

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PANDUIT CORP.,
Petitioner,

v.

CCS TECHNOLOGY, INC.,
Patent Owner.

Cases

IPR2016-01647 (Patent 6,758,600 B2)
IPR2016-01648 (Patent 6,869,227 B2)

Before JONI Y. CHANG, JENNIFER S. BISK, and
DANIEL J. GALLIGAN, *Administrative Patent Judges*.

GALLIGAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a)

IPR2016-01647 (Patent 6,758,600 B2)

IPR2016-01648 (Patent 6,869,227 B2)

I. INTRODUCTION

In these *inter partes* reviews, instituted pursuant to 35 U.S.C. § 314 and 37 C.F.R. § 42.108, Panduit Corp. (“Petitioner”) challenges the patentability of claims 1 and 2 of U.S. Patent No. 6,758,600 B2 (“the ’600 patent”) and claims 1–3 and 8–10 of U.S. Patent No. 6,869,227 B2 (“the ’227 patent”),¹ both of which are owned by CCS Technology, Inc. (“Patent Owner”). The parties raised overlapping issues. For efficiency, we exercise our discretion under 37 C.F.R. § 42.122(a) to consolidate these two *inter partes* reviews. *See also* 35 U.S.C. § 315(d) (giving Director discretion to consolidate proceedings).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trials in these *inter partes* reviews. For the reasons discussed below, we determine that Petitioner has proven by a preponderance of the evidence that claims 1 and 2 of the ’600 patent and claims 1–3 and 8–10 of the ’227 patent are unpatentable. *See* 35 U.S.C. § 316(e) (“In an *inter partes* review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.”).

A. Procedural History

On August 19, 2016, Petitioner requested *inter partes* review of claims 1–4 of the ’600 patent and *inter partes* review of claims 1–3, 6, and 8–11 of the ’227 patent. IPR2016-01647, Paper 2 (“IPR1647 Pet.”); IPR2016-01648, Paper 2 (“IPR1648 Pet.”). In each proceeding, Patent

¹ The challenged patent is Exhibit 1001 in each proceeding. Citations may be preceded by “IPR1647” to designate IPR2016-01647 or “IPR1648” to designate IPR2016-01648.

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Owner filed a Preliminary Response. IPR2016-01647, Paper 7 (“IPR1647 Prelim. Resp.”); IPR2016-01648, Paper 7 (“IPR1648 Prelim. Resp.”). In IPR2016-01647, we instituted trial as to claims 1 and 2 of the ’600 patent on the following grounds of unpatentability:

1. Whether claims 1 and 2 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka;² and
2. Whether claims 1 and 2 are unpatentable under 35 U.S.C. § 103(a) as having been obvious over Toyooka and Kang.³

IPR2016-01647, Paper 8 (“IPR1647 Dec. on Inst.”), 27. In IPR2016-01648, we instituted trial as to claims 1–3 and 8–10 of the ’227 patent on the following ground of unpatentability:

1. Whether claims 1–3 and 8–10 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.⁴

IPR2016-01648, Paper 8 (“IPR1648 Dec. on Inst.”), 31.

In each review, Patent Owner filed a Response (IPR2016-01647, Paper 14, “IPR1647 PO Resp.”; IPR2016-01648, Paper 13, “IPR1648 PO Resp.”), and Petitioner filed a Reply (IPR2016-01647, Paper 21, “IPR1647 Reply”; IPR2016-01648, Paper 21, “IPR1648 Reply”).

² JP H11-160542, published June 18, 1999 (Ex. 1004). Petitioner also filed Toyooka as Exhibit 1008 with a declaration by the translator to address a deficiency noted in Patent Owner’s Preliminary Responses and in our Decisions on Institution. *See* IPR1647 Prelim. Resp. 12–14; IPR1647 Dec. on Inst. 5–7; IPR1648 Prelim. Resp. 10–12; IPR1648 Dec. on Inst. 6–7. Because the parties cite Toyooka as Exhibit 1004 in these matters, we also cite Toyooka as Exhibit 1004 for consistency in the record.

³ US 6,604,866 B1, filed Mar. 4, 2002, issued Aug. 12, 2003 (IPR1647 Ex. 1005).

⁴ JP H11-160542, published June 18, 1999 (Ex. 1004).

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An oral hearing was held for both proceedings on November 16, 2017, a transcript of which appears in the record of each proceeding. IPR2016-01647, Paper 26 (“Tr.”); IPR2016-01648, Paper 26.

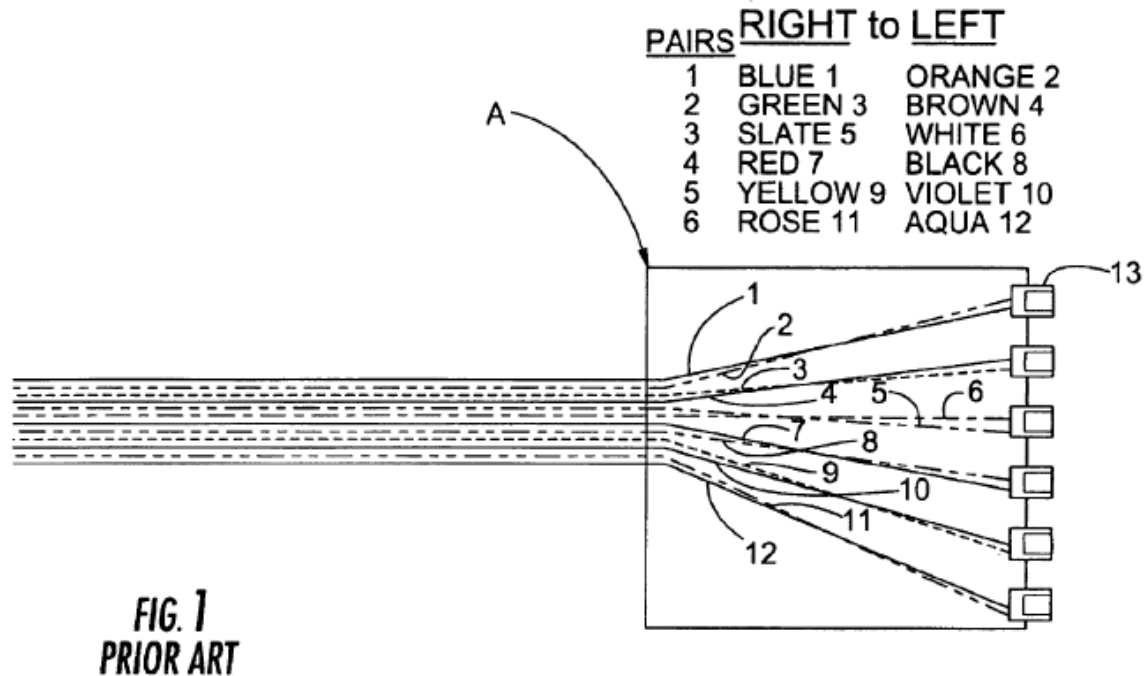
B. Related Matters

The parties indicate that the ’600 and ’227 patents are at issue in *Corning Optical Communications LLC v. Panduit Corp.*, No. 1:16-cv-00268-GMS (D. Del.). IPR1647 Pet. 1; IPR2016-01647, Paper 5, 1; IPR1648 Pet. 1; IPR2016-01648, Paper 5, 1. The ’600 and ’227 patents are also the subjects of IPR2017-01323 and IPR2017-01375, respectively.

