

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLTAGE, LLC,
NINGBO VOLTAGE SMART PRODUCTION CO.
Petitioners

v.

SHOALS TECHNOLOGIES GROUP, LLC
Patent Owner

Inter Partes Review No.: To Be Assigned
U.S. Patent No. 12,015,375

PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 12,015,375 UNDER
35 U.S.C. § 311 AND 37 C.F.R. § 42.100

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LIST OF EXHIBITS

Exhibit No.	Description of Exhibit
1001	U.S. Patent No. 12,015,375
1002	Notice of a Commission Final Determination Finding No Violation of Section 337; Termination of the Investigation, Certain Photovoltaic Connectors and Components Thereof, Inv. No. 337-TA-1365 (Jan. 14, 2025, EDIS Doc. ID 841065).
1003	File History for U.S. Patent No. 12,015,375
1004	U.S. Provisional Patent Application No. 62/047,773
1005	Original Japanese Language Publication of JPH10-135499A
1006	Certified English Translation of JPH10-135499A (“Machida”)
1007	U.S. Patent Publication No. 2011/0011642 A1 (“Solon”)
1008	Order No. 20: Construing Claim Terms, Certain Photovoltaic Trunk Bus Cable Assemblies and Components Thereof, Inv. No. 337-TA-1438 (July 23, 2025, EDIS Doc. ID 858239).
1009	U.S. Patent Publication No. 2014/0272293 A1 (“Saitou”)
1010	Wikipedia entry for “American wire gauge” (archived on Wayback Machine on July 13, 2014)
1011	Webpage “The Original MC4 DC PV connector offers a unique high contact quality” (https://www.staubli.com/global/en/electrical-connectors/industries/renewable-energy/the-original-mc4.html)
1012	Original Korean Patent No. 10-1428689
1013	Certified English Translation of Korean Patent No. 10-1428689 (“Kim”)

Pursuant to 35 U.S.C. § 311 and 37 C.F.R. § 42.100, Voltage, LLC and Ningbo Voltage Smart Production Co. (collectively, “Petitioners”) request *inter partes* review (“IPR”) of claims 1-2, 4-8, 10-17, and 19-24 (“the Challenged Claims”) of U.S. Patent No. 12,015,375 (“the ’375 Patent”) (EX1001). The ’375 Patent is purportedly assigned to Shoals Technologies Group, LLC (“Patent Owner”) per USPTO assignment records.

I. INTRODUCTION

The ’375 Patent is the result of a continuation patent application claiming priority to two patents that were each previously asserted against Petitioners, *unsuccessfully*, by Patent Owner at the United States International Trade Commission (“ITC”). *See* EX1002; EX1008 at 1-2.¹ While the investigation was pending, Patent Owner pursued additional claims as a contingency plan. On the eve of the Commission’s adverse determination, Patent Owner filed suit against Petitioners again at the ITC and in U.S. District Court for the Middle District of

¹ Patent Owner initially asserted the parent, U.S. Patent No. 10,992,254 (“the ’254 patent”) in May 2023 and added the first issued continuation upon issuance, U.S. Patent No. 11,689,153 (“the ’153 patent”) in July 2023 against Petitioners. Patent Owner terminated the investigation as to the ’254 Patent and the Commission found no section 337 violation of the ’153 Patent.

North Carolina alleging infringement of the '375 Patent and another issued continuation (the '376 Patent²). The '375 Patent—and the new suits that followed issuance—represents Patent Owner's second bite at the apple to get an infringement ruling based on claims from the same limited specification directed to technology already found not to be practiced by Petitioners.

However, Patent Owner continues to overreach. The claims of the '375 Patent capture the prior art. For example, the primary reference relied upon in this Petition, Machida (EX1005-EX1006)—a Japanese Patent Publication that was not considered during prosecution of the '375 Patent—explicitly discloses transmitting power by connecting the outputs of solar cell modules to the inverter using connectors in the same configuration recited in many claims of the '375 Patent.

As an example showing the similarity between the disclosure of Machida and the '375 Patent, FIG. 1 below reproduces Figure 7 of the '375 Patent showing a cross section of the “joint 17” identifying the following features: a drop line 12 (in red), a feeder cable 14 (in blue), and exposed wire 18 (in orange) within compression lug 20 (in purple) located within a mold (in grey). The reproduced Figure 7 is annotated and flipped for ease of comparison to Machida's Figure 3.

² U.S. Patent No. 12,015,376 (“the '376 Patent”).

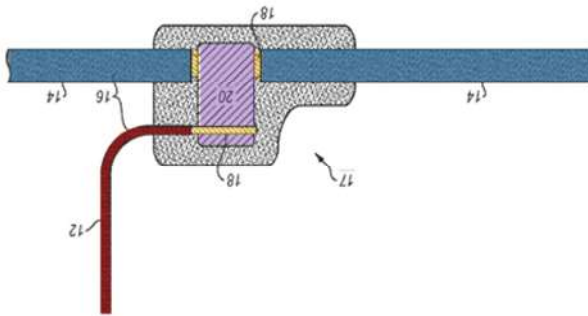


**FIG. 1³: Figure 7 of '375 Patent
(flipped and annotated)**

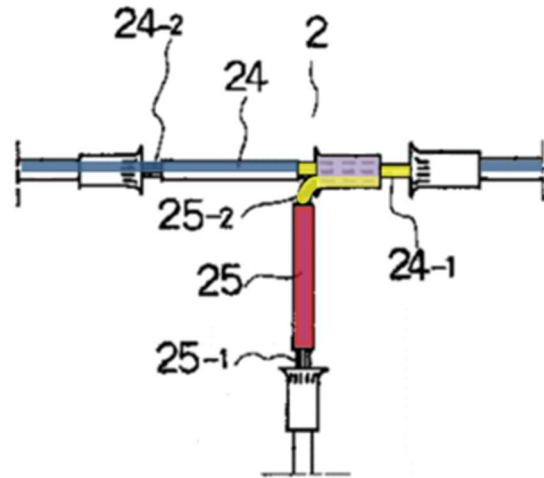


**FIG. 2: Figure 3 of Machida
(annotated)**

FIG. 2 reproduces Figure 3 of Machida, showing a front view of “wire processing product 2” identifying the following features: an electrical wire 25 (in red), an electrical wire 24 (in blue), and exposed portions 24-1 and 25-2 (in yellow) with soldering component (in purple). Figure 2 of Machida (reproduced as FIG. 10 below at p. 19) further shows a mold that encapsulates this wiring, like the mold (in grey) in FIG. 1.

As shown in FIGS. 1 and 2, the technical solutions of the '375 Patent and

³ “FIG” used throughout this Petition refers to the Petition Figure numbers—often times representing a demonstrative illustration of aspects of the challenged patent or the prior art. “Figure” used throughout this petition refers to the Figures included in those underlying documents.

Machida are the same, both aiming to electrically couple the drop line to the feeder cable at the nexus inside a joint encapsulated by a mold. Thus, in 1998, 16 years earlier than the earliest identified priority date of the '375 Patent, the technical solution claimed in the '375 Patent was disclosed. Therefore, many of the challenged claims are invalid as obvious over Machida alone (obviousness is asserted in this Petition, although the claims are likely anticipated as well)—as demonstrated in Ground 1. Other claims in the '375 patent that are directed to a dual drop wire configuration are invalid as obvious over Machida in view of either Solon (Ground 2) or Kim (Ground 3), prior art references that both disclose similar dual drop wire arrangements.

II. OVERVIEW OF THE '375 PATENT

A. The Specification and the Challenged Claims

The '375 Patent specification purports to provide assemblies for connecting solar panel arrays to an inverter without the use of a combiner box. *See* EX1001, 1:24-27. Figure 3 of the '375 Patent, reproduced as FIG. 3 below, shows one such embodiment, with a plurality of wire harnesses 34 coupled to a lead assembly 10 that connects to an inverter 38.

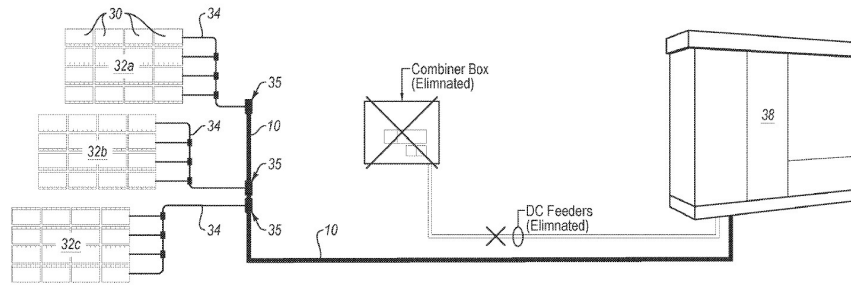


FIG. 3

FIG. 3: Figure 3 of '375 Patent

The bulk of the '375 Patent specification—and the claims that are the subject of the '375 Patent—are directed to a lead assembly with at least one drop line that is joined to a feeder cable within a joint. Figure 7 (reproduced as FIG. 4 and annotated below) includes a cross section of a joint 17 including a single drop line. *See id.*, 2:41-42. It depicts drop line 12 (in red), feeder cable 14 (in blue), and exposed wires 18 (in orange) within compression lug 20 (in purple). *See id.*, 4:10-34.

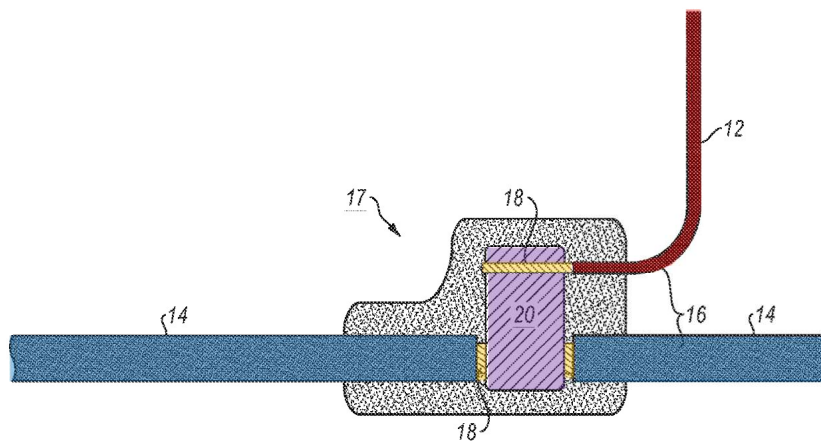


FIG. 7

FIG. 4: Figure 7 of '375 Patent (annotated)

The specification describes that the joint is surrounded by a mold that may be

applied by injection molding. It describes that certain embodiments may include an undermold that is surrounded by an overmold, although other embodiments may include just an overmold applied by a single molding process. *See* EX1001, 5:67-6:12, 4:55-58.

Figure 8, reproduced as FIG. 5 below, provides a schematic view of the single drop joint shown in FIG. 4. *See id.*, 4:10-34. It depicts the feeder cable 14 and the drop line 12, both exiting the joint.

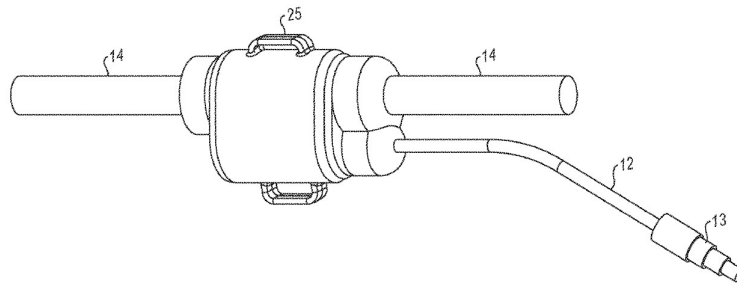


FIG. 8

FIG. 5: Figure 8 of '375 Patent

Figures 33-38 depict an embodiment that includes two drop lines. Figure 37, reproduced and annotated as FIG. 6 below, shows one drop line 12 (in red) on the right, a second drop line (not numbered) on the left, and feeder cable 14 (in blue) with exposed wires 18 (in orange) electrically coupled at nexus 19. *See* EX1001, 5:58-60.

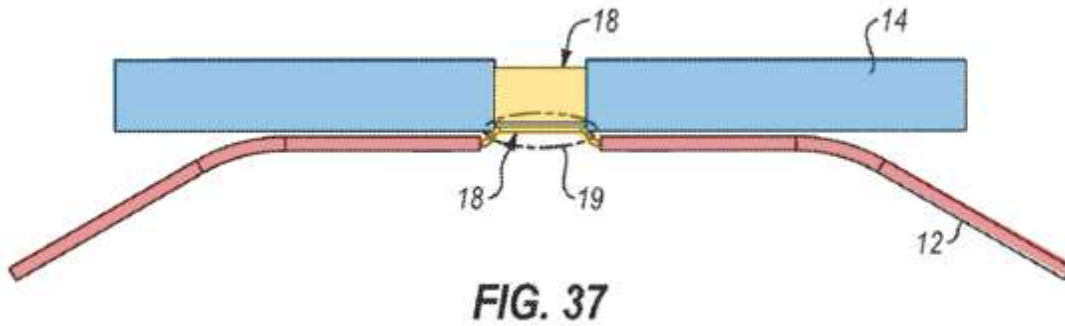


FIG. 6: Figure 37 of '375 Patent (annotated)

The specification describes that the drop lines and feeder cable shown in Figure 37 are held together by compression lug 20 (in purple)—as shown in Figure 35 reproduced as FIG. 7 below. *See* EX1001, 4:55-58.

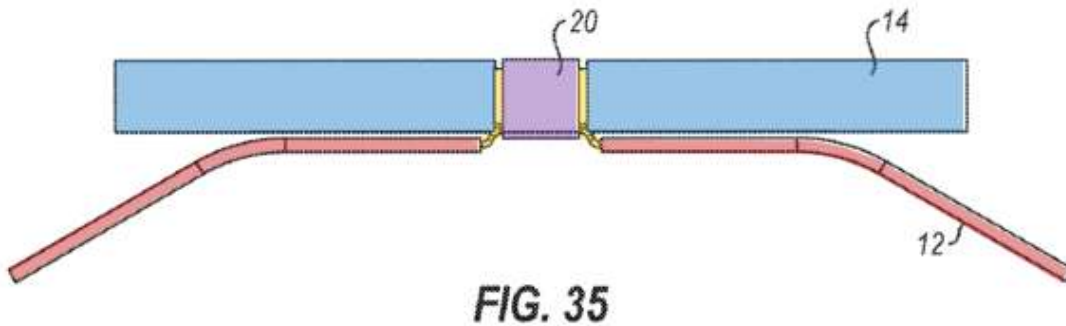


FIG. 7: Figure 35 of '375 Patent (annotated)

That joint is surrounded by undermold 22, shown in Figure 33 reproduced as FIG. 8 below. *See* EX1001, 4:55-58.

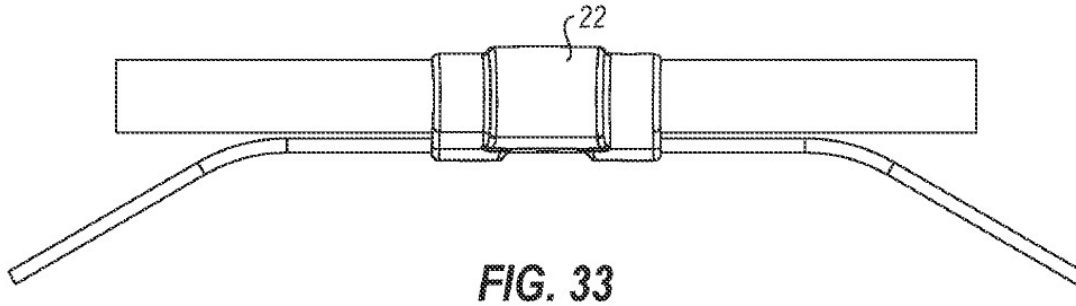


FIG. 8: Figure 33 of '375 Patent

The Challenged Claims are recited fully in the Claims Appendix of Challenged Claims, including an identification of the subparts referenced throughout this Petition.

Independent claim 1 generally relates to the embodiment of a lead assembly requiring only a single drop line and a single drop line pathway. Independent claims 15 and 20 contain many of the same requirements but are directed to configurations requiring two drop lines and two drop line pathways. The dependent claims recite additional features of the wiring connections.

