throughout this proceeding.

[0491] I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.

Dated: May 8, 2024

By: 

Thomas W. Kenny, Ph.D.