C. Overview of the ’600 and ’227 Patents

The ’600 and ’227 patents generally relate to a particular interconnection scheme used in optical interconnection modules. Ex. 1001,⁵ 2:3–19. In particular, the challenged patents address fiber polarity issues in fiber interconnections. Ex. 1001, 1:33–43. The patents describe various prior art methods to connect a transmitter on one end to a receiver on the other end in a conventional point-to-point fiber system to manage fiber polarity. *Id.* For example, fiber polarity can be addressed by “flipping fibers in one end of the assembly.” *Id.* at 1:37–40. The patents also describe the use of “A” and “B” type modules. *Id.* at 1:41–56. Figure 1 of the patents is reproduced below.

⁵ The ’227 patent purports to be a continuation of the ’600 patent and contains all of the disclosure of the ’600 patent. The ’227 patent also contains an additional figure that does not appear in the ’600 patent. See IPR1648 Ex. 1001, Fig. 5. For ease of reference, Exhibit 1001 in this Decision refers to the ’227 patent unless otherwise noted.



The patents explain that Figure 1 “illustrates a conventional module ‘A’ having six fiber pairs matched as follows: 1–2; 3–4; 5–6; 7–8; 9–10; and 11–12.” *Id.* at 1:47–49. The patents explain that “[m]odule A is used in a system utilizing an ‘A’ and ‘B’ type module approach where the fibers in the ‘B’ module are flipped with respect to module A to address, or correct for, fiber polarity.” *Id.* at 1:53–56.

The patents state:

In an effort to reduce implementation confusion, complexity and stocking issues with the “A” and “B” module method, or fiber flipping before entering the connector, the idea of wiring a module in a fiber sequence according to the present invention has been devised. Wiring a module in accordance with the present invention eliminates the need for an “A” and “B” module approach where the module according to the present invention is used universally in the system.

Ex. 1001, 1:59–67.

The fiber sequence allegedly devised in these patents is illustrated in Figure 2 of the patents, which is reproduced below.

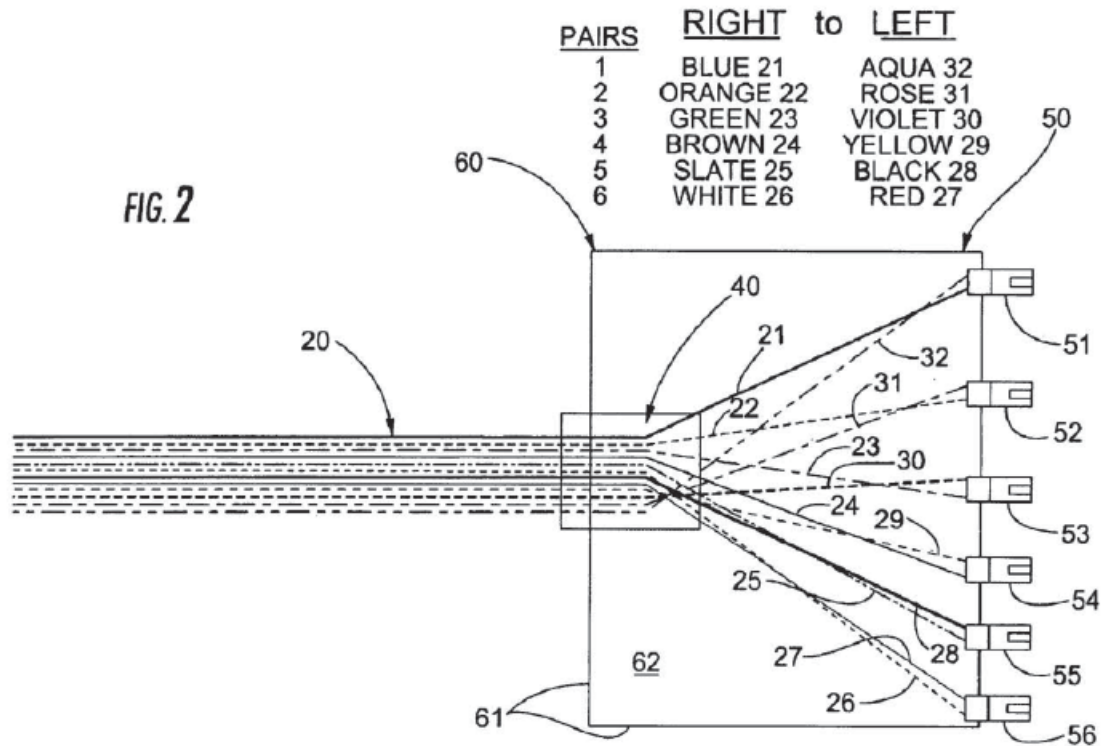


Figure 2 “illustrates an exemplary fiber wiring scheme for routing of optical fibers from connector 40 to single or multi-fiber connectors located at connector stations 51–56, defined at a break-out section 50 of module 60.” Ex. 1001, 3:14–16. The patents explain that “the optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60, the fiber pairs being formed by the optical fibers.” *Id.* at 3:30–34. As illustrated in Figure 2 and explained in the patents, fiber pairs are defined within the cavity of the module such that the fiber optically connected to the first fiber from ribbon 20 is paired with the fiber optically connected to the last fiber at connector station 51, and then the fiber optically connected to the next fiber in ribbon 20 is paired with the fiber optically connected to the next-to-last fiber in ribbon 20 at connector station 52, and so on. *See id.* at 3:25–27 (“With reference to FIG. 2, the fiber pairs are defined as follows: 21–32;

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22–31; 23–30; 24–29; 25–28; and 26–27.”). As explained in detail below, Toyooka described a fiber optical module with this routing scheme over three years before the filing of the application that issued as the ’600 patent.