B. The Prosecution History of the '375 Patent

U.S. Provisional Patent Application No. 62/047,773 (EX1004) was filed on September 9, 2014. U.S. Patent Application No. 14/849,458 (“the ’458 application”) was then filed on September 9, 2015, claiming priority to the provisional application, and eventually matured into the ’254 Patent. U.S. Patent Application No. 17/301,609 (“the ’609 application”) was filed on April 8, 2021, as a continuation of the ’458

application, and matured into the '153 Patent.

U.S. Patent Application No. 18/341,655 (“the '655 application”), which issued as the '375 Patent, was filed on June 26, 2023, as a continuation of the '609 application. The '375 Patent was originally filed with 20 claims, where claims 1 and 17 were independent. Patent Owner submitted a preliminary amendment on November 10, 2023, which amended several of the claims. *See* EX1003 at 121-124.

A non-final office action issued January 12, 2024, rejecting all claims. The Examiner rejected claims 1-3, 5-7, 9-12, and 15 as anticipated over JP2014/050227A (“Fujimoto”) and rejected claims 1-3, 6, and 15-16 as anticipated over WO2001/009990A1 (“Harrison”). *See* EX1003 at 94-98. Among other obviousness rejections, claims 17, 18 and 20 were also rejected as obvious over Fujimoto in view of Solon. EX1003 at 101-103.

On February 22, 2024, Patent Owner amended independent claims 1 and 17 (corresponding to issued claim 15), and added new claim 22 (corresponding to issued claim 20). *See* EX1003 at 52-54.

On February 28, 2024, the Examiner proposed amendments to independent claims 1, 17 and 22 to bring the application into condition for allowance. *See* EX1003 at 27.

As reflected in the interview summary dated February 29, 2024, Patent Owner accepted and then further altered the Examiner’s proposed amendments. *See*

EX1003 at 15, 32-33.

In response, the Examiner issued a Notice of Allowance. *See* EX1003 at 14-15.

C. Person of Ordinary Skill in the Art (“POSA”)

A POSA would have had at least a bachelor’s degree in mechanical or electrical engineering, or a related scientific field, and at least two years of experience with electrical wiring and connectors, including significant experience with electrical wiring in photovoltaic systems, in which more education could substitute for experience and that experience combined with training could substitute for formal education. *See* EX1008 at 5-6.

III. CLAIM CONSTRUCTION

In an *inter partes* review, claims shall be construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). The Board construes claims only to the extent necessary to resolve the underlying controversy. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed.

Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

On July 23, 2025, a Claim Construction Order was issued by the Administrative Law Judge (“ALJ”) in the parallel ITC litigation. EX1008. For purposes of this proceeding, Petitioners propose this Board adopt the interpretation of the challenged claims in the ITC Claim Construction Order. *See Apple Inc. v. Geoscope Techs.*, IPR2024-00259, Paper 32 at 12, 2025 Pat. App. LEXIS 2229. (PTAB May 7, 2025) (“A petition need only include how the challenged claims are to be construed. 37 C.F.R. § 42.104(b)((3)”). Here, Petitioners meet this requirement by identifying the proposed interpretations of the claim terms.

A chart showing the ALJ’s construction in the ITC Claim Construction Order for adoption in this IPR is reproduced below. *See* EX1008 at 6-40.

Disputed Claim Term	ALJ’s Construction
“lead assembly”	Likely “an assembly for electrically coupling a solar panel array” or “a plurality of solar panel arrays.” Deferred construction to determine whether the “lead assembly” should exclude a combiner box. EX1008 at 6-13.
“feeder cable”	Plain and ordinary meaning, which is “a cable that feeds electrical current.” <i>Id.</i> at 14-17.
“drop line”	“line that electrically couples a solar array to a feeder cable.” <i>Id.</i> at 13-14.
“nexus”	“region in which a drop line and a feeder cable are electrically coupled.” <i>Id.</i> at 17-21.
“opposite direction(s)” claims 15, 20, 21	Plain and ordinary meaning, which does not require precisely 180 degrees of separation. <i>Id.</i> at 21-24.

“wherein the . . . [line / line pathway] and the . . . [cable / cable pathway] extend parallel to one another within the [region of electrical interconnection / nexus]” claim 1	“wherein the . . . [line / line pathway[s]] and the . . . [cable / cable pathway] extend parallel to one another within the [region of electrical interconnection / nexus] considered as a whole”
“wherein at least a portion of the first drop line pathway and at least a portion of the second drop line pathway extend in opposite directions” claims 15, 20	Plain and ordinary meaning, which does not require considering each pathway “taken as a whole.”
“directly electrically connected” '375 Patent, claim 16	Plain and ordinary meaning, “directly” means “without intervening components.” <i>Id.</i> at 34-37.

Alternatively, the Board need not construe any of these claim terms, since the differences between the ITC constructions and the plain and ordinary meaning should be insignificant with respect to the invalidity Grounds presented herein. *See Huawei Techs. Co. v. WSOU Invs., LLC*, IPR2021-00228, Paper 9 at 20 (PTAB June 10, 2021) (“we find it unnecessary to construe any claim term expressly to resolve the disputed issues before us”). In other words, the claims are also invalid under 35 U.S.C. §103 under the plain and ordinary meaning of the terms. Petitioners reserve the right to address any construction proposed by Patent Owner or the Board.

IV. STATUTORY GROUNDS OF CHALLENGES

Ground	References	Basis	Claims Challenged
1	Machida	§ 103	1-2, 4-8, 10-17, 19
2	Machida in view of Solon	§ 103	6, 15-17, 19-20, 22-24
3	Machida in view of Kim	§ 103	6, 15-17, 19-24

V. OVERVIEW OF THE PRIOR ART REFERENCES

A. MACHIDA

Machida is a Japanese Patent Application Publication, titled “Method for Connecting Solar Cell Module Wiring.” It is prior art under 35 U.S.C. § 102(a)(1) because it was published on May 22, 1998, before the earliest priority date of the '375 Patent. Machida was not cited or applied during prosecution of the '375 Patent. EX1005 is the original publication; EX1006 is a certified translation. Machida discloses the wiring of solar cell modules to an inverter by using a connector 1 with an injection molded plug 3. An object of the invention is to complete the task of connecting electrical wires (drop lines) from solar cell modules to the base wires (feeder cables). *See* EX1006, ¶ [0006].

B. SOLON

U.S. Patent Application Publication No. 20110011642A1 (“Solon”) was filed July 14, 2009 and published January 20, 2011. *See* EX1007. Solon was cited and

relied on as a secondary reference in combination with another prior art reference, Fujimoto (that is not relied on in this Petition), to reject original dependent claims 8 and 13 (now dependent claims 6 and 11 respectively), original independent claim 17 (now independent claim 15), and original dependent claims 18-21 (now dependent claims 16-19 respectively) during the prosecution of the '375 Patent. *See* EX1003 at 100-103. However, Patent Owner did not present any specific argument to distinguish Solon in its response, but relied on its amendment to the independent claims, including with respect to Fujimoto, to overcome the obviousness rejections. *Id.* at 16, 34, 63, 77. The Examiner did not consider Solon as a secondary reference modifying Machida.

Solon is prior art under 35 U.S.C. § 102(a)(1) because it was published before the earliest priority date of the '375 Patent. Solon “relates generally to electrical components and, more particularly, low-leakage electrical joints and wire harnesses for simplifying the electrical infrastructure associated with solar energy utilities.” *See* EX1007, ¶ [0002].

C. KIM

Korean Patent No. 10-1428689B1 (“Kim”) was granted and published on August 11, 2014. EX1012 is the original Korean patent; EX1013 is a certified translation. Kim was cited but not relied on to reject any claim during the prosecution of the '375 Patent. *See* EX1003 at 80. It is prior art under 35 U.S.C. § 102(a)(1)

because it was published before the earliest priority date of the '375 Patent. Kim relates to a cable connecting apparatus to “transmit power, such as power generated by photovoltaic modules.” EX1013, ¶ [0001]. Kim explains electrically coupling a plurality of cables in an X-shape, Y-shape, or T-shape. *Id.*, Summary, Figures 1, 4, 5.

VI. DETAILED EXPLANATION OF THE CHALLENGE

A. Ground 1—Claims 1-2, 4-8, 10-17, and 19 Would Have Been Obvious over Machida

Machida discloses every limitation of claims 1-2, 4-5, 7-8, 10-11, 13, and 14. Even though those claims are likely anticipated, Petitioners rely on obviousness in this Petition in case any limitations are determined to not be expressly or inherently taught by Machida. *See Cohesive Techs., Inc. v. Waters Corp.*, 543 F.3d 1351, 1364 (Fed. Cir. 2008) (“prior art references that anticipate a claim will usually render that claim obvious”). While certain limitations of claims 6, 12, 15-17, and 19 are not expressly disclosed in Machida, such claims would have been obvious in view of the teachings of Machida.

1. Claim 1

Preamble

Machida relates to “a method for connecting the wiring of solar cell modules used in solar power generation.” *See* EX1006, ¶ [0001]. Machida Figure 1 (reproduced as FIG. 9 and annotated below) shows “a configuration diagram of the wiring connections [(in purple box)] for solar cell modules using a connector [(in

blue)].” *Id.*

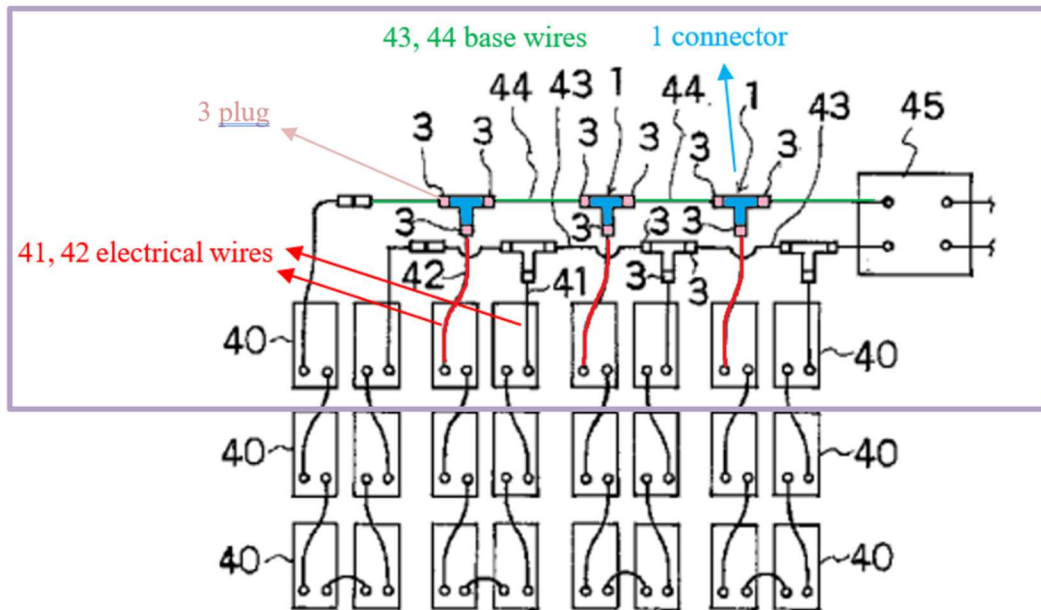


FIG. 9: Machida, Figure 1 (annotated)

With reference to FIG. 2 above (Machida, Figure 3), the electric wire 25 is connected to an electrode of “a block formed by connecting a plurality of solar cell modules 40 in series” via the electrical wire 41 (or 42) (depicted in red above). *Id.*, Abstract, ¶¶ [0016], [0026], [0027]. The electric wire 25 is the claimed “drop line” (*i.e.*, a “line that electrically couples a solar array to a feeder cable”), as it electrically couples a solar array (solar cell modules 40) to a feeder cable (base wire 24, see discussion below). *See* EX1006, Abstract; ¶ [0016], FIGS. 1-3.⁴

⁴ To the extent that the Board determines that it need not construe this term, this disclosure is consistent with the plain and ordinary meaning of the term as shown by

Machida discloses that the “electrical wires that supply power from the solar cell modules to the power supply destination are called base wires.” *Id.*, ¶ [0010]. With reference to FIG. 9 above, Machida shows two base wires 43, 44 (in green) that are “connected to a terminal box 45 leading to an inverter (not shown).” *Id.*, ¶¶ [0010], [0026], [0027], Abstract.⁵ With reference to FIG. 2 above (Machida, Figure 3), the electric wire 24 “is the electrical wire corresponding to the portion constituting the horizontal segment of the T-shape.” *Id.*, ¶ [0016]. Thus, the electric wire 24 is a portion of the base wire 43 or 44 within the connector 1. The base wire 24 is the claimed “feeder cable” (*i.e.*, “a cable that feeds electrical current”), as it feeds electric current to an inverter.⁶ Also, as illustrated in FIG. 9, the base wires 43, 44 (the claimed “feeder cable,” in green) attach to the terminal box 45. The terminal

the usage in the specification: “In use, the drop line is connected to solar arrays, and the feeder cable is connected to an inverter....” EX1001 at 2:3-4.

⁵ Machida uses the terms “wire” and “cable” interchangeably. *See id.*, ¶ [0016].

⁶ To the extent that the Board determines that it need not construe this term, this disclosure is consistent with the plain and ordinary meaning of the term as shown by the usage in the specification: “feeder cable is connected to an inverter...” EX1001 at 2:3-4.

box 45 functions as an electric connector that relays the base wires 43, 44 directly to the inverter.⁷

To the extent the preamble is limiting, the connector 1 depicted and described above is the claimed “lead assembly” (*i.e.*, “an assembly for electrically coupling a solar panel array” or “a plurality of solar panel arrays”), as it is an assembly for electrically coupling a solar panel array (*i.e.*, solar cell modules 40), which can be seen in FIG. 9.

a. Part [a]

Machida Figure 2 (reproduced as FIG. 10 and annotated below) shows a connector 1 used for wiring connections of solar cell modules. The connector “as a whole forms a T-shaped three-way branch receptacle, with the outer shell formed from a soft vinyl chloride material by insert molding of the wire processing product.” *See* EX1006, ¶ [0015]. Machida further discloses “1a is the main body, from which the receptacle portions are extended in a T-shaped three-way branch configuration

⁷ Notably, the terminal box 45 is not a combiner because it does not combine solar energy. FIG. 9 illustrates two wires going into the terminal box 45 and two wires leaving it. This is in sharp contrast to what a combiner looks like shown by the ’375 Patent—a plurality of wires input into the combiner, and a single wire outputs from the combiner. *See* EX1001, Figure 1.

at 11, 12, and 13.” See EX1006, ¶ [0021]. Receptacle portions 11 and 12 in Figure 2 are configured to be connected to the base wire 43 or 44 shown in in Figure 1. Receptacle portion 13 is configured to be connected to the electrical wire 41 or 42 shown in in Figure 1.