D. Illustrative Claims

Claims 1 and 2 of the ’600 patent are reproduced below.

1. An optical interconnection module, comprising:
 - a) an enclosure defining walls and a cavity within said walls for receiving and supporting optical fibers and connectors;
 - b) an optical interconnection section formed in a wall of said module, said optical interconnection section having a multi-fiber connector with multiple optical paths formed therein, said optical paths being arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path for optical alignment with optical fibers in an optical fiber ribbon;
 - c) an optical connector station formed in a wall of said module having a plurality of optical fiber connectors;
 - d) said optical paths and said optical connectors being optically interconnected by optical fibers disposed in said cavity, fiber pairs being formed by the optical fibers, at least one of the fiber pairs being routed to a respective connector station that is in optical communication with said optical paths, said at least one optical fiber pair being optically interconnected with at least two of said optical paths, said at least two optical paths selected from optical paths not being immediately adjacent to each other.
2. The optical interconnection module of claim 1, at least 80% of said fiber pairs being optically interconnected with optical paths selected from optical paths not being immediately adjacent to each other.

Of the challenged claims in the ’227 patent, claims 1 and 3 are independent. Claims 2 and 8–10 depend directly or indirectly from claim 1. Claims 1, 2, and 3 of the ’227 patent are reproduced below.

1. A universal breakout harness for reversing the polarity of optical fibers, comprising:

a multi-fiber connector with multiple optical paths formed therein, the optical paths being arranged in a generally planar array with each optical path being immediately adjacent to at least one other optical path;

a plurality of optical fibers of an optical ribbon disposed in the optical paths formed in the multi-fiber connector; and

a plurality of optical fiber connectors disposed opposite the multi-fiber connector, the plurality of optical fiber connectors defining a plurality of pairs of optical paths for receiving the optical fibers of the optical ribbon;

wherein the optical fibers of the optical ribbon are separated and routed between the optical paths formed in the multi-fiber connector and the pairs of optical paths defined by the plurality of optical fiber connectors; and

wherein the optical fibers in at least one of the pairs of optical paths defined by the plurality of optical fiber connectors are selected from optical fibers disposed in optical paths formed in the multi-fiber connector that are not immediately adjacent to each other.

2. The universal breakout harness of claim 1, wherein at least 80% of the optical fibers in the pairs of optical paths defined by the plurality of optical fiber connectors are selected from optical fibers disposed in optical paths formed in the multi-fiber connector that are not immediately adjacent to each other.

3. A method of implementing reverse-ribbon positioning in a cabling system, comprising:

assigning a sequential number to each of the optical fibers of an optical ribbon;

installing one end of the optical ribbon into a multi-fiber connector with the optical fibers of the optical ribbon arranged in sequential number from left to right; and

installing the other end of the optical ribbon into a plurality of optical fiber connectors with the optical fibers of the optical ribbon arranged in reverse sequential number from left to right.

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II. ANALYSIS

A. Level of Ordinary Skill in the Art

Citing the testimony of its declarant, Dr. Casimer DeCusatis, Petitioner argues that the level of ordinary skill in the art is “(a) a Bachelor’s Degree in Electrical Engineering or similar, with at least 5 years of experience designing fiber optic cassettes or harnesses; or (b) a Master’s Degree in Electrical Engineering or similar, with at least 3-5 year[s] of experience designing fiber optic cassettes or harnesses.” IPR1647 Pet. 12 (citing Ex. 1003 ¶ 19); IPR 1648 Pet. 11 (citing Ex. 1003 ¶¶ 16–19).

Patent Owner, citing the testimony of its declarant, Mr. Eric Pearson, argues that “[a] person of ordinary skill in the art of the ’600 [and ’227] patent[s] would have a bachelor’s degree in mechanical engineering, materials science, or a related field; and 2 years of experience in fiber optic equipment design.” IPR1647 PO Resp. 1 (citing IPR1647 Ex. 2001 ¶ 16); IPR1648 PO Resp. 1 (citing IPR1648 Ex. 2001 ¶ 14).

Although there are differences between the proposed levels of ordinary skill in the art, the parties’ declarants agree that an ordinarily skilled artisan would have had a four-year technical degree and some amount of professional experience with fiber optic equipment. Based on the evidence of record, including the testimony of the parties’ declarants, the subject matter at issue, and the prior art of record, we determine that the skill level of a person of ordinary skill in the art would have been that of a person having a four year technical degree with a minimum of two years of professional technical experience in fiber optic equipment design. We apply this level of ordinary skill in the art in our analysis below. However, we note that our analysis would be the same if we adopted either party’s proposed level of ordinary skill.

B. Claim Interpretation

The Board interprets claims in an unexpired patent using the “broadest reasonable construction in light of the specification of the patent in which [they] appear[.]” 37 C.F.R. § 42.100(b). Under this standard, we interpret claim terms using “the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant’s specification.” *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997). We presume that claim terms have their ordinary and customary meaning. *See Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1062 (Fed. Cir. 2016) (“Under a broadest reasonable interpretation, words of the claim must be given their plain meaning, unless such meaning is inconsistent with the specification and prosecution history.”); *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (“The ordinary and customary meaning is the meaning that the term would have to a person of ordinary skill in the art in question.” (internal quotation marks omitted)). A patentee, however, may rebut this presumption by acting as his own lexicographer, providing a definition of the term in the specification with “reasonable clarity, deliberateness, and precision.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

1. “Optical Fiber Ribbon”/“Optical Ribbon”

The term “optical fiber ribbon” appears in challenged claim 1 of the ’600 patent, and the term “optical ribbon” appears in challenged claims 1, 3, and 8 of the ’227 patent.