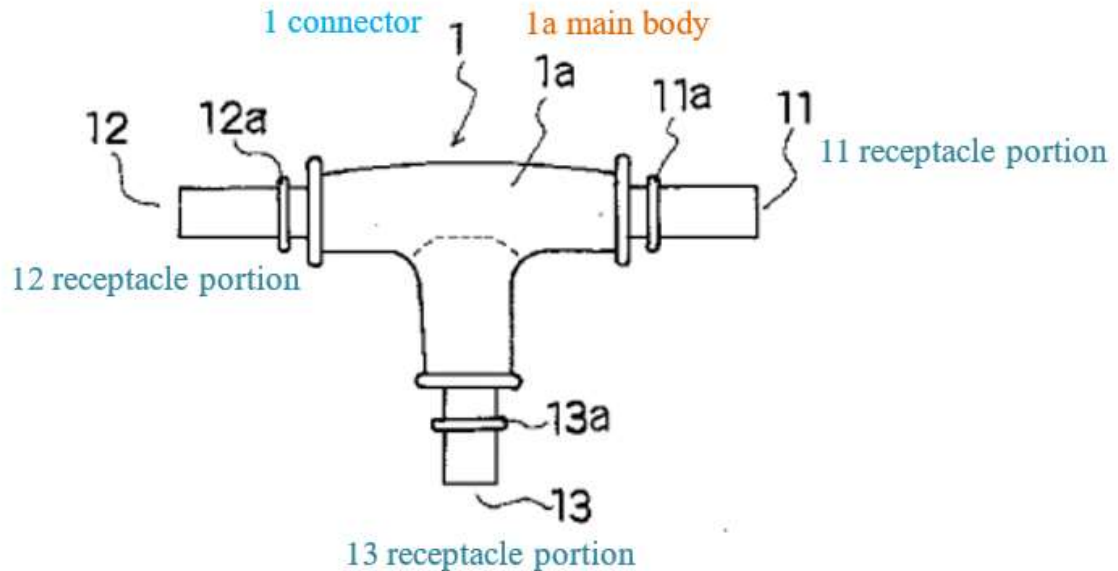


FIG. 10: Machida, Figure 2 (annotated)

FIG. 11 below shows that connector 1 includes a “main body” 1a (in orange). *Id.*, ¶¶ [0021], [0007] & claim 1. As illustrated in FIG. 12 below, where Machida Figures 2 and 3 are combined, the main body 1a is where a section of wire 24 (part of the claimed “feeder cable”) and a section of wire 25 (part of the claimed “one or more drop lines”) are electrically coupled. The section of wire 24 and the section of wire 25 are included in the main body, and are coupled within the “joint” of Machida

as that term is used in the '375 Patent.⁸

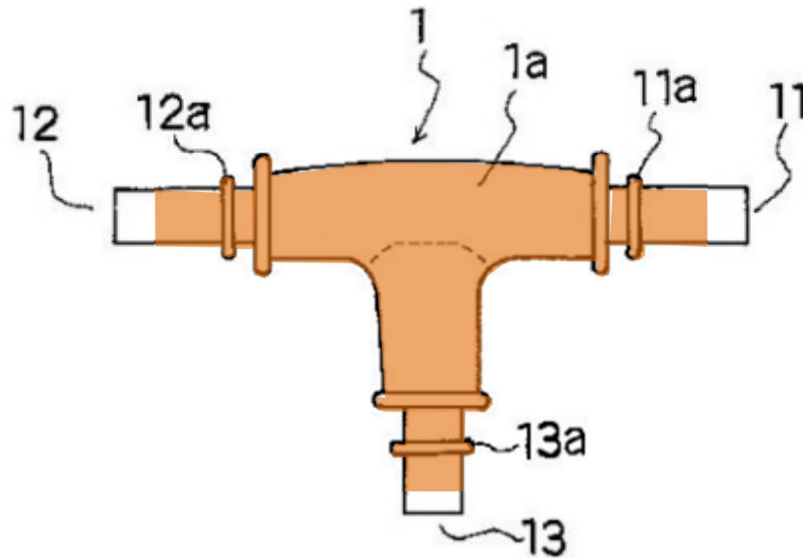


FIG. 11: Machida, Figure 2 (annotated)

Referring to FIG. 12 below, Machida also discloses that connector 1 is “used at [] parallel connection points [(in red circle)].” *Id.*, ¶ [0010]; *see also id.*, ¶ [0004], [0007], [0009] & [0027]. “The connector is used at the connection points at which the electrical wires 41, 42 from the solar module blocks are connected to the base wires 43, 44.” *See* EX1006, ¶ [0026] & Figure 1.

⁸ For comparison purposes, the '375 Patent labels element 17, which can be seen in its Figure 7, as the “joint.” EX1001 at 4:19.

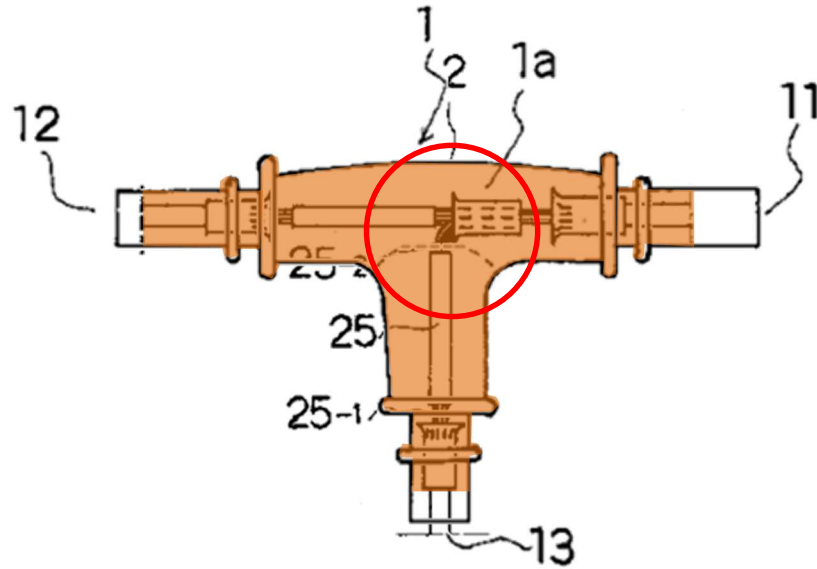


FIG. 12: Combined Figure of Machida Figures 2 & 3

As an example, Machida Figure 5 (reproduced as FIG. 13 and annotated below) shows “a configuration diagram of conventional wiring connections for solar cell modules” that includes “connection points 56, 57” (in red circles). *Id.*, ¶¶ [0003]-[0004]. The connection points are where “the electrical wires 41, 42 from the solar module blocks are connected to the base wires 43, 44.” *Id.*, ¶ [0026]. The connection points in FIG. 13 each correspond to the connection point in FIG. 12 (in a red circle). *See id.*, ¶ [0020].

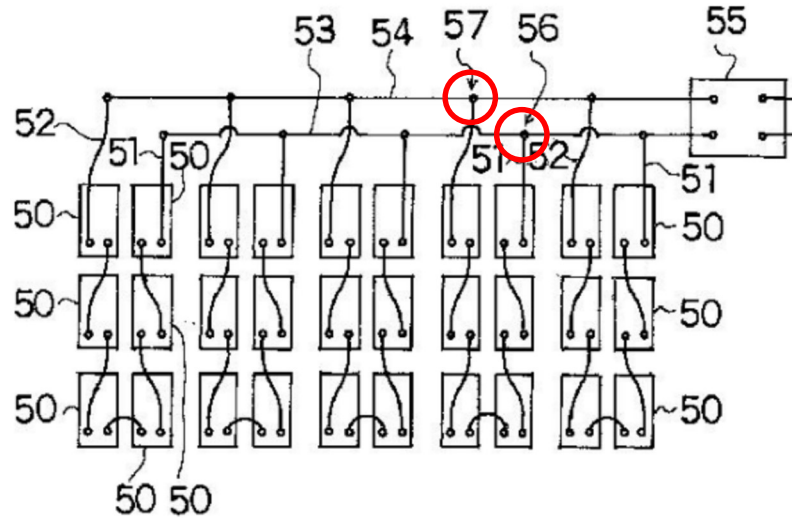


FIG. 13: Machida, Figure 5 (annotated)

The connection point of Machida is the claimed “nexus” (*i.e.*, “region in which a drop line and a feeder cable are electrically coupled”), as this location is the region in which a drop line (the electric wire 25) and a feeder cable (the base wire 24) are electrically coupled.⁹

b. Part [b]

As shown in FIG. 12 above, connector 1 encapsulates the connection point (the claimed “nexus,” as shown in the **red circle**). Machida discloses that connector

⁹ To the extent that the Board determines that it need not construe this term, this disclosure is consistent with the plain and ordinary meaning of the term as shown by the usage in the specification. For example, the '375 Patent labels element 19, which can be seen in Figure 37, as the “nexus.” EX1001 at 4:21.

1 has an “outer shell formed from a soft vinyl chloride material by insert molding of the wire processing product.” *Id.*, ¶ [0015]. Machida further discloses that connector 1 “is formed by insert molding the wire processing product 2.” *Id.*, ¶ [0021], Figure 2. Specifically, “the wire processing product 2 is inserted and molded using a soft vinyl chloride material.” *Id.* Thus, the outer shell (in light purple) of connector 1 discloses the claimed “monolithic mold,” as illustrated in Machida Figure 2 below (reproduced as FIG. 14 and annotated), which encapsulates the identified “nexus.”

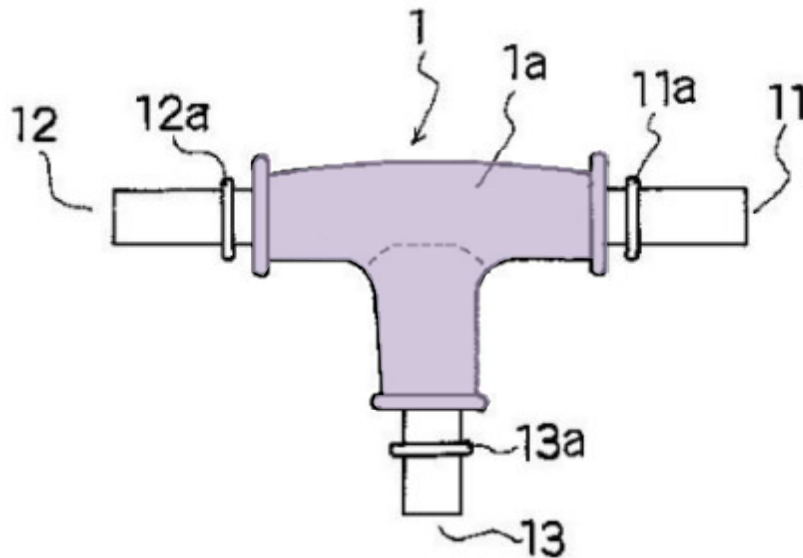


FIG. 14: Machida, Figure 2 (annotated)

c. Part [c]

A combined figure (FIG. 15, annotated below) of Machida Figures 2 & 3 shows a horizontal segment (in green) for wire 24 that extends completely through the outer shell (in light purple). *Id.*, Figures 2 & 3. Wire 24 “correspond[s] to the portion constituting the horizontal segment of the T-shape.” *Id.*, ¶ [0016]. Wire 24,

which is part of the “base wire 43” or “base wire 44,” is further connected to an inverter (not shown) through a terminal box 45, as shown and described with reference to FIG. 9 above. *See id.*, ¶¶ [0025], Figure 1. Wire 24 is thus also part of the identified “feeder cable” (base wire 43, 44) as set forth above in the discussion of the preamble of claim 1. As shown in FIG. 15, the horizontal segment allows wire 24 (the claimed “feeder cable”) to extend completely through the outer shell (the claimed “monolithic mold”). Thus, the horizontal segment of the T-shaped connector 1 as shown in FIG. 15 discloses the claimed “feeder pathway.”

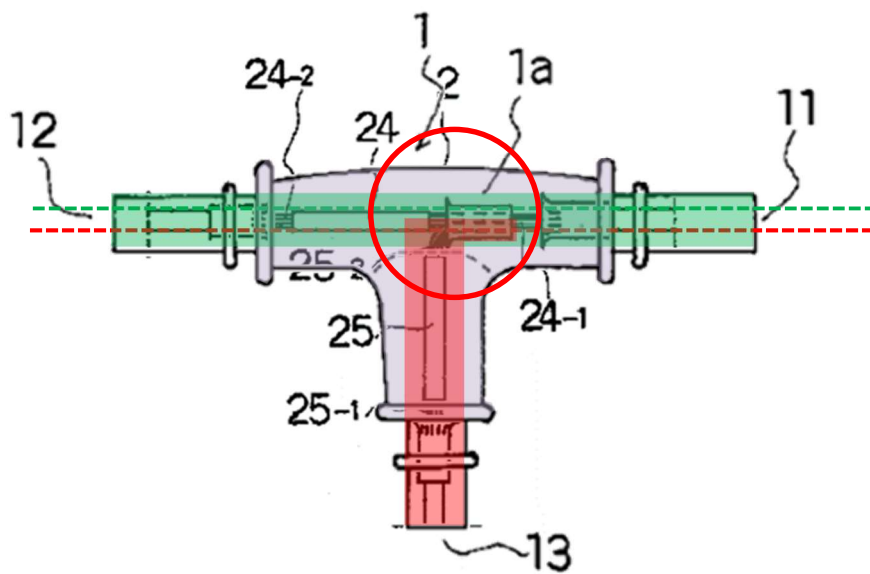


FIG. 15: Combined Figure (annotated) of Machida Figures 2 & 3

d. Part [d]

FIG. 15 shows a pathway (in red) for wire 25 that extends at least partially through the outer shell (in light purple). *Id.*, Figures 2 & 3. Wire 25 “is a wire corresponding to the portion that forms the vertical segment of the T-shape.” *Id.*,

¶¶ [0016] & [0019]. Wire 25 is connected to the “electric wire 41” or “electric wire 42” that is further connected to solar cell modules 40, as shown and described with reference to FIG. 9 above. *See id.*, ¶¶ [0016], [0019]-[0020], Figures 1 & 3. Wire 25 is part of the “drop line,” as set forth above in the discussion of the preamble of claim 1. As shown in FIG. 15, the vertical segment allows wire 25 (the claimed “one or more drop lines”) to extend at least partially through the outer shell (the claimed “monolithic mold”). Machida discloses that each of the plugs 3 “is inserted into each receptacle of the connector 1 at the connection points to complete the wiring connection work.” *See id.*, Abstract; *see also* FIG. 9. Thus, the pathway as shown in FIG. 15 discloses the claimed “one or more drop line pathways.”

e. Part [e]

With reference to FIG. 9 above, Machida discloses “a block formed by connecting a plurality of solar cell modules 40 in series” and “a plurality of such blocks.” *Id.*, Abstract, ¶ [0003], Figures 1 & 5. Specifically, “[a] plurality of solar cell modules 40 (six in this example) are connected in series to form a single block, a plurality of blocks are formed (five blocks in this example), a plurality of blocks are connected in parallel by connecting electrical wires 41, 42 from solar cell modules forming the two poles of each block to base wires 43, 44, and the two base wires 43, 44 are connected to a terminal box 45 leading to an inverter (not shown).” *Id.*, ¶ [0025], Figure 1. Thus, the solar cell modules 40 or 50 of Machida disclose the

claimed “plurality of solar panels.”

Still with reference to FIG. 9, Machida also discloses that the solar cell modules are connected, via each of the electrical wires 41, 42 (the claimed “wire harness”) as well as wire 25 (the claimed “one or more drop lines”), to “a base wire [43, 44] for connecting the outputs of the plurality of blocks [of solar cell modules 40] in parallel to transmit power.” *Id.*, ¶¶ [0007], [0016], [0026], [0027], claim 1. Thus, Machida discloses that “each of the one or more drop lines are configured to be capable of receiving electrical power from a plurality of solar panels.”

Machida Figure 1 (reproduced as FIG. 16 and annotated below) shows that power generated by a single block (in purple box) of six solar cell modules 40 is combined at two connection points (one serving as positive pole and one as negative pole) encapsulated by two connectors 1 (in red circles) on the base wires 43 and 44, respectively. Each of the two connection points occurs at the claimed “nexus,” which is also shown and discussed with reference to FIG 19 below. *See* Sec. VI.A.1.f *infra*.

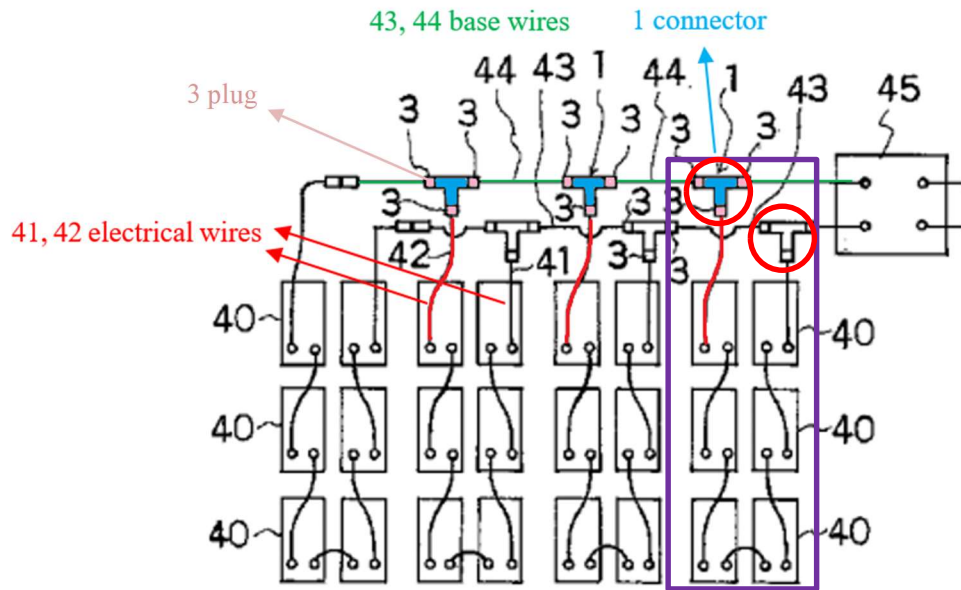


FIG. 16: Machida, Figure 1 (annotated)

Thus, Machida discloses “receiving electrical power ... for combination at the nexus to the feeder cable.”

f. Part [f]

Machida discloses that the electric wire 25 has “the insulating sheath removed at both ends to the specified length.” *Id.*, ¶ [0016], Figure 3. Specifically, “[t]he [] end 25-2 of electrical wire 25 ... has its insulating sheath removed.” *Id.*, ¶ [0020]. Machida Figure 3 (reproduced below as FIG. 17 and annotated) shows that the end 25-2 (in orange) of the electric wire 25 (the claimed “one of the one or more drop lines”) has a section of exposed wire at the connection point (the claimed “nexus,” in red circle).