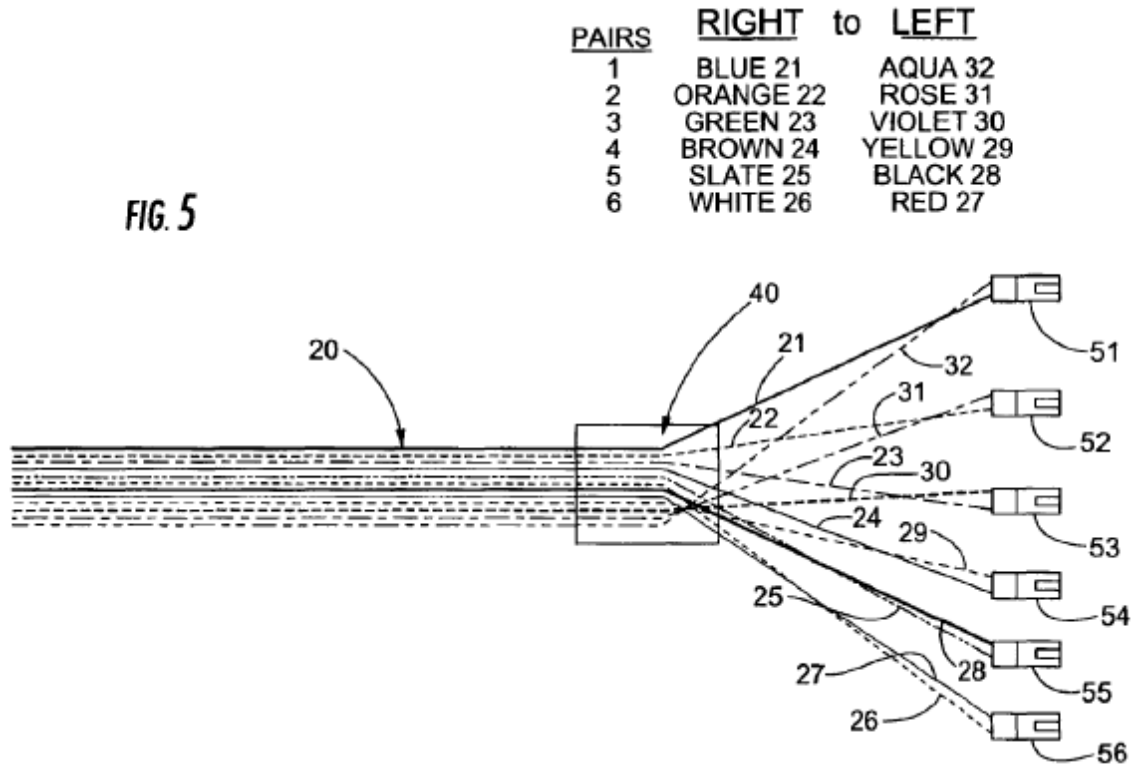
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a. Preliminary Determination

Although prior to institution the parties did not propose express constructions for the terms “optical fiber ribbon” and “optical ribbon,” the parties’ briefing in IPR2016-01648 evinced implicit claim constructions. IPR1647 Dec. on Inst. 11–12; IPR1648 Dec. on Inst. 12; IPR1648 Pet. 31; IPR1648 Prelim. Resp. 3. In particular, Petitioner contends that certain fibers in Toyooka disclose “an optical ribbon” because they “are grouped and aligned and arrayed in a planar array.” IPR1648 Pet. 31; *see* IPR1647 Dec. on Inst. 12; IPR1648 Dec. on Inst. 12. In its Preliminary Response, Patent Owner, referring to Figure 5 of the ’227 patent, stated: “An optical fiber ribbon 20 leads into the connector. [Ex. 1001,] 3:57–59. The optical fibers of the ribbon are connected to optical fibers from within the module that are also ‘ribbonized’ (*bonded together in a planar array*) before they are placed into the connector.” IPR1648 Prelim. Resp. 3 (emphasis added); *see* IPR1647 Dec. on Inst. 13; IPR1648 Dec. on Inst. 13.

Because the parties provided implicit constructions for the terms “optical fiber ribbon” and “optical ribbon,” we provided an analysis and a preliminary claim construction for these terms in our Decisions on Institution. IPR1647 Dec. on Inst. 11–14; IPR1648 Dec. on Inst. 12–14. Our initial determination as to the scope of “optical ribbon” and “optical fiber ribbon” was based in part on Patent Owner’s own explanation of the technology of the ’227 patent with reference to Figure 5. *See* IPR1647 Dec. on Inst. 11–14; IPR1648 Dec. on Inst. 12–14. Figure 5 of the ’227 patent is reproduced below.



The '227 patent states that Figure 5 “is a schematic view of a breakout harness without a module according to the present invention.” Ex. 1001, 2:40–41. In its Preliminary Response in IPR2016-01648, Patent Owner argued:

As shown in Figure 5 above, the breakout harness contains a multifiber connector 40. [Ex. 1001,] 3:49–59. An optical fiber ribbon 20 leads into the connector. *Id.* at 3:57–59. The optical fibers of the ribbon are connected to optical fibers from within the module that are also “*ribbonized*” (*bonded together in a planar array*) before they are placed into the connector. Within the module, the “*ribbonized*” optical fibers in the module are arranged into fiber pairs by splitting them apart (using, for example, a fan-out kit as described at 3:11–13) before they are terminated with respective optical connectors, as shown on the right-hand side of Figure 5.

1648 Prelim. Resp. 3 (emphasis added). Based in part on Patent Owner’s explanation that optical fibers are “*ribbonized*” when they are “*bonded*

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together in a planar array” (*id.*), we determined preliminarily that the broadest reasonable interpretation of the terms “optical fiber ribbon” and “optical ribbon” in view of the specification of the ’600 and ’227 patents includes optical fibers that are bonded together in a generally planar array or optical fibers that are grouped and aligned in a generally planar array.

IPR1647 Dec. on Inst. 14; IPR1648 Dec. on Inst. 14.

b. Post-Institution Analysis

In its Responses to the Petitions in these proceedings, Patent Owner argues that, “[i]n light of the intrinsic record, the term ‘optical [fiber] ribbon’ is not so broad that it includes fibers that are merely ‘grouped and aligned in a generally planar array.’” IPR1647 PO Resp. 6; IPR1648 PO Resp. 7.

According to Patent Owner, “[t]he broadest reasonable interpretation consistent with the specification of the term ‘optical [fiber] ribbon’ is ‘a group of optical fibers that are coated with a ribbon common layer.’”

IPR1647 PO Resp. 6; IPR1647 PO Resp. 7. Patent Owner bases this argument primarily on the statement in the “Background of the Invention” section of the patents that “[a]n optical ribbon *includes* a group of optical fibers that are coated with a ribbon common layer.” Ex. 1001, 1:18–19 (emphasis added); *see* IPR1647 PO Resp. 6–9; IPR1648 PO Resp. 7–10.

However, this sentence does not necessarily define the “optical ribbon” as “a group of optical fibers that are coated with a ribbon common layer” but, rather, merely indicates that the term *encompasses* such a group of fibers.