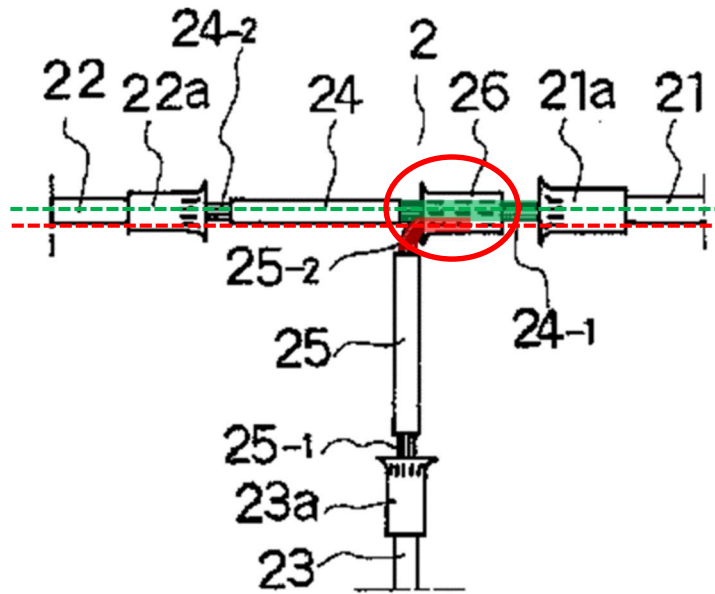


FIG. 17: Machida, Figure 3 (annotated)

g. Part [g]

Machida discloses that the base wire 24 has “the insulating sheath [] removed to the specified dimensions at both ends.” *Id.*, ¶ [0016], Figure 3. Specifically, “the end portion 24-1 of electrical wire 24 [has] its insulation coating removed.” *Id.*, ¶ [0017], Figure 3. FIG. 17 shows that the end portion 24-1 (in green) of the base wire 24 (part of the claimed “feeder cable”) has a section of exposed wires at the connection point (the claimed “nexus,” in red circle).

h. Part [h]

Machida discloses that “[t]he other end 25-2 of electrical wire 25... has its insulating sheath removed, and is bent so that it runs parallel to the end portion 24-1 of electrical wire 24, which also has its insulating sheath removed.” *Id.*, ¶ [0020],

Figure 3. With reference to FIG. 17, the bent portion of the end 25-2 (in red) of the electric wire 25 (the claimed “one of the one or more drop lines”) with its insulating sheath removed discloses the claimed “at least a portion of the section of exposed wire of the drop line.” The end portion 24-1 (in green) of the base wire 24 (part of the claimed “feeder cable”) with its insulating sheath also removed discloses the claimed “at least a portion of the section of exposed wire of the feeder cable.”

As illustrated in FIG. 17, a green dashed line represents a longitudinal axis of the base wire 24, and a red dashed line represents a longitudinal axis of the bent portion of the electric wire 25. As shown, a portion of the end 25-2 of the electric wire 25 is parallel to the base wire 24.

i. Part [i]

As illustrated in FIG. 15 above, a green dashed line represents a longitudinal axis of the horizontal section (the claimed “feeder pathway,” in green) of the T-shaped connector 1, and a red dashed line represents a longitudinal axis of the portion of the pathway (the claimed “one or more drop line pathways,” in red) for wire 25 within the connection point (the claimed “nexus,” in red circle). As shown, within the connection point (the red circle), the pathway of wire 25, considered as a whole, extends parallel to the pathway of the feeder cable (the portion of the T-shaped connector 1), considered as a whole.

j. Part [j]

A combined figure (FIG. 18 annotated below) of Machida Figures 2 & 3 shows that the outer shell (the claimed “monolithic mold,” in light purple) of the connector 1 has distinct openings (in dark purple) at ends of the horizontal segment (the claimed “feeder pathway,” in green) of the T-shaped connector 1 and the end of the pathway (the claimed “one or more drop line pathways,” in red) for wire 25. Thus, Machida discloses that “the monolithic mold has distinct openings at ends of the feeder pathway and one or more drop line pathways.”

As illustrated in FIG. 18 below, the electric wire 25 (the claimed “one or more drop lines,” in blue) exits the outer shell (the claimed “monolithic mold,” in light purple) of the connector 1 through an opening (in dark purple) at the end of the pathway (the claimed “one or more drop line pathways,” in red) for the electric wire 25. Also, the base wire 24 (part of the claimed “feeder cable,” in orange) exits the outer shell (the claimed “monolithic mold,” in light purple) of the connector 1 through openings (in dark purple) at both ends of the horizontal segment (the claimed “feeder pathway,” in green) of the T-shaped connector 1, respectively. Thus, Machida discloses the claimed “distinct openings ... through which the one or more drop lines and the feeder cable exit the monolithic mold.”

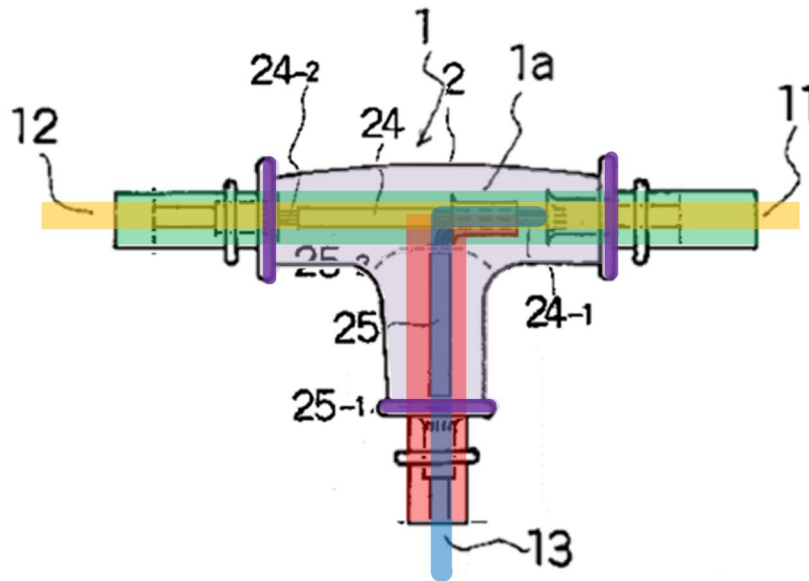


FIG. 18: Combined Figure (annotated) of Machida Figures 2 & 3

Accordingly, Machida discloses all of the elements of claim 1. As a result, claim 1 would have at least been obvious to a POSA.

2. Claim 2

Machida discloses that “the electrical wires [*e.g.*, wire 25] and base wires [*e.g.*, wire 24] are connected using soldering or some other specified procedure.” EX1006, ¶ [0004] (emphases added). “The two wires [the end 25-2 of the electric wire 25 and the end 24-1 of the base wire 24] are connected by soldering.” *Id.*, ¶ [0020] (emphases added), Figure 3; *see also* FIG. 12. The soldering portion “is passed through the ring sleeve 26 and reinforced by crimping from the outer circumference of the ring sleeve 26.” *Id.*, ¶ [0020]. As illustrated in FIG. 12 above, the electric wire 25 and the base wire 24 are soldered at the connection point (the claimed “nexus,” in red circle). Claim 2 claims “at least one” from a group of embodiments for the

“nexus,” one of which (“solder portion”) is disclosed by Machida (“soldering”).

3. Claim 4

With reference to FIG. 15 above, a green dashed line represents a first longitudinal axis of the horizontal section (the claimed “feeder pathway,” in green) of the T-shaped connector 1, and a red dashed line represents a different longitudinal axis of the portion of the pathway (the claimed “one or more drop line pathways,” in red) for wire 25 within the connection point (the claimed “nexus,” in red circle). As shown, the horizontal section of the T-shaped connector 1 and the portion of the pathway for wire 25 within the nexus are formed along different longitudinal axes.

4. Claim 5

Machida discloses that the base wire 24 can use “[a] cable of approximately CV 3.5 mm² or CV 2.0 mm²” and that the electric wire 25 “is made of a cable of the same thickness [*i.e.*, the same set of CV 3.5 mm² and CV 2.0 mm²] as above.” EX1006, ¶ [0016], Figure 3. That is, Machida suggests an embodiment where the horizontal section (the claimed “feeder pathway,” in green) of the T-shaped connector 1 has a first diameter adapted to hold a base wire 24 of approximately CV 3.5 mm², and the vertical section (part of the claimed “one or more drop line pathways,” in red) of the T-shaped connector 1 has a second diameter adapted to hold an electric wire 25 of approximately CV 2.0 mm², in which the second diameter is smaller than the first diameter.

Alternatively, a POSA would have known that the base wire 24 carries a total electric power that is larger than the portion of the electric power received from the electric wire 25, as the base wire 24 receives electric power from multiple electric wires 25. *See* FIG. 16, *supra*. As a result, the diameter of the electric wire 25 can be smaller than the diameter of the base wire 24, as the diameter of an electricity-carrying cable is proportionate to the maximum current the cable can carry. This would have been well known within the knowledge of a POSA as defined in Section II.C above, who has at least two years of experience with electrical wiring and connectors. *See* Section VI.A.9, *infra* (Patent Owner's admission suggested that the "MC4/PV-KBT4/6I-UR & PV-KST4/6I-UR" connectors as well as the sizes of the wire sizes connected thereto had been general knowledge to a POSA as of the effective filing date of the '375 Patent). A POSA would have been motivated to select different gauge wires for different current or power requirements so as to lower the cost of the wiring, because small-gauge wires are generally cheaper than large-gauge wires.

5. Claim 6

Based on Machida's disclosure alone, "two or more drop line pathways" would have been obvious to the POSA, rendering claim 6 obvious over Machida. Machida discloses that "the three-way connectors may be T-shaped, the three-way connectors may be disk-shaped, or the three-way connectors may be polygonal."

EX1006, ¶ [0008]. That is, the form factor of connector 1 can be modified in various ways and is not limited to the example embodiments expressly shown and described in Machida. Machida further discloses that the plugs 3 corresponding to the connector 1 can also be modified in almost unlimited ways, as long as the plugs can seal the connector 1. Specifically, “[t]he plugs that are used are not necessarily limited to those described above, and any structure may be used as long as the plug has a waterproof structure and a structure that keeps fingertips and tools, etc. from touching the plug tip during connection work, or a structure [that] does not cause an electric shock if accidentally touched.” *Id.*, ¶ [0031].

Therefore, it would have been obvious for a POSA to modify the connector 1 to include two or more drop line pathways (in red) as shown in FIG. 21. For example, such modification can be made by: (1) modifying the wire processing product 2 by including an additional electric wire 28 (which is similar to electric wire 25) (*see* FIG. 19); (2) soldering the additional electric wire 28 to the same base wire 24 at the connection point (*see* FIG. 20) within the nexus (in red circle); and (3) molding the modified wire processing product 2 into the main body of the connector 1 by insert molding, where two drop line pathways are formed for the two electric wires 25 and 28 (*see* FIG. 21).

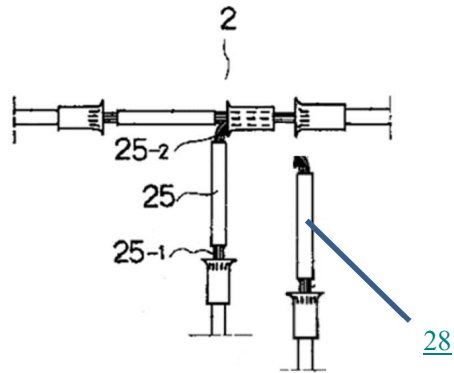


FIG. 19 (modified Machida Figure 3)

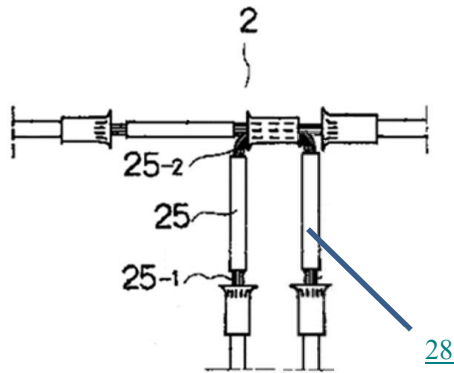


FIG. 20 (modified Machida Figure 3)

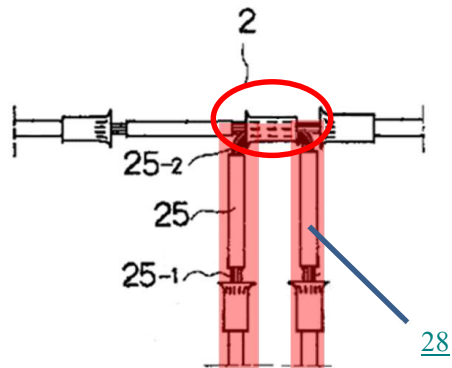


FIG. 21 (modified Machida Figure 3)

As discussed, Machida aims to “make wiring connecting work for solar cell modules less time-consuming and safer” and discloses “a method for connecting the

wiring of solar cell modules used in solar power generation.” *Id.*, Abstract, ¶ [0001]. With its disclosed “method for connecting solar cell module,” “work can be carried out quickly and easily even if there are many blocks.” *Id.*, Abstract, claim 1. The connectors and plugs disclosed by Machida are substantially sealed “so that workers cannot touch the charged portions, ensuring safe installation.” *Id.*, Abstract. Without using the disclosed method and connectors, the wiring connecting work for solar cell modules in the existing techniques “is extremely time-consuming,” yet “it is necessary to complete the work as quickly as possible to prevent accidents.” *Id.*, ¶ [0004]. The object of Machida’s invention is “to complete the task of connecting electrical wires from solar cell modules to the base wires, which is time-consuming and involves the risk of electric shock due to a long working period as mentioned above, safely and reliably, and in as little time as possible.” *Id.*, ¶ [0006].

Although the Machida specification does not expressly disclose two or more drop line pathways—in principle, a modifiable-form-factor connector can include two or more drop line pathways sealed by a modifiable-form-factor plug—the POSA would have been motivated to modify the connector and the plug to include two or more drop line pathways in the connector (the claimed “lead assembly”). Indeed, a POSA would have been well aware of the ability to connect multiple drop lines to a feeder cable at a single joint, as there were numerous prior art references showing such a configuration in solar panel installations. *See* EX1013, Figures 1, 2, ¶ [0018];

EX1007, ¶¶ [0012], [0025] & [0026]). For all the reasons explained in Machida, the POSA would have been motivated to make such modification to further minimize the amount of time for a worker to complete the wiring connection for solar cell modules because fewer connectors are needed for the same amount of solar cell blocks to be connected, such as by connecting two blocks (*see* FIG. 16 that shows a single block) in to the base wires 43, 44 with a single pair of connectors (as positive pole and negative pole, respectively). It would have been apparent to the POSA that such modification can be readily made, with a reasonable expectation of success, to accomplish the same result as the embodiment described in Machida.

6. Claim 7

Machida Figure 3 (reproduced as FIG. 22 and annotated below) shows a “wire processing product inserted into the connector 1 during molding.” *See* EX1006, ¶ [0016]. The product “forms a T-shaped overall” with “24 [being] the electrical wire [(in green)] corresponding to the portion constituting the horizontal segment of the T-shape” and “25 [being] a wire [(in red)] corresponding to the portion that forms the vertical segment of the T-shape.” *Id.* Wire 24 has cylindrical sleeves 21 and 22. *Id.*, ¶¶ [0017]-[0018]. Wire 25 has ring sleeve 23a. *Id.* ¶ [0019]. When Figures 2 and 3 are combined, sleeves 21, 22, and 23 are positioned corresponding to the positions of receptacle portions 11, 12, and 13, respectively.

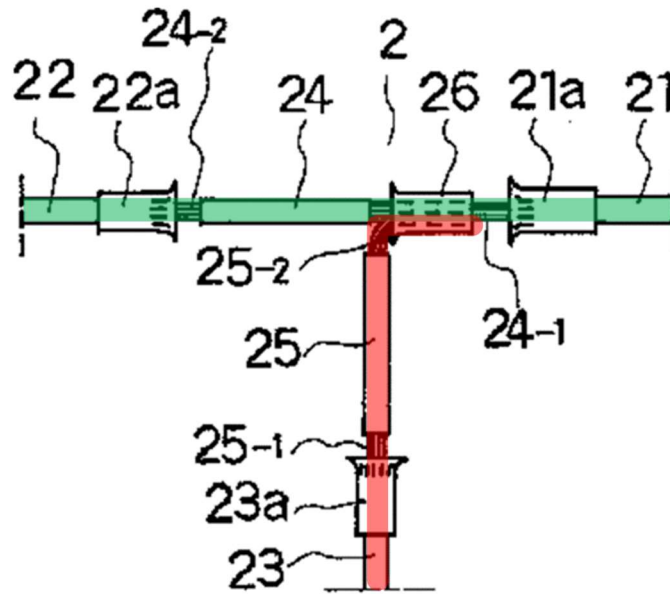


FIG. 22: Machida, Figure 3 (annotated)

With reference to FIG. 22, Machida discloses that “21 [or 22] is a cylindrical sleeve formed of phosphor bronze with a nickel-plated surface” with “[o]ne end of the sleeve receives the end portion 24-1 [or 24-2] of electrical wire 24,” and that “21a [or 22a] is a ring sleeve for maintaining strength, which is fitted over the outer circumference of the sleeve 21 and has a structure that crimp-connects and reinforces the portion where end portion 24-1 [or 24-2] of electrical wire 24 is connected to the sleeve 21.” EX1006, ¶ [0017]-[0018], Figure 3. The other end of sleeve 21 or 22 “receives the contact pin on the plug side.” *Id.* That is, the contact pin of the identified “drop line” terminates the base wire 24.

Machida also discloses that “23 and 23a are sleeves and ring sleeves similar to those described above.” *Id.*, ¶ [0019]. Thus, similarly, ring sleeve 23a has a contact

pin that terminates the electric wire 25. FIG. 22 shows that the electric wire 25 (a portion of the claimed “each of the one or more drop lines,” in red) terminates at ring sleeve 23a (the “drop line connector”).

7. Claim 8

As discussed in Section VI.A.1.e, the solar cell modules 40 of Machida disclose the claimed “plurality of solar panels.” *See* FIG. 9. With reference to FIG. 9, electrical wires 41, 42 connect to a plurality of solar cell modules 40. Thus, the electrical wires 41, 42 of Machida disclose the claimed “wire harness.” Also shown in FIG. 9, the electric wire 42 connects to a plug 3 of a connector 1. With reference to FIGS. 9 & 22, electric wire 42 (the claimed “wire harness”) connects to the ring sleeve 23a (the claimed “drop line connector”) inside the receptacle portion 13 where plug 3 and ring sleeve 23a mate. Indeed, “plugs or receptacles are attached to the electrical wire terminals of both poles of blocks composed of solar cell modules.” EX1006, ¶ [0011].

8. Claim 10

As discussed in Section VI.A.1.e, with reference to FIG. 16, the electrical power received from a block (in purple box) of six solar cell modules 40 (the claimed “plurality of solar panels”) is combined at two connection points (the claimed “nexus”) encapsulated by two connectors 1 (the claimed “lead assembly,” in red circles) on the base wires 43 and 44 (the claimed “feeder cable”), respectively. FIG.

23 below is a figure modified from Machida Figure 1 based on the above disclosure.

As illustrated in FIG. 23, the base wires 43, 44 (the claimed “feeder cable,” in green) attach to the terminal box 45 and further to the inverter (in purple box). The terminal box 45 functions as an electric connector that relays the base wires 43, 44 directly to the inverter.¹⁰ Thus, base wires 43, 44 (the claimed “feeder cable”) are in electrical communication with the inverter. The two connectors 1 deliver the combined electrical power in each of the base wires 43, 44 to the inverter.

¹⁰ Notably, the terminal box 45 is not a combiner because it does not combine solar energy. FIG. 23 illustrates two wires going into the terminal box 45 and two wires leaving it. This is in sharp contrast to what a combiner looks like shown by the '375 Patent—a plurality of wires input into the combiner, and a single wire outputs from the combiner. *See* EX1001, Figure 1.

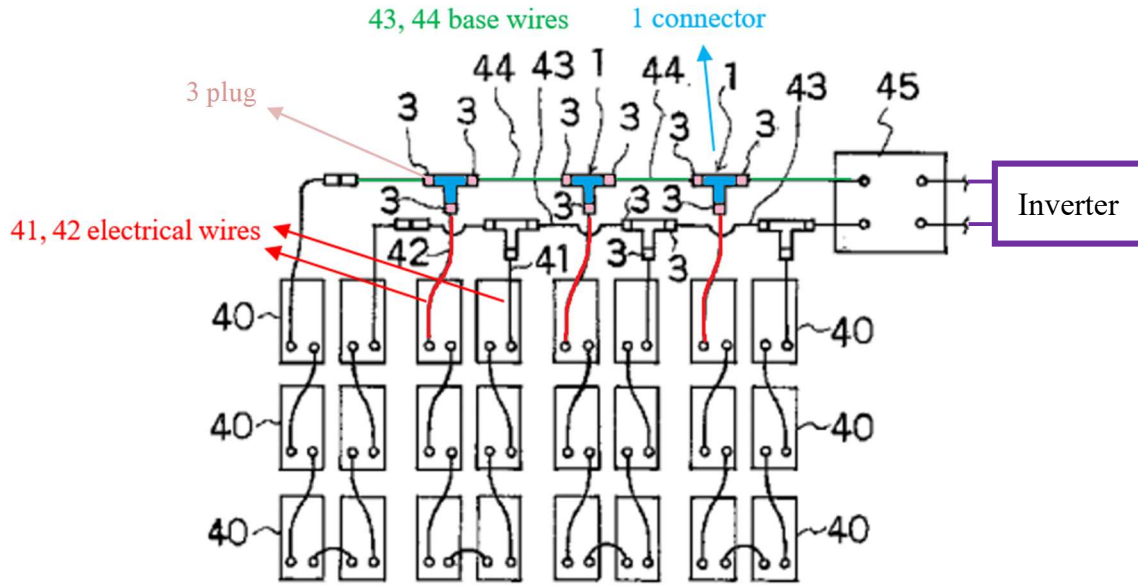


FIG. 23: Machida, Figure 1 (annotated and modified)

9. Claim 11

The “gauge” in claim 11 refers to American wire gauge, which “is a standardized wire gauge system used since 1857 predominantly in North America for the diameters of round, solid, nonferrous, electrically conducting wire.” EX1008 at 1. In accordance with the American wire gauge system, a wire of gauge 4 has a cross-sectional area of 21.2 mm², and a wire of gauge 18 has a cross-sectional area of 0.823 mm². *Id.* at 2.

Machida discloses that the base wire 24 can use “[a] cable of approximately CV 3.5 mm² or CV 2.0 mm²” and that the electric wire 25 “is made of a cable of the same thickness [approximately CV 3.5 mm² or CV 2.0 mm²] as above.” EX1006, ¶ [0016], Figure 3. That is, wire 25 can have cross-sectional areas of 3.5 mm² or 2.0

mm², which fall between the above claimed value range (0.823-21.2 mm²).

Alternatively, the limitations of claim 11 would have been obvious to the POSA, rendering claim 11 obvious over Machida.

As evidence of a POSA's general knowledge as of its effective filing date, the '375 Patent states that "drop line 12 is preferably constructed of 18 to 4 gauge wire, and drop line connectors 13 are preferably off-the-shelf connectors such as MC4/PV-KBT4/61-UR & PV-KST4/61-UR from Multi-Contact of Windsor, CA." EX1001, 4:63-66 (emphasis added); *see also id.*, Figure 5 (reproduced below as FIG. 24). That is, Patent Owner admitted that the connectors 13 in the '375 Patent had been sold or offered for sale before its effective filing date, and thus the "MC4/PV-KBT4/61-UR & PV-KST4/61-UR" connectors as well as the sizes of the wire sizes connected thereto had been general knowledge to a POSA as of the effective filing date of the '375 Patent.

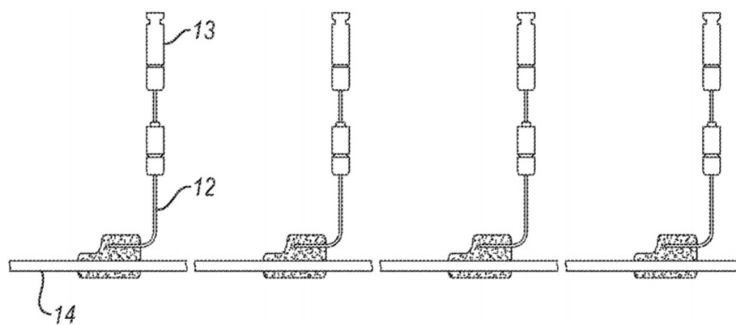


FIG. 5

FIG. 24: '375 Patent Figure 5

A POSA would have been motivated to modify the connector 1 of Machida to

receive an electric wire 25 having a cross-sectional area of 0.823-21.2 mm² (such as 19.63 mm²) so that it can be connected to pre-existing off-the-shelf products used in solar panel installations. *See id.*; *see also* EX1011 at 2. It would have been apparent to the POSA that such modification can be readily made, with a reasonable expectation of success, and would be done for adaptation to the U.S. market, to accomplish the same result as the embodiment described in Machida.

10. Claim 12

As evidence of a POSA's general knowledge as of its effective filing date, the '375 Patent states that "the present invention can be scaled up or down to accommodate any feeder cable size, including the common 250 and 750 MCM cable sizes." EX1001, 6:35-37 (emphases added). That is, Patent Owner admitted that the feeder cable with "250 and 750 MCM cable sizes" in the '375 Patent had been commonly sold or offered for sale before its effective filing date, and thus the "250 and 750 MCM cable sizes" had been general knowledge to a POSA as of the effective filing date of the '375 Patent. The "250 and 750 MCM cable sizes" fall within the claimed size range "between 250 MCM to 1000 MCM."

Notably, '375 Patent does not specify any benefits of using or shortcomings of not using the claimed value range for feeder cables. *See* EX1001. Instead, it expressly admitted that "the present invention can be scaled up or down to accommodate any feeder cable size." EX1001, 6:35-36 (emphasis added).

A POSA would have been motivated to modify the connector 1 of Machida to receive a base wire 24 having a size of 250 and 750 MCM because such cable size is “common” in the U.S. market. It would have been apparent to the POSA that such modification can be readily made, with a reasonable expectation of success, and would be done for adaptation to the U.S. market, to accomplish the same result as the embodiment described in Machida.

11. Claim 13

As discussed in Section VI.A.1.b, with reference to FIG. 12, Machida discloses an outer shell (the claimed “monolithic mold”) that is “formed from a soft vinyl chloride material by insert molding of the wire processing product.” EX1006, ¶ [0015]. Insert molding is a type of injection molding. *See* EX1009, ¶ [0101] (“various injection molding methods such as an insert molding method, an injection molding simultaneous decoration method, a blow molding method, a gas injection molding method and the like”).

12. Claim 14

a. Part [a]

Machida discloses that connector 1 “is formed by insert molding the wire processing product 2.” EX1006, ¶ [0021], Figure 2. Specifically, “the wire processing product 2 is inserted and molded using a soft vinyl chloride material.” *Id.* Thus, the resulting molding using the soft vinyl chloride material is an “undermold.”

b. Part [b]

As discussed above, with reference to FIG. 12, the connector 1 (the claimed “lead assembly”) includes an outer shell (the claimed “monolithic mold”). This outer shell encapsulates the resulting vinyl-chloride molding at the outer surface of it. Thus, the outer shell of the connector 1 discloses the “overmold” as used in the claim. The outer shell of the connector 1 encapsulates the above resulting molding made of soft vinyl chloride material (the claimed “undermold”) inside it.

c. Part [c]

As discussed above, the outer shell of the connector 1 discloses the “overmold.” The outer shell “is formed by insert molding the wire processing product 2.” EX1006, ¶ [0021], Figure 2.

13. Claim 15

Claim 15 recites, *inter alia*, “[a] lead assembly.” The preamble of claim 15 is disclosed by Machida. *See* Section VI.A.1, *supra*.

a. Part [a]

Machida discloses the limitations of part [a] except the “two drop lines.” *See* Section VI.A.1, *supra*. However, as discussed in Section VI.A.5, such a feature would have been obvious in view of Machida. As illustrated in FIG. 21, a section of each of two electric wires (the claimed “two drop lines”) would be electrically coupled with a section of the base wire 24 (the claimed “feeder cable”) at a

connection point (the claimed “nexus,” in red circle).

b. Part [b]

Machida discloses the “primary mold that encapsulates the nexus.” *See* Section VI.A.1.b, *supra* (the discussions of “monolithic mold” also apply to the claimed “primary mold”). Machida also discloses that the connector 1 can have receptacles (*e.g.*, receptacles 11, 12, and 13) mated with plugs “attached on the electrical wire side.” *See* EX1006, ¶¶ [0027] & [0032]. FIG. 9 above also shows plugs 3 (in pink) “inserted into the receptacle portions” of connectors 1, which are “attached to the ends of the electrical wires 41, 42” and “also attached to the connection points of ... base wire 43, 44.” *Id.*, Abstract. Machida discloses that each of the plugs 3 “is inserted into each receptacle of the connector 1 at the connection points to complete the wiring connection work.” *See* EX1006, Abstract; *see also* FIG. 9.

Machida further discloses that “the reverse relationship may be used, that is, the connector of the three-way branch may be a plug and the electrical wire side a receptacle.” *Id.*, ¶ [0032]. That is, the connector 1 can have plugs mated with receptacles attached on the electrical wire side. “[T]he plugs for the connector have a waterproof structure and are designed to keep fingertips and tools, etc. from touching the plug tip during connection work, or to prevent electric shocks even if accidentally touched.” *Id.*, ¶ [0033] (emphases added). “The receptacles and plugs

that constitute a connector are set in a proper mating position, and adequate waterproofing is ensured by using an uneven ring shape relationship for both components.” *Id.*, ¶ [0013] (emphases added). “The plugs that are used are not necessarily limited to those described above, and any structure may be used as long as the plug has a waterproof structure and a structure that keeps fingertips and tools, etc. from touching the plug tip during connection work, or a structure does not cause an electric shock if accidentally touched.” *Id.*, ¶ [0030] (emphases added).

Thus, when the connector 1 has plugs instead of receptacles, the plugs that constitute the connector 1 (as part of the claimed “primary mold”) keep the connection point (the claimed “nexus”) inside connector 1 waterproof and touch-proof (“substantially seal the nexus from external environmental conditions”).

c. Part [c]

Machida discloses the “feeder pathway” and that it is “configured to allow the feeder cable to extend completely through the primary mold.” *See* Section VI.A.1.c, *supra*.

d. Part [d]

Machida discloses a “drop line pathway” (*see* Section VI.A.1.d, *supra*) and that it is “configured to allow the [drop line pathway] to extend at least partially through the primary mold” (*see id.*). Machida also rendered obvious the claimed “two drop line pathways” that includes “a first drop line pathway and a second drop

line pathway.” *See* Section VI.A.5. As illustrated in FIG. 21, each of two drop line pathways (in red) would allow the two electric wires (the claimed “two drop lines”) to extend at least partially through the outer shell (the claimed “primary mold”).

e. Part [e]

Machida discloses these the limitations of part [e]. *See* Section VI.A.1.i, *supra*.

f. Part [f]

Machida discloses that “at least a portion of the first drop line pathway ... extend[s] ... along a longitudinal axis that is parallel to a longitudinal axis of the feeder pathway.” *See* Section VI.A.3, *supra*.