As explained more fully below, in view of the intrinsic record as a whole, we determine that the subject matter that falls within the broadest reasonable interpretation of “optical ribbon” and “optical fiber ribbon” is *not limited* to Patent Owner’s proposal.

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First, we discuss Patent Owner's contradictory positions on this issue. In its Response to the Petition in IPR2016-01648, Patent Owner provides the following overview of the subject matter of the '227 patent:

As shown in Figure 5 above, the breakout harness contains a multi-fiber connector 40. [Ex. 1001,] 3:49–59. An optical fiber ribbon 20 leads into the connector 40. *Id.*, 3:57–59. After this, the ribbon is split apart (using, for example, a fan-out kit as described at 3:11–13). The fibers are then routed to individual optical connectors for termination, as shown on the right-hand side of the figure.

This design is reflected in the claims of the '227 patent. Claim 1 recites a “universal breakout harness” of the general type described above. *Id.*, 4:32. The harness contains “a multi-fiber connector” with “an optical ribbon disposed in the optical paths formed in the multi-fiber connector.” *Id.*, 4:34–40. At the other end of the harness, there are “a plurality of optical fiber connectors” that define a “plurality of pairs” that are respectively associated with transmit and receive optical signal functions of the optical paths. *Id.*, 4:42–45. Next, “the optical fibers of the optical ribbon are separated and routed between the optical paths formed in the multi-fiber connector and the pairs of optical paths defined by the plurality of optical fiber connectors” in accordance with the transmit and receive functions of the optical paths. *Id.*, 4:46–49.

IPR1648 PO Resp. 3–4.

Patent Owner, therefore, contends that the fibers to the right of connector 40 in Figure 5 are the fibers from ribbon 20, rather than fibers to which the fibers within ribbon 20 are optically connected. This contrasts with the following passage in Patent Owner's Preliminary Response in IPR2016-01648:

As shown in Figure 5 above, the breakout harness contains a multifiber connector 40. [Ex. 1001,] 3:49–59. An optical fiber ribbon 20 leads into the connector. *Id.* at 3:57–59. *The optical fibers of the ribbon are connected to optical fibers from within the module* that are also “ribbonized” (bonded together in a

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planar array) before they are placed into the connector. Within the module, the “ribbonized” optical fibers in the module are arranged into fiber pairs by splitting them apart (using, for example, a fan-out kit as described at 3:11–13) before they are terminated with respective optical connectors, as shown on the right-hand side of Figure 5.

IPR1648 Prelim. Resp. 3 (emphasis added). There, Patent Owner argued that fibers from the ribbon are connected to fibers 21–32 to the right of connector 40, and, as such, fibers 21–32 to the right of connector 40 are not fibers of ribbon 20 but, rather, are fibers that are connected to fibers of ribbon 20. This explanation makes sense in the context of the ’600 and ’227 patents. For example, the ’600 and ’227 patents explain that connector 40 “contains *multiple optical paths*, the optical paths being arranged in a generally planar array. The optical paths being immediately adjacent to at least one other optical path *for optical alignment with the optical fibers in an optical fiber ribbon.*” Ex. 1001, 2:63–67 (emphases added). Connector 40 contains “optical paths,” which are paths through which light travels, such as the light from the fibers within ribbon 20 connected to connector 40. If the fibers in ribbon 20 are the same fibers to the right of connector 40, as Patent Owner argues in its Response, what purpose does a connector with optical paths serve? Indeed, the ’600 and ’227 patents state that “the optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60.” *Id.* at 3:30–33.

This discussion is important because, post-institution, Patent Owner argues that, “[i]n light of the intrinsic record, the term ‘optical [fiber] ribbon’ is not so broad that it includes fibers that are merely ‘grouped and aligned in a generally planar array.’” IPR1647 PO Resp. 6; IPR1648 PO Resp. 7.

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During oral argument in these cases, counsel for Patent Owner stated: “So our position is an optical ribbon can’t be just individual fibers that aren’t coated or covered with a common material that keeps them together.”

Tr. 30:23–25. Patent Owner further argued: “Our definition [of] an optical ribbon is fibers coated in a ribbon common layer. And once you have separated and routed them from the common -- ribbon common layer, they are individual fibers. They are not an optical ribbon.” Tr. 33:19–22; *see also* Tr. 21:12–14 (Patent Owner: “And once you have separated them out, from the -- whether it be the matrix material, the common matrix material or the ribbon common layer, you are now talking about individual fibers.”). According to Patent Owner, therefore, once fibers from an optical ribbon are separated from each other, they are individual fibers, not a ribbon.

Contrary to Patent Owner’s arguments, however, independent claim 3 of the ’227 patent, when read in light of the specification, claims “an optical ribbon” as individual fibers or, at least, encompasses such subject matter. In particular, claim 3 recites “installing one end of the optical ribbon into a multi-fiber connector with the optical fibers of the optical ribbon arranged in sequential number from left to right” and then “installing *the other end of the optical ribbon into a plurality of optical fiber connectors* with the optical fibers of the optical ribbon arranged in reverse sequential number from left to right.” (Emphasis added). The claim requires installing “one end” and “the other end” of the ribbon, which corresponds to the fibers between connector 40 (“multi-fiber connector”) and connector stations 51–56 (“plurality of optical fiber connectors”) in figures 2 and 5. The ’600 and ’227 patents describe that “the optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60.” Ex. 1001, 3:30–33. The ’600 and

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'227 patents do not describe interconnecting a multi-fiber connector and connector stations using anything other than individual fibers, such as those depicted in figure 2 of the '600 and '227 patents and figure 5 of the '227 patent. Thus, claim 3, read in light of the specification of the '227 patent, claims an "optical ribbon" encompassing optical fibers that are grouped and aligned in a generally planar array.

During oral argument, counsel for Patent Owner was asked about claim 3 of the '227 patent and stated:

So if we focus on the yellow highlighting here, the second part, so we are in the context of a method here, right, of installing an end of the optical ribbon into the plurality of optical fiber connectors. Here what I was going to say is I think one of ordinary skill in the art would understand that to install the optical ribbon into the individual connectors, you [have] got to separate out the fibers to do that. The claim does not specifically say that but one of ordinary skill in the art would understand that is what you have got to do.

And then if you keep reading after the second yellow highlight here on slide 8, it talks about and distinguishes the optical fibers from the optical ribbon. And it's the optical fibers of the optical ribbon that have been arranged in reverse sequential number and installed into the individual connectors. So I think within the claim language exactly here that we are looking at, it distinguishes between optical ribbon and the individual optical fibers. I agree it doesn't say one of ordinary skill in the art would understand. But it doesn't say that you have got to separate the individual fibers from the ribbon common material before you install them in the individual connectors. That would have been clearer, I understand that. But I think one of ordinary skill in the art would understand that's what's going on here.

Tr. 34:17–35:12. According to Patent Owner, therefore, the claimed recitation of "installing the other end of the optical ribbon into a plurality of optical fiber connectors" requires "separat[ing] out the fibers to do that."

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Tr. 34:17–24. As noted above, however, Patent Owner elsewhere argues that once fibers from an optical ribbon are separated from each other, they are individual fibers, not a ribbon. Tr. 21:12–14, 30:23–25, 33:19–22.

Therefore, under Patent Owner’s interpretation of claim 3, the step of “installing the other end of the optical ribbon into a plurality of optical fiber connectors” really means “installing optical fibers separated from the other end of the optical ribbon into a plurality of optical fiber connectors.”

(Emphasis added). This suggests that optical fibers need not be coated in a ribbon common layer to be an “optical ribbon” as recited in claim 3. Indeed, if Patent Owner is correct that once fibers are separated they are no longer a ribbon, then claim 3 as written cannot be performed because individual fibers would be installed into the connectors, not a ribbon.

The friction between Patent Owner’s proposed construction on one hand and the plain language of claim 3 on the other hand renders Patent Owner’s construction untenable. The more reasonable reading of the terms “optical ribbon” and “optical fiber ribbon” is that they encompass optical fibers that are bonded together in a generally planar array or optical fibers that are grouped and aligned in a generally planar array. This construction gives meaning to the step of claim 3 of “installing the other end of the optical ribbon into a plurality of optical fiber connectors” and is supported by the disclosure of the ’600 and ’227 patents that “the optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60.” Ex. 1001, 3:30–33, Figs. 2, 5.

Therefore, the intrinsic evidence, including the plain language of claim 3, supports our initial determination that the broadest reasonable interpretation of the terms “optical fiber ribbon” and “optical ribbon” in

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view of the specification of the '600 and '227 patents encompasses optical fibers that are bonded together in a generally planar array or optical fibers that are grouped and aligned in a generally planar array.⁶ We apply this definition below in our analysis of the grounds of unpatentability.

2. Remaining Terms

In our Decisions on Institution, we determined that the remaining terms of the challenged claims did not require express constructions at that time. IPR1647 Dec. on Inst. 15; IPR1648 Dec. on Inst. 15. Based on the record developed in these *inter partes* reviews, we maintain our initial determination that the remaining terms of the challenged claims do not require express constructions.

C. Principles of Law

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Although the elements must be arranged or combined in the same way as in the claim, “the reference need not satisfy an *ipsissimis verbis* test,” i.e.,

⁶ We have also considered the extrinsic evidence Patent Owner introduces regarding the interpretation of “optical fiber ribbon” and “optical ribbon,” including the testimony of Mr. Pearson (Ex. 2001 in each proceeding) and a definition of “fiber ribbon” from the *Fiber Optics Illustrated Dictionary* (Ex. 2003 in each proceeding). In light of the intrinsic record discussed above, however, we do not find this evidence to be particularly useful in determining the broadest reasonable interpretation of the terms “optical fiber ribbon” and “optical ribbon” as they are used in the '600 and '227 patents. See *Phillips v. AWH Corp.*, 415 F.3d 1303, 1318 (Fed. Cir. 2005) (*en banc*) (authorizing the consideration of extrinsic evidence in determining the meaning of claims but noting that it is “in general . . . less reliable than the patent and its prosecution history in determining how to read claim terms”).

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identity of terminology is not required. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of non-obviousness (i.e., secondary considerations). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

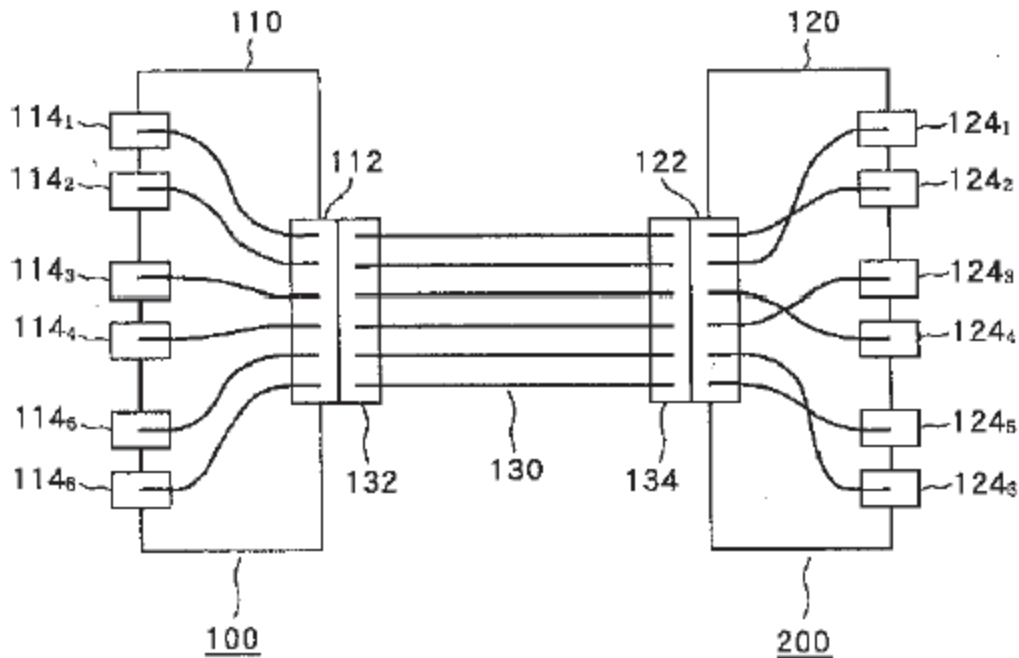
*D. Anticipation by Toyooka
(Claims 1 and 2 of the ’600 Patent;
Claims 1–3 and 8–10 of the ’227 Patent)*

Petitioner contends claims 1 and 2 of the ’600 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka. IPR1647 Pet. 4, 19–30. Petitioner also contends claims 1–3 and 8–10 of the ’227 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka. IPR1648 Pet. 4, 17–35.

1. Overview of Toyooka

Like the ’600 and ’227 patents, Toyooka also addresses issues with fiber polarity. Figure 5 of Toyooka is reproduced below.

【図5】



Toyooka explains that Figure 5 depicts “a connection configuration of conventional optical-fiber wiring units and multicore optical-fiber tape” in which “two optical-fiber wiring units 100 and 200 are connected with a multicore optical-fiber tape 130.” Ex. 1004 ¶ 5. As depicted in Figure 5 and described in Toyooka, connections between single-core connectors 114 of wiring unit 100 and single-core connectors 124 of wiring unit 200 are as follows: 114₁ to 124₂, 114₂ to 124₁, 114₃ to 124₄, 114₄ to 124₃, 114₅ to 124₆, and 114₆ to 124₅. Ex. 1004 ¶¶ 9–10. Through this configuration, Toyooka explains that

it becomes possible to achieve the parallel transmission and reception of multiple-bit (3-bit in the case of the present figure) data between one of the devices (which is connected to the single-core connectors 114₁-114₆ of the optical-fiber wiring unit 100 via single-core optical fibers) and the other device (which is connected to the single-core connectors 124₁-124₆ of the fiber wiring unit 200 via single-core optical fibers).

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Ex. 1004 ¶ 10. Toyooka, however, explains that a drawback of the conventional configuration of Figure 5 is that “the specifications of the optical-fiber wiring units 100 and 200 are not identical because the internal connection modes for optical fibers are different from each other” such that “it is necessary to prepare two types of optical-fiber wiring units in order to connect two devices with an optical-fiber transmission line, thereby attributing to the facilitation of connection errors.” Ex. 1004 ¶ 11.

To address this issue, Toyooka discloses a wiring unit that “can be used in an optical-fiber transmission line that connects devices, doing so in a pair of two units having the identical specifications.” Ex. 1004 ¶ 12.

Toyooka discloses that this wiring unit employs a particular fiber interconnection scheme, which is illustrated in Figure 1, reproduced below.

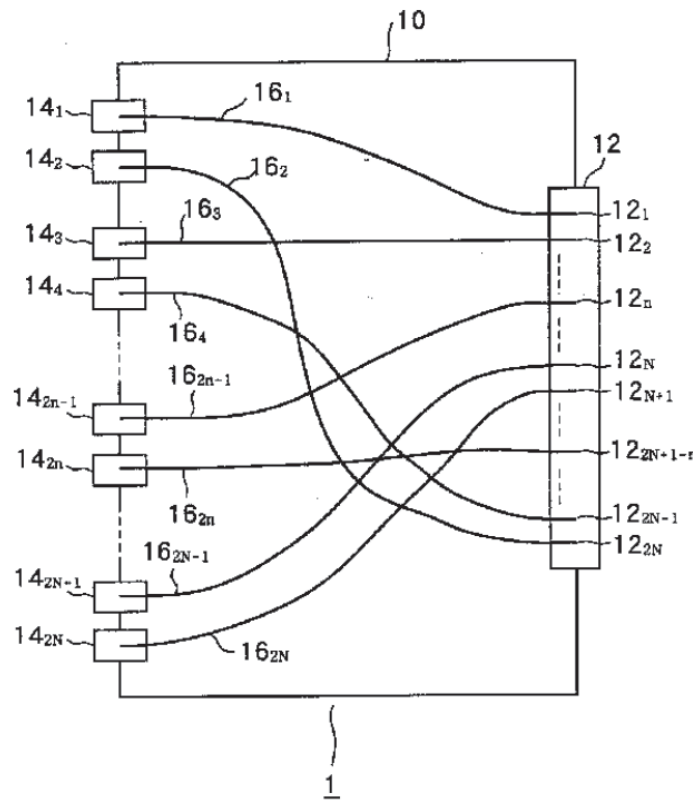


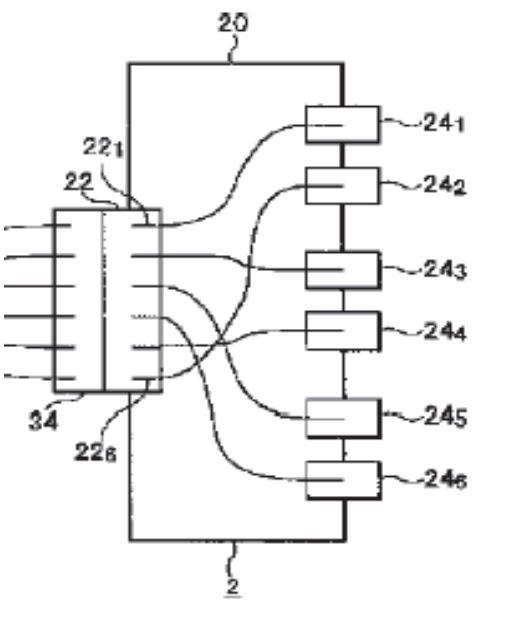
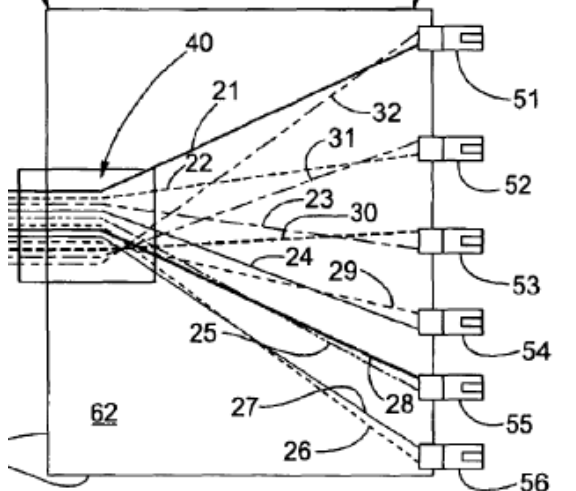
Figure 1 of Toyooka depicts an optical fiber wiring unit having “multicore connector 12” on one side of “box 10” and “single-core connectors 14₁ to

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14_{2N}” on the other side of box 10. Ex. 1004 ¶ 20. Toyooka describes that “each of the two single-core connectors constituting each connector pair is connected, by means of an optical fiber, to each of the two symmetrically situated cores of the multicore connector 12.” *Id.* ¶ 23. As such, single-core connectors 14₁ and 14₂ are connected, respectively, to cores 12₁ and 12_{2N}, which are situated symmetrically on multicore connector 12. *Id.* ¶ 24. This pattern continues and, ultimately, single-core connectors 14_{2N-1} and 14_{2N} are paired with 12_N and 12_{N+1}, respectively. *See id.*, Fig. 1.