Machida does not expressly disclose “at least a portion of the first drop line pathway and at least a portion of the second drop line pathway extend in opposite directions along a longitudinal axis.” However, as discussed in Section VI.A.5, the first drop line pathway and the second drop line pathway would have been obvious over the teachings of Machida. *See also* FIGS. 19-21.

The resulting two pathways (in red)—discussed above—for the two electric wires are shown in FIG. 25 below (an annotated version of FIG. 20). In FIG. 25, at least a portion (in red arrow) of the first pathway and at least a portion (in another red arrow) of the second pathway extend in the claimed “opposite directions” (*i.e.*, plain and ordinary meaning, which does not require precisely 180 degrees of separation), as the two red arrows pointing in opposite directions. Also, FIG. 25

shows that the two pathways within the nexus (in red circle) share the same longitudinal axis (the orange line). Within the nexus, the longitudinal axis of the two pathways is parallel to the longitudinal axis (the green line) of the base wire 24 (the claimed “feeder cable”).

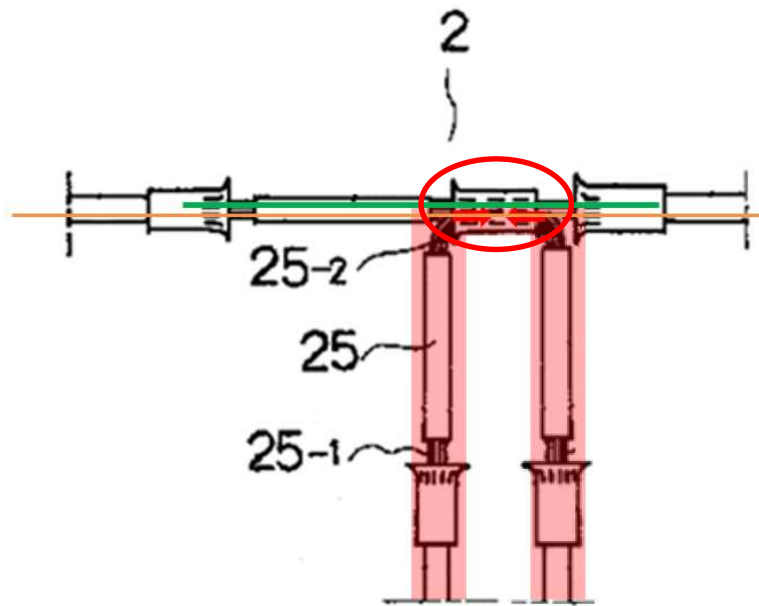


FIG. 25 (Machida Figure 3, modified and annotated)

14. Claim 16

Machida discloses that “the feeder cable is directly electrically connected to ... a connection unit.” As shown in FIG. 9 above, the base wires 43, 44 (the claimed “feeder cable”) are directly electrically connected to a terminal box 45. *See* EX1006, ¶ [0025] (“the two base wires 43, 44 are connected to a terminal box 45.”). This is consistent with ALJ’s construction (“without intervening components”). The terminal box 45 is an example of the claimed “connection unit.” Claim 16 claims “at

least one” from a group of embodiments for the “component,” one of which (“connection unit”) is disclosed by Machida (“terminal box 45”).

15. Claim 17

Machida discloses the “secondary mold” that “encapsulate[s] the primary mold.” *See* Section VI.A.12.b, *supra* (the discussions of “overmold” also apply to the claimed “secondary mold”).

16. Claim 19

Machida discloses that “[s]olar cell modules used in solar power generation have been standardized, with regulations governing voltage and current capacity, such as ... a maximum voltage of DC350V for the circuit breakers.” EX1006, ¶ [0002] (emphasis added). Machida also discloses that “[a] plurality of solar cell modules 40 (six in this example) are connected in series to form a single block.” *Id.*, ¶ [0025] (emphases added). As an example, FIG. 16 above shows such a block of solar cell modules (in **purple box**). As shown in FIG. 16, Machida discloses a configuration where, for each of the positive pole and the negative pole, there are three solar cell modules connected in series. That is, Machida discloses a configuration where the output voltage of the block of FIG. 16 is 1050 volts (stacked from 3×350V) of direct current (“VDC”). Thus, the connector 1 that is connected to the block of FIG. 16 necessarily has a voltage rating of at least 1050 VDC, which falls in the claimed range of “at least 1000 VDC.”

B. Ground 2—Claims 6 and 15-17, 19, 20, 22-24 Would Have Been Obvious over Machida in view of Solon

1. Motivation to Combine Machida and Solon

Solon expressly discloses at least two branch wires (drop lines) branching off from a single lead assembly. A POSA would have been motivated to modify the wiring harnesses and solar array configurations of Machida with the teachings of Solon—including the dual “drop line” arrangement—for multiple reasons. First, Solon discloses information regarding a multiple drop line arrangement that allows for the connection of additional solar panels to a single connector, providing a POSA with additional guidance for designing and fabricating a variety of such connectors. Second, Solon teaches that “low leakage electrical joints and wire harnesses [can be used] for simplifying the electrical infrastructure associated with solar energy utilities.” EX1007, ¶ [0002]; *see also* discussion of claim 6 below. Third, Solon describes a “wire harness 10 constructed of a plurality of joints” which “can be shaped as T’s, crosses or Y’s, and be fitted with various lengths of insulated wire” (EX1007, ¶¶ [0012], [0025] & [0026]), while Machida describes a “three-way connectors [that] may be T-shaped” (EX1006, ¶ [0008]). Indeed, Solon emphasizes that “a multitude of electrical configurations may be achieved by varying the number and choice of connectors and joint types.” EX1007, ¶ [0025]. That is, Solon starts with, but does not limit itself, to using the described examples of “tee joint 20,” “cross joint 22” and “y joint 24.”

Both Machida and Solon are analogous prior art to each other, as well as to the '375 Patent, since they disclose components and methods for wiring connections in solar power systems. “[The aim of this invention is to] make wiring connecting work for solar cell modules less time-consuming and safer.” EX1006, Front Page. Solon “relates generally to electrical components and, more particularly low leakage electrical joints and wire harnesses for simplifying the electrical infrastructure associated with solar energy utilities.” EX1007, ¶ [0002]. Machida explains that conventional methods for “connecting electrical wires from solar cell modules to the base wires” are “time-consuming and involves the risk of electric shock due to a long working period.” EX1006, ¶ [0006]. Solon explains that conventional wiring methods require “extensive wiring” which “often further requires the labor and expense of troubleshooting and repairing.” EX1007, ¶ [0005]. Solon explains that a need exists “for components that decrease electrical leakage,” and “[i]deally, these low leakage components are relatively simple, safe and inexpensive to manufacture, transport and use.” *See id.*, [0010]. Further, both Machida and Solon are analogous prior art because they are in the same field as the '375 Patent. *See* EX1001 at 1:24-2:21.

Further, the motivation to combine Solon with Machida is also evidenced by the Examiner’s comment in the prosecution history of the '375 Patent, specifically, in the rejection of the original claim 17 (now the independent claim 15). There,

“Fujimoto teaches a section of one drop line [] connected to the feeder cable [] at the nexus [], and thus only teaches one drop line pathway. However, ... it would have been obvious ... to connect more than one drop line connected to a wire harness at a nexus as a matter of design.” EX1003 at 102. “[A] skill artisan would also form *two or more drop line pathways* that are each configured to allow the two drop lines to extend partially through the primary mold *according to an obvious design.*” *Id.* (emphases added). Machida, like Fujimoto, also teaches a design of one drop line pathway. Therefore, a POSA designing or fabricating a solar power system would have been aware of and motivated to consider both Machida and Solon.

Finally, a POSA would have an expectation of success in modifying the connector disclosed by Machida with the teachings of Solon because both references are directed to connectors or joints used for solar power installations and aim to achieve their stated common goal of minimizing working time for safe and reliable wiring connection for solar cell modules. *See* EX1006, ¶¶ [0006] & [0008]; EX1007, ¶¶ [0005], [0012], [0025] & [0026]. Specifically, Solon discloses that “[p]referably insulated wire 30 includes copper, and most preferably is a 8, 10 or 12 AWG photovoltaic wire” and that “[a] branch wire may be the next smaller size of wire as it will not carry as much current.” EX1007, ¶ [0028]. A 12 AWG wire has a cross-sectional area of 3.31 mm², which is very similar to the CV 3.5 mm² cable used for photovoltaic power generation disclosed by Machida. *See* EX1010 at 2; EX1007,

¶ [0016]. Moreover, a “commercially available and suitable insulated wire 30” is a “preferred example” of the invention of Solon. EX1007, ¶ [0028]. Therefore, such modification would be readily made as of the time of the filing of the ’375 Patent with a reasonable expectation of success, as this is a simple substitution of structures known to a POSA to yield a predictable result.

2. Claim 6

Even if claim 6 is not obvious over Machida alone (see Section VI.A.5, *supra*), claim 6 would have been obvious over Machida in view of Solon. Solon expressly discloses “two or more drop line pathways.” For example, as shown in Solon Figure 2 (reproduced as FIG. 26 below), Solon discloses two branch wires (annotated in red) branching off from a single cross joint or t-joint connecting branch wires with the trunk wire 30 (annotated in green). The branch wires correspond to the claimed “two or more drop line pathways.” The trunk wire 30 corresponds to the claimed “feeder cable.”

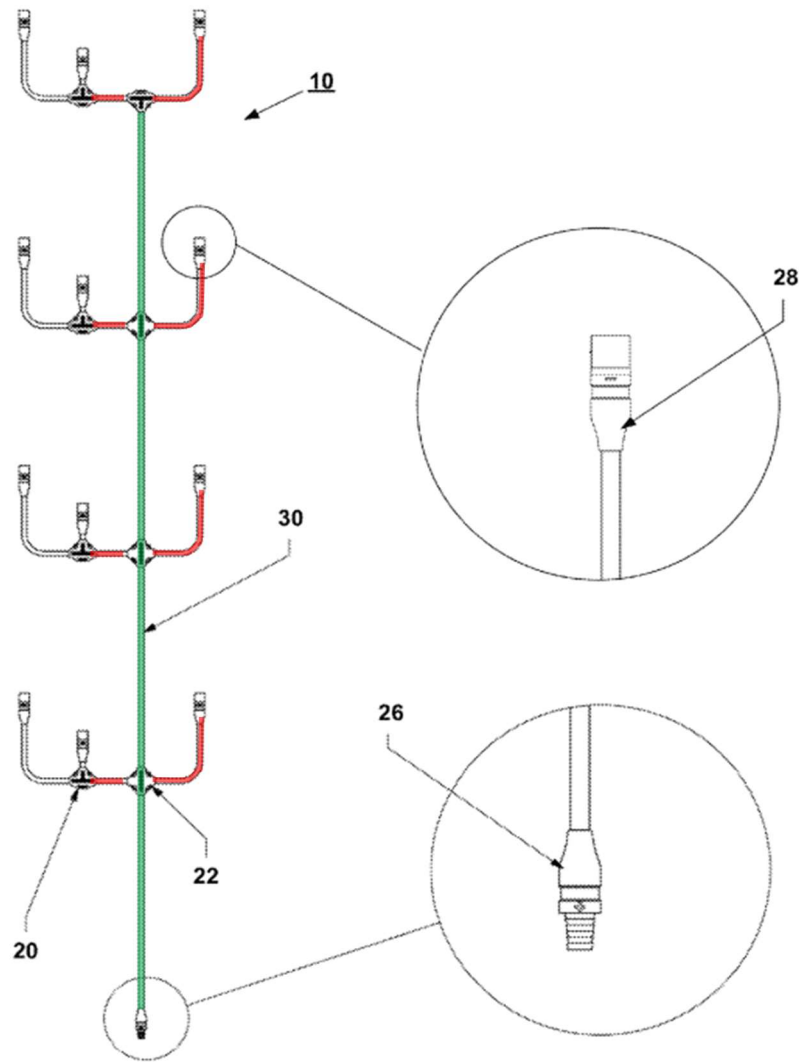


FIG. 2

FIG. 26: Solon, Figure 2 (annotated)

A POSA would have been motivated to modify the connector and plug assembly of Machida to include a second drop line and pathway, as disclosed in Solon for the reasons discussed in Section VI.B.1 above.

3. Claim 15

a. Preamble and Part [a]

Machida discloses all elements of the preamble and part[a] except the “two drop lines.” *See* Section VI.A.1, VI.A.13.a, *supra*. However, a POSA would have been motivated to modify the connector and the plug disclosed by Machida to include two or more drop line pathways in the connector (the claimed “lead assembly”) in view of Solon. *See* Section VI.B.2, *supra*; *see also* Section VI.B.7.b, *infra*.

b. Part [b]

Part [b] of claim 15 is disclosed by Machida. *See* Section VI.A.13.b, *supra*.

c. Part [c]

Part [c] of claim 15 is disclosed by Machida. *See* Section VI.A.13.c, *supra*.

d. Part [d]

Part [d] of claim 15 would have been obvious over Machida. *See* Section VI.A.13.d, *supra*.

e. Part [e]

Part [e] of claim 15 would have been obvious over Machida. *See* Section VI.A.13.e, *supra*.

f. Part [f]

Part [f] of claim 15 would have been obvious over Machida. *See* Section VI.A.13.f, *supra*.

4. Claim 16

Claim 16 is disclosed by Machida. *See* Section VI.A.14, *supra*.

5. Claim 17

Claim 17 is disclosed by Machida. *See* Section VI.A.15, *supra*.

6. Claim 19

Claim 19 is disclosed by Machida. *See* Section VI.A.16, *supra*.

7. Claim 20

The preamble of independent claim 20 is the same as the preamble of independent claim 15. *See* Sections VI.A.13 & VI.B.3, *supra*.

a. Part [a]

Machida discloses the limitations of part [a]. *See* Sections VI.A.13.a & VI.B.3.a, *supra*.

b. Part [b]

Machida in view of Solon discloses “a first drop line and a second drop line” and that “each of the first drop line and the second drop line having an end connected to a wire harness and configured to receive power from a plurality of solar panels.” *See* Sections VI.B.2, VI.B.3.a, *supra*.

Machida and Solon do not expressly disclose a “drop line cable” that includes two drop lines.¹¹ However, with reference to FIG. 25 above, where two electric wires (the claimed two “drop lines”) are shown, it would have been obvious for a POSA to modify a cable that includes a single electric wire (the electric wire 25) into a cable that includes two electric wires. *See* Section VI.A.13.f, *supra* (a cable can include both electric wires 25, 28). Alternatively, such a feature would also have been obvious over Solon. *See* Sections VI.B.2 & VI.B.3.a, *supra*. It would have been apparent to the POSA that such modification can be readily made, and with a reasonable expectation of success. *See* Section VI.B.1, *supra*.

c. Part [c]

Machida and Solon, alone or in combination, disclose the limitations of part [c]. *See* Sections VI.B.3.a & VI.B.3.b, *supra*.

d. Part [d]

Machida discloses the “mold structure.” *See* VI.A.1.b & VI.B.3.b, *supra* (the discussions of “monolithic mold” and “primary mold” also apply to the claimed

¹¹ Notably, the “drop line cable” term was introduced in the claim amendments of February 22, 2024. *See* EX1003 at 63. Patent Owner relied upon Figures 29 and 31-37 and associated description as support for this amendment. *See id.* Based upon the context in the claims, the “drop line cable” refers to a cable including two drop lines.

“mold structure”). Machida also discloses the remaining limitations of part [d]. *See* Section VI.B.3.b.

e. Part [e]

Machida discloses the limitations of part [e]. *See* Sections VI.A.1.c & VI.B.3.c, *supra*.

f. Part [f]

Solon discloses the limitations of part [f]. As shown in Solon Figures 9A-9E (reproduced as FIG. 27 below), a branch wire (annotated in red) extends partially through the encasement 50 (annotated in green). *See* EX1007, ¶ [0028]-[0029] (“As shown in FIG. 9C, exposed wires are resistance welded to form welded wire 36, with the end of the branch wire preferably welded to the center of the trunk wire”).