Notably, Toyooka’s symmetrical wiring technique discloses the wiring scheme described and illustrated in the ’600 and ’227 patents. Comparing the module in Figure 2 of the ’227 patent and the module in Figure 2 of Toyooka, reproduced side-by-side in the table below, demonstrates the correspondence.

Module 20 of Toyooka’s Figure 2	Module 60 of ’600/’227 patent’s Figure 2
	

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Toyooka discloses that optical-fiber wiring unit 2 in Figure 2 is identical to optical-fiber wiring unit 1 of Figure 1 except that N equals three in Figure 2 (i.e., there are six fibers). Ex. 1004 ¶ 26. As shown in the side-by-side comparison, Toyooka discloses pairing the outside fibers (22_1 and 22_6) from connector 22 just as the '600 and '227 patents describe pairing the outside fibers (21 and 32). Toyooka and the '600 and '227 patents further describe pairing each fiber with its symmetrical counterpart in the multicore connector, such that fibers 22_2 and 22_5 are paired in Toyooka just as fibers 22 and 31 are paired in Figure 2 of the '600 and '227 patents. *Compare* Ex. 1004 ¶ 24 (“[T]he single-core connectors 14_{2n-1} and 14_{2n} constituting a connector pair are each connected to the respective ones of symmetrically situated cores 12_n and 12_{2N+1-n} of the multicore connector 12 via the respective ones of the optical fibers 16_{2n-1} and 16_{2n} .”), *with*, Ex. 1001, 3:25–27 (“With reference to FIG. 2, the fiber pairs are defined as follows: 21–32; 22–31; 23–30; 24–29; 25–28; and 26–27.”). As will be discussed in detail below, this wiring scheme is reflected in various claims of the '600 and '227 patents.

2. Claim 1 of the '600 Patent

a. Optical interconnection module having enclosure defining walls and cavity

Petitioner contends Toyooka describes “[a]n optical interconnection module” having “an enclosure defining walls and a cavity within said walls for receiving and supporting optical fibers and connectors,” as recited in claim 1 of the '600 patent. IPR1647 Pet. 20–21, 27–28 (citing Ex. 1004 ¶ 20, Fig. 1). We are persuaded by these contentions. Figure 1 of Toyooka is reproduced below.

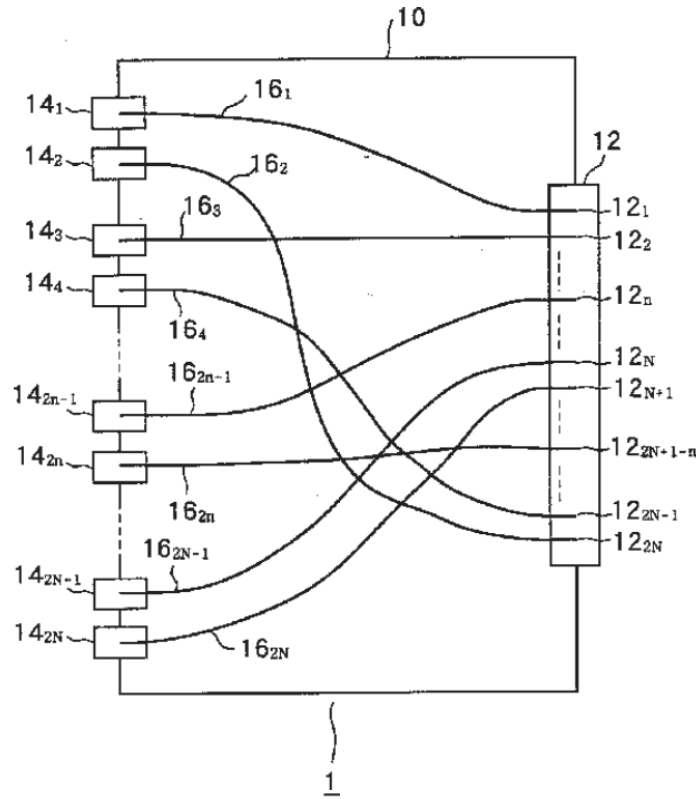


Figure 1 depicts an optical fiber wiring unit having “multicore connector 12” on one side of “box 10” and “single-core connectors 14₁ to 14_{2N}” on the other side of box 10. Ex. 1004 ¶ 20. We find Toyooka’s disclosure of “optical-fiber wiring unit 1” as a “box” describes an enclosure with walls and a cavity. Ex. 1004 ¶ 20, Fig. 1. We also are persuaded, and we find, that Toyooka’s wiring unit is “for receiving and supporting optical fibers and connectors,” as recited in claim 1 of the ’600 patent, because Toyooka describes that

[t]he optical-fiber wiring unit 1, as is claimed by the present embodiment, comprises a multicore connector 12 with 2N pieces of cores on the lateral surface of the box 10 at one side. It also comprises 2N pieces of single-core connectors 14₁ to 14_{2N} being arranged--side by side in the order given--on the other lateral surface of the box 10. This figure also illustrates the manner whereby the optical fibers 16₁ to 16_{2N} are wired within the box 10.

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Ex. 1004 ¶ 20.

Therefore, we find Toyooka discloses “[a]n optical interconnection module” having “an enclosure defining walls and a cavity within said walls for receiving and supporting optical fibers and connectors,” as recited in claim 1 of the ’600 patent.

b. Optical interconnection section having a multi-fiber connector

Claim 1 further recites that the claimed “optical interconnection module” has

an optical interconnection section formed in a wall of said module, said optical interconnection section having a multi-fiber connector with multiple optical paths formed therein, said optical paths being arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path for optical alignment with optical fibers in an optical fiber ribbon.

Petitioner contends the portion of wiring unit 1 having “multicore connector 12” of Toyooka describes the claimed “optical interconnection section.” IPR1647 Pet. 21–24, 28 (citing Ex. 1004 ¶¶ 20, 21, 23, 27, Fig. 1). We find Toyooka describes “an optical interconnection section formed in a wall of said module” because Toyooka discloses that multicore connector 12 is situated “on the lateral surface of the box 10 at one side.” Ex. 1004 ¶ 20. A lateral surface of Toyooka’s wiring unit, which is a box, discloses “a wall of said module.” We also find Toyooka’s multicore connector 12 discloses “a multi-fiber connector with multiple optical paths formed therein” because the cores in the multicore connector are optical paths through which light signals from and to a fiber tape/ribbon travel, for example. Ex. 1004, Abstract (“A multicore optical-fiber tape (which constitutes the principal part of an optical-fiber transmission line) is connected to the multicore connector 12 . . .”).

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Petitioner