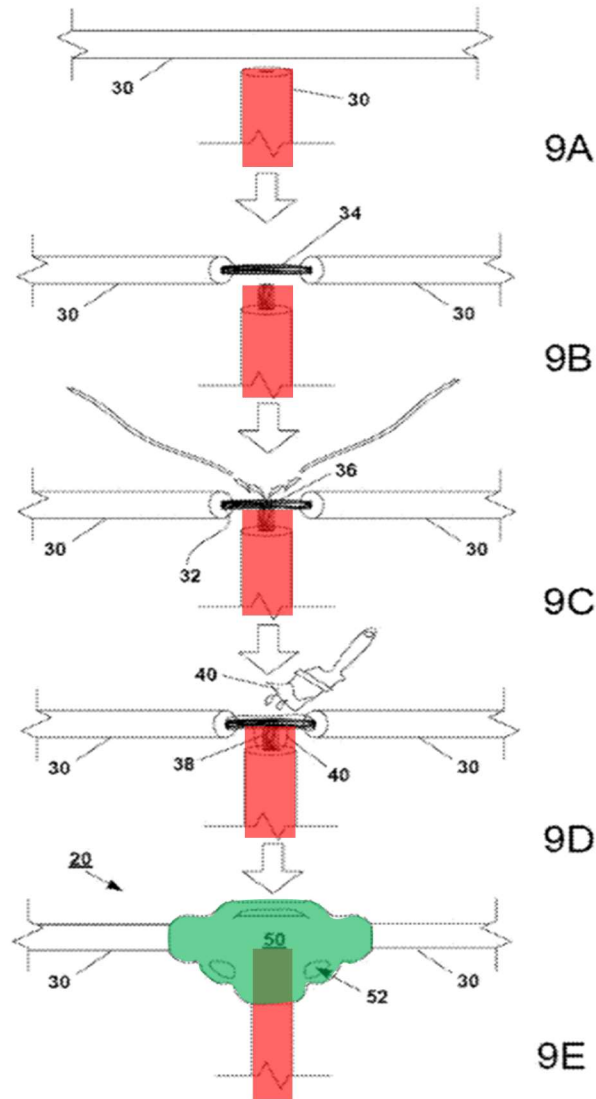


FIG. 9

FIG. 27: Solon, Figures 9A-9E

Solon explains that “joints comprise spokes 58 protruding from central hub 56” and “[c]entral hub 56 includes external tee encasement 60, [or cross encasement 62 or y encasement 64] which defines channels 54 (best shown in FIG. 28) through which insulated wire 30 protrudes outwardly (best shown in FIG. 2).” *See* EX1007, ¶ [0026]-[0027], Figures 6-7 (reproduced below as FIG. 28).

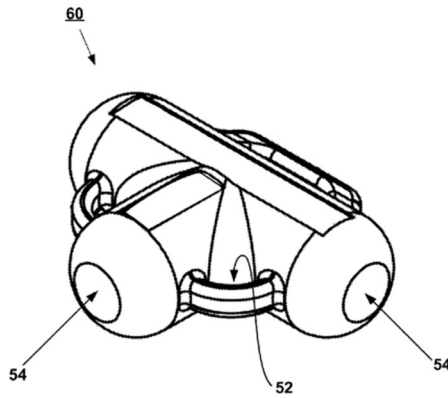


FIG. 6

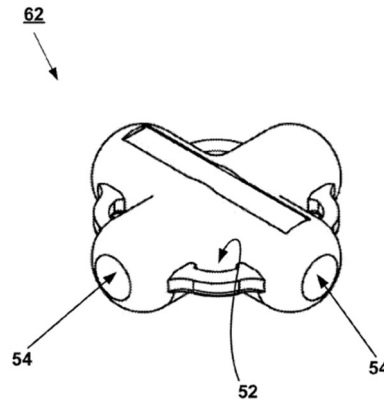


FIG. 7

FIG. 28: Solon, Figures 6-7

Accordingly, Solon discloses two drop line pathways (by the branch wire pathway—horizontal lines annotated in **red**—in FIG. 26) that each extend at least partially through the monolithic mold (the joint 22 in FIG. 26 and encasement 50 in FIG. 27), and each configured to allow one of the two drop lines to extend at least partially through the monolithic mold (so as to allow the exposed wires of the two drop lines to be resistance welded to the feeder cable).

g. Part [g]

Machida discloses the limitations of part [g]. *See* Sections VI.A.1.i & VI.B.3.e, *supra*.

h. Part [h]

Part [h] would have been obvious over Machida in view of Solon. *See* Sections VI.A.3 & VI.B.3.f, *supra*. Specifically, a POSA would have understood that

Machida's T-shaped "connector 1" can be modified to be a cross-shape in view of Solon's "cross encasement 62" such that Machida's connector 1 can receive two drop lines. The two drop lines can be "resistance welded," as disclosed by Solon, to the base wire 24 of Machida. Such a modification can be illustrated by FIG. 29 (a modified and annotated version of FIG. 25). In FIG. 29, at least a portion (in blue arrow) of the first pathway (in red) and at least a portion (in another blue arrow) of the second pathway (in red) extend in the claimed "opposite directions" (*i.e.*, plain and ordinary meaning, which does not require precisely 180 degrees of separation), as the two blue arrows pointing in opposite directions. Also, FIG. 29 shows that the two pathways within the nexus (in red circle) share the same longitudinal axis (the orange line). Within the nexus, the longitudinal axis of the two pathways is parallel to the longitudinal axis (the green line) of the base wire 24 (the claimed "feeder cable").

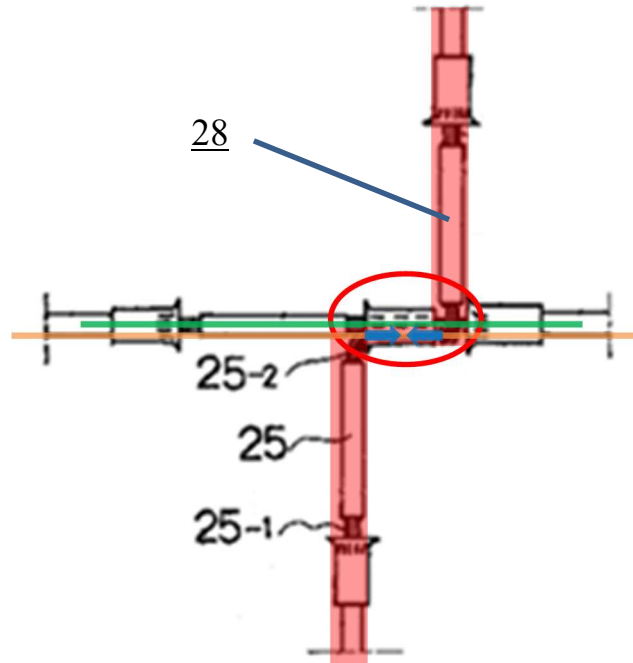


FIG. 29 (Machida Figure 3 modified and annotated)

8. Claim 22

a. Part [a]

Machida discloses the limitations of part [a]. *See* Section VI.A.1.f, *supra*.

b. Part [b]

Part [b] would have been obvious over Machida in view of Solon. *See* Section VI.A.1.f, *supra*. A POSA would have been motivated to modify the connector 1 of Machida in view of Solon to include two or more drop lines at the connection point (the claimed “nexus”). For example, FIG. 30 below shows an annotated version of Figure 3 of Machida, where a drop line cable (in blue box) includes two electric wires (the claimed two “drop lines”), each of which includes an end portion 25-2 and 28-2, respectively (that has exposed wires). Thus, the two exposed wires of the

drop line cable are parts of the first electric wire and the second electric wire, respectively.

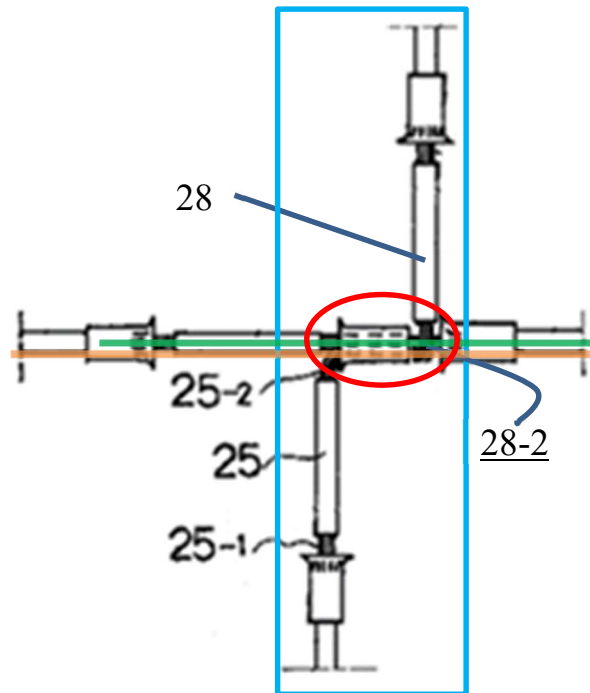


FIG. 30 (Machida Figure 3 modified and annotated)

c. Part [c]

Machida discloses the limitations of part [c]. *See* Section VI.A.1.g, *supra*.

d. Part [d]

Machida discloses the sections of exposed wires of the electric wire (the claimed “drop line”) and the base wire (the claimed “feeder cable”). *See* Sections VI.A.1.f, VI.A.1.g & VI.A.1.h, *supra*. Machida also discloses that “the electrical wires and base wires are connected using soldering or some other specified procedure.” EX1006, ¶ [0004]. With reference to FIG. 25 above, Machida renders obvious that the end portions 25-2 (the claimed “section of exposed wire”) of two

electric wires (as part of the claimed “drop line cable”) are soldered (the claimed “electrically coupled”) to the end portions 24-1 and 24-2 (the claimed “section of exposed wire”) of the base wire (the claimed “feeder cable”) to electrically couple the two electric wires (the claimed “first drop line and the second drop line”) to the base wire.

9. Claim 23

Machida discloses the limitations of claim 23. *See* Section VI.A.1.h, *supra*. Specifically, as illustrated in FIG. 30 above, within the nexus (the red-dashed circle), at least a portion of the section of exposed wire of the two electric wires 25 and 28 (the claimed two “drop lines”) included in a drop line cable (in blue box) share the same longitudinal axis (the orange line). Within the nexus, the longitudinal axis of the two sections of exposed wires is parallel to at least a portion of the section of exposed wire of the base wire 24 (the claimed “feeder cable”), the longitudinal axis of which is indicated by the green line in FIG. 30.

10. Claim 24

Machida discloses the limitations of claim 24. *See* Section VI.A.1.b, *supra*.

C. Ground 3—Claims 6, 15-17, and 19-24 Would Have Been Obvious over Machida in view of Kim

1. Motivation to Combine Machida and Kim

Kim expressly discloses at least two cables (drop lines) branching off from a single lead assembly. A POSA would have been motivated to modify the T-shaped

connector of Machida with the teachings of Kim—including the dual “drop line” arrangement—for multiple reasons. First, Kim discloses information regarding a multiple drop line arrangement that allows for the connection of additional solar panels to a single connector, providing a POSA with additional guidance for designing and fabricating a variety of such connectors. *See* EX1013, summary, Figure 1. Second, Kim teaches a cable connection device that can electrically couple cables in X-shape, Y-shape, or T-shape (EX1013, summary, Figures 1, 4, 5), while Machida describes a “three-way connectors [that] may be T-shaped” (EX1006, ¶ [0008]). Third, Kim describes that a “sealing portion (300) can strengthen the environmental adaptability of the connection area by sealing the core portion (110) area,” so that “the sealing portion (300) can prevent the cable (100) connection area from becoming vulnerable to external environments.” EX1013, ¶ [0024]. Machida expressly states that the connector can use various structure for its plug as long as “the plug has a waterproof structure and a structure that keeps fingertips and tools, etc. from touching the plug tip during connection work.” EX1006, ¶ [0031].

Both Machida and Kim are analogous prior art to the '375 Patent because they are in the same field as the '375 Patent. *See* EX1001 at 1:24-2:21. Kim “pertains to a cable connection device and method, and more particularly to a cable connection device and method for cables that transmit power, such as power generated by photovoltaic modules.” EX1013, ¶ [0001]. Kim identifies a problem that

“photovoltaic cables are [] located outdoors and are exposed to harsh external environments for long periods, that is, at least 10 years or more.” EX1013, ¶ [0002]. Kim explains that a need exists to manufacture photovoltaic cables “under conditions that can withstand harsh external environments.” *Id.* Kim provides a solution for “a cable connection device and method” that “can seal cable connection portions so that they have no problems even in external environments.” *Id.*, ¶¶ [0005], [0012]. Specifically, Kim discloses a cable connection device to “transmit power, such as power generated by photovoltaic modules.” *Id.*, ¶ [0001]. Kim explains electrically coupling a plurality of cables in an X-shape, Y-shape, or T-shape. *Id.*, summary, Figures 1, 4, 5. On the other hand, Machida’s invention “relates to a method for connecting the wiring of solar cell modules used in solar power generation” and discloses a connector that uses receptacles and plugs for easy installation. EX1006, ¶¶ [0001], [0033]. Therefore, a POSA designing or fabricating a solar power system would have been aware of and motivated to consider both Machida and Kim.

Finally, a POSA would have an expectation of success in modifying the connector disclosed by Machida with the teachings of Kim because both references are directed to connectors or joints used for solar power installations and aim to achieve their stated common goal of sealing the wire connection portion from external environments. *See* EX1006, ¶¶ [0006] & [0008]; EX1013, ¶¶ [0002], [0005]

& [0012]. Specifically, Kim discloses that “[t]he cables are connected in X-shaped, Y-shaped, or T-shaped configurations.” EX1013, ¶ [0010]. Machida also discloses that its connectors may be T-shaped, disk-shaped, or polygonal. *See* EX1006, ¶ [0008]. Therefore, such modification would be readily made as of the time of the filing of the ’375 Patent with a reasonable expectation of success, as this is a simple substitution of structures known to a POSA to yield a predictable result.

2. Claim 6

Even if claim 6 is not obvious over Machida alone (see Section VI.A.5, *supra*), claim 6 would have been obvious over Machida in view of Kim. Kim expressly discloses “two or more drop line pathways.” For example, as shown in Kim Figures 1 and 2 (reproduced as FIGS. 31 and 32 below with annotation), Kim discloses two cables 102 (the claimed “drop lines”) branching off from a joint with a sealing portion 300. Kim describes a second cable 102 in FIG. 31, and FIG. 32 shows that each of the drop lines extend at least partially through the sealing portion 300. EX1013, Figures 1, 2, ¶ [0018]; *see also id.*, ¶ [0029]. The joint also includes a cable 101 (the claimed “feeder cable”) extend completely through the joint. Inherently, any feeder cable or drop line through Kim’s joint is positioned in a “pathway.” Accordingly, Kim discloses two drop line pathways (second cable 102 pathways—one on the left, and another on the right).

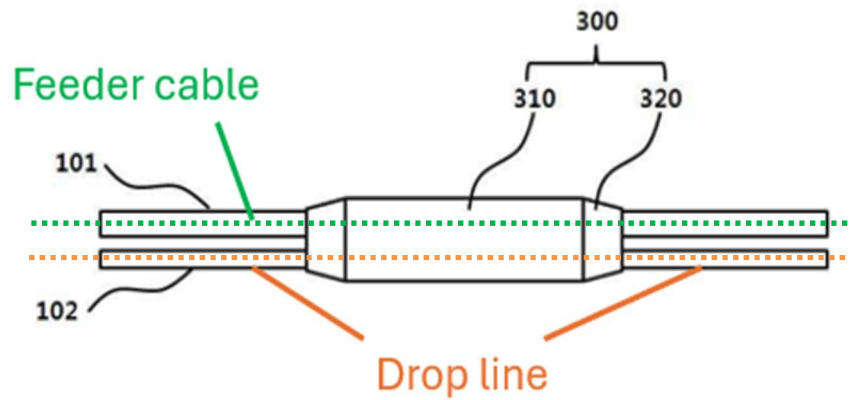


FIG. 31: Kim Figure 1 (annotated)

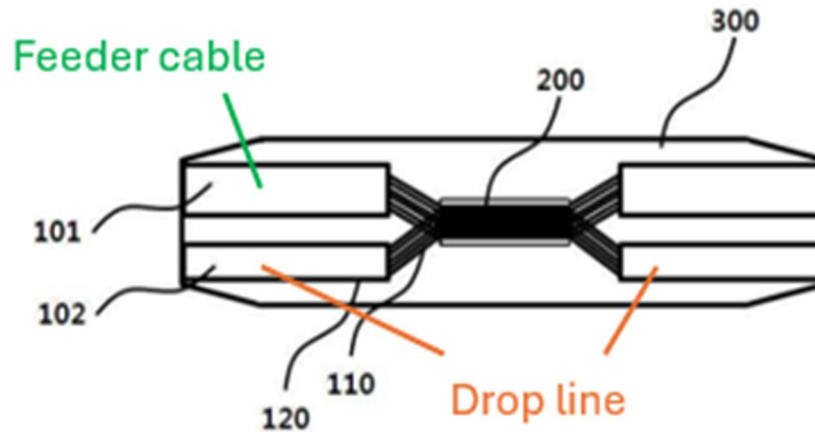


FIG. 32: Kim Figure 2 (annotated)

A POSA would have been motivated to modify the connector and plug assembly of Machida to include a second drop line and pathway, as disclosed in Kim for the reasons discussed in Section VI.C.1 above.

3. Claim 15

a. Preamble and Part [a]

Machida discloses all the elements of the preamble and part[a] except the “two

drop lines.” *See* Section VI.B.3.a, *supra*. However, as discussed above, a POSA would have been motivated to modify the connector and the plug disclosed by Machida to include two or more drop line pathways in the connector (the claimed “lead assembly”) in view of Kim. *See* Section VI.C.2, *supra*; *see also* Section VI.C.7.b, *infra*.

b. Part [b]

Part [b] of claim 15 is disclosed by Machida. *See* Sections VI.B.3.b & VI.A.13.b, *supra*.

c. Part [c]

Part [c] of claim 15 is disclosed by Machida. *See* Sections VI.B.3.c & VI.A.13.c, *supra*.

d. Part [d]

Part [d] would have been obvious over Machida in view of Kim because Kim discloses two drop line pathways that are each configured to allow the two drop lines to extend at least partially through the sealing portion 300 (the claimed “primary mold”), with the two drop line pathways including a first drop line pathway and a second drop line pathway. *See* Section VI.C.2, *supra*.

e. Part [e]

Part [e] would have been obvious over Machida in view of Kim because Kim discloses a portion of the first drop line pathway that is parallel to the portion of the

feeder pathway. *See* Section VI.C.2, *supra*; FIGS. 31-32.

f. Part [f]

Part [f] would have been obvious over Machida in view of Kim because Kim discloses portions of the first and second drop line pathways that extend in opposite directions along a longitudinal axis (the orange dotted line in FIG. 31) that is parallel to a longitudinal axis (the green dotted line in FIG. 31) of the feeder pathway. *See* Section VI.C.2, *supra*; FIGS. 31-32.

4. Claim 16

Claim 16 is disclosed by Machida. *See* Sections VI.B.4 & VI.A.14, *supra*.

5. Claim 17

Claim 17 is disclosed by Machida. *See* Sections VI.B.5 & VI.A.15, *supra*.

6. Claim 19

Claim 19 is disclosed by Machida. *See* Sections VI.B.6 & VI.A.16, *supra*.

7. Claim 20

The preamble of independent claim 20 is the same as the preamble of independent claim 15. *See* Sections VI.A.13.a & VI.B.3.a, *supra*.

a. Part [a]

Machida discloses the limitations of part [a]. *See* Sections VI.A.13 & VI.B.3, *supra*.

b. Part [b]

As discussed in Section VI.B.7.b, Machida discloses all features in Part [b] except a “drop line cable” that includes two drop lines. Such a feature would have been obvious over Kim. For example, as shown in FIGS. 31 and 32, Kim discloses a cable 100 that “includes a first cable 101 of a first thickness and a second cable 102 of a second thickness” where “two first cables 101 and two second cables 102” are connected in a “cross configuration.” EX1013, ¶¶ [0018], [0026]. Thus, a POSA would have understood that the second cable 102 is a single cable with two portions—one on the left, and another on the right.

c. Part [c]

Machida and Kim, alone or in combination, disclose the limitations of part [c]. *See* Sections VI.B.3.a & VI.B.3.b, *supra*.

d. Part [d]

Machida discloses the “mold structure.” *See* Sections VI.A.1.b & VI.B.3.b, *supra* (the discussions of “monolithic mold” and “primary mold” also apply to the claimed “mold structure”). Machida also discloses the remaining limitations of part [d]. *See* Section VI.B.3.b.

e. Part [e]

Machida discloses the limitations of part [e]. *See* Sections VI.A.1.c & VI.B.3.c, *supra*.

f. Part [f]

As discussed in Sections VI.C.3.d and VI.C.7.b, Kim discloses two drop line pathways. Accordingly, a POSA would have understood that “the drop line cable pathway” includes “two drop line pathways,” which include “a first drop line pathway configured to allow the first drop line to extend partially through the mold structure” and “second drop line pathway configured to allow the second drop line to extend partially through the mold structure.”

g. Part [g]

Part [g] would have been obvious over Machida in view of Kim. *See* Section VI.C.3.e, *supra*.

h. Part [h]

Part [h] would have been obvious over Machida in view of Kim. *See* Section VI.C.3.f, *supra*.

8. Claim 21

Kim discloses that first cables 101 and two second cables 102 connected at the conductive portion 200. EX1013, ¶ [0026]. As shown in FIGS. 31 and 32 above, one second cable 102 (the claimed “first drop line”) extends out of and away from the sealing portion 300 (the claimed “mold structure”) in one direction, and the other second cable 102 (the claimed “second drop line”) extends out of and away from the sealing portion 300 in the claimed “opposite direction” (*i.e.*, plain and ordinary

meaning, which does not require precisely 180 degrees of separation).

9. Claim 22

i. Part [a]

Machida discloses the limitations of part [a]. *See* Sections VI.B.8.a & VI.A.1.f, *supra*.

j. Part [b]

Machida would have rendered the limitations of part [b] obvious. *See* Section VI.B.8.b, *supra*.

k. Part [c]

Machida discloses the limitations of part [c]. *See* Sections VI.B.8.c & VI.A.1.g, *supra*.

l. Part [d]

Machida would have rendered the limitations of part [d] obvious. *See* Section VI.B.8.d, *supra*.

10. Claim 23

Claim 23 would have been obvious over Machida in view of Kim. Kim discloses a conductive portion 200 that is “positioned in the overlapped area of exposed cable core portions (110) for cable connection.” EX1013, ¶ [0021]. The conductive portion 200 can be “copper rings” or any other “metallic rings.” *Id*. The cable core portions 110 include “multiple wires” and thus corresponds to the claimed “exposed wires” of the drop line and the feeder cable. *See id.*, ¶ [0020]. The cable

core portions 110 and the conductive portion 200 are crimped together. *See id.*, ¶ [0022]. Thus, as shown in FIG. 32, a portion of the exposed wire of the drop line is parallel to a portion of the exposed wire of the feeder cable.

11. Claim 24

Machida discloses the limitations of claim 24. *See* Sections VI.B.10 & VI.A.1.b, *supra*.

VII. MANDATORY NOTICES

A. Real Parties-in-Interest (37 C.F.R. § 42.8(b)(1))

Other than the Petitioners, there are no real parties-in-interest.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

The '375 Patent is involved in the following legal matters:

Matter	Case Name	Case No.
Civil Action	Shoals Technologies Group, LLC v. Voltage, LLC <i>et al</i>	1-25-cv-00026 (M.D.N.C.)
ITC	Certain Photovoltaic Trunk Bus Cable Assemblies and Components Thereof	337-TA-1438

C. Identification of Counsel (37 C.F.R. § 42.8(b)(3))

Lead Counsel	Back-Up Counsel
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Please direct all correspondence to lead and backup counsel at the address identified above. Petitioners consent to electronic service by e-mail. Concurrently filed herewith are Powers of Attorney pursuant to 37 C.F.R. § 42.10(b).

VIII. GROUNDS FOR STANDING AND PROCEDURAL STATEMENT

Petitioners certify that the '375 Patent is available for *inter partes* review and that Petitioners are not barred or estopped from requesting an *inter partes* review of the patent on the grounds identified herein.

IX. PAYMENT OF FEES (37 C.F.R. §§ 42.103 and 42.15(a)(1))

The *inter partes* review fee accompanies this Petition. Petitioners authorize the PTO to charge any additional fees to Deposit Acct. No. 05-1323 (Reference No. 125063.0000001).

X. CONCLUSION

The Challenged Claims are unpatentable for the reasons set forth above.

Respectfully submitted,

DATED: August 19, 2025

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Claim Appendix of Challenged Claims

Independent Claim 1

- [pre]** A lead assembly for electrically coupling one or more drop lines to a feeder cable, the lead assembly comprising:
- [a]** a joint where a section of the feeder cable and a section of the one or more drop lines can be electrically coupled at a nexus, the joint including the section of the feeder cable and the section of the one or more drop lines; and
- [b]** a monolithic mold that encapsulates the nexus, the monolithic mold further comprising:
- [c]** a feeder pathway extending completely through the monolithic mold and configured to allow the feeder cable to extend completely through the monolithic mold; and
- [d]** one or more drop line pathways that each extend at least partially through the monolithic mold, and each configured to allow one of the one or more drop lines to extend at least partially through the monolithic mold;
- [e]** each of the one or more drop lines are configured to be capable of receiving electrical power from a plurality of solar panels for combination at the nexus to the feeder cable;
- [f]** one of the one or more drop lines includes a section of exposed wire at the nexus;
- [g]** the feeder cable includes a section of exposed wire at the nexus; and

- [h]** at least a portion of the section of exposed wire of the drop line is parallel to at least a portion of the section of exposed wire of the feeder cable;
- [i]** wherein the one or more drop line pathways and the feeder pathway extend parallel to one another within the nexus, and
- [ii]** the monolithic mold has distinct openings at ends of the feeder pathway and one or more drop line pathways through which the one or more drop lines and the feeder cable exit the monolithic mold.

Claim 2

- [2]** The lead assembly of claim 1, wherein the nexus includes at least one of a compression lug, a solder portion, a splice, and a crimp.

Claim 4

- [4]** The lead assembly of claim 1, wherein the feeder pathway is formed along a first longitudinal axis and the one or more drop line pathways are each formed along a longitudinal axis different from the first longitudinal axis.

Claim 5

- [5]** The lead assembly of claim 1, wherein the feeder pathway has a first diameter, and the one or more drop line pathways have a second diameter, wherein the second diameter is smaller than the first diameter.

Claim 6

- [6]** The lead assembly of claim 1, comprising two or more drop line pathways.

Claim 7

[7] The lead assembly of claim 1, wherein each of the one or more drop lines is configured to terminate at a drop line connector.

Claim 8

[8] The lead assembly of claim 7, wherein each of the one or more drop line connectors is configured to connect to a wire harness that is configured to connect to a plurality of solar panels.

Claim 10

[10] The lead assembly of claim 1, wherein the lead assembly is configured to combine electrical power received from the plurality of solar panels at the nexus and to deliver the combined electrical power to an inverter that is in electrical communication with the feeder cable.

Claim 11

[11] The lead assembly of claim 1, wherein the one or more drop lines each includes a wire of between four (4) to eighteen (18) gauge.

Claim 12

[12] The lead assembly of claim 1, wherein the feeder cable includes a wire of between 250 MCM to 1000 MCM.

Claim 13

[13] The lead assembly of claim 1, wherein the monolithic mold is injection molded.

Claim 14

[a] The lead assembly of claim 1, wherein: the monolithic mold comprises an undermold;

[b] the lead assembly further comprises an overmold that encapsulates the undermold;

[c] the overmold is injection molded.

Independent Claim 15

[pre] A lead assembly comprising:

[a] a joint where a section of a feeder cable and a section of each of two drop lines can be electrically coupled at a nexus, each of the two drop lines connected to a wire harness and configured to receive power from a plurality of solar panels;

[b] a primary mold that encapsulates the nexus so as to substantially seal the nexus from external environmental conditions, the primary mold further comprising:

[c] a feeder pathway configured to allow the feeder cable to extend completely through the primary mold; and

[d] two drop line pathways that are each configured to allow the two drop lines to extend at least partially through the primary mold, the two drop line pathways including a first drop line pathway and a second drop line pathway;

[e] wherein at least a portion of the first drop line pathway is parallel to at least a portion of the feeder pathway; and

[f] wherein at least a portion of the first drop line pathway and at least a portion of the second drop line pathway extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder pathway.

Claim 16

[16] The lead assembly of claim 15, wherein the feeder cable is directly 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.

Claim 17

[17] The lead assembly of claim 15, further comprising a secondary mold encapsulating the primary mold and forming an undermold-overmold interface at an outer surface of the primary mold.

Claim 19

[19] The lead assembly of claim 15, wherein the lead assembly has a voltage rating of at least 1000 VDC.

Independent Claim 20

[pre] A lead assembly comprising:

[a] a feeder cable;

[b] a drop line cable that includes a first drop line and a second drop line, each of the first drop line and the second drop line having an end connected to a wire harness and configured to receive power from a plurality of solar panels;

[c] a joint where a section of the feeder cable and a section of the drop line cable can be electrically coupled at a nexus to electrically couple each of the first drop line and the second drop line to the feeder cable at the nexus;

- [d]** a mold structure that encapsulates the nexus so as to substantially seal the nexus from external environmental conditions, the mold structure comprising:
- [e]** a feeder pathway configured to allow the feeder cable to extend completely through the mold structure; and
- [f]** a drop line cable pathway configured to allow the drop line cable to extend completely through the mold structure, the drop line cable pathway including a first drop line pathway configured to allow the first drop line to extend partially through the mold structure and a second drop line pathway configured to allow the second drop line to extend partially through the mold structure;
- [g]** wherein at least a portion of the drop line cable pathway is parallel to at least a portion of the feeder pathway; and
- [h]** wherein at least a portion of the first drop line pathway and at least a portion of the second drop line pathway extend in opposite directions along a longitudinal axis that is parallel to a longitudinal axis of the feeder pathway.

Claim 21

- [21]** The lead assembly of claim 20, wherein the first drop line extends out of and away from the mold structure in one direction and the second drop line extends out of and away from the mold structure in an opposite direction.

Claim 22

- [a]** The lead assembly of claim 20, wherein: the drop line cable includes a section of exposed wire at the nexus;

- [b]** a first portion of the section of exposed wire of the drop line cable is a part of the first drop line; a second portion of the section of exposed wire of the drop line cable is a part of the second drop line;
- [c]** the feeder cable includes a section of exposed wire at the nexus;
- [d]** the section of exposed wire of the drop line cable is electrically coupled to the section of exposed wire of the feeder cable to electrically couple the first drop line and the second drop line to the feeder cable.

Claim 23

- [23]** The lead assembly of claim 22, wherein at least a portion of the section of exposed wire of the drop line cable is parallel to at least a portion of the section of exposed wire of the feeder cable.

Claim 24

- [24]** The lead assembly of claim 20, wherein the mold structure further comprises a monolithic mold structure.

Certification of Word Count

Pursuant to 37 C.F.R. § 42.24(d), Petitioners hereby certify, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in the Petition is 13,869. Pursuant to 37 C.F.R. § 42.24(a), this word count excludes the table of contents, mandatory notices, the certificates of service and word count, claim appendix of challenged claims and the appendix of exhibits.

Respectfully submitted,

Dated: August 19, 2025

/Scott L. Bittman/
Scott L. Bittman

Certificate of Service

Pursuant to 37 C.F.R. § 42.6(e)(4), I certify that the foregoing Petition, along with the accompanying exhibits, is being served on the following correspondence address of record for the subject patent via Federal Express on this August 19, 2025:

Maschoff Brennan
1389 Center Drive, Ste. 300
Suite 300
Park City, UT 84098

Courtesy copies are also being served via e-mail on Patent Owner's litigation counsel of record at the following address:

William Belanger (William.Belanger@Troutman.com)
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Respectfully submitted,

Dated: August 19, 2025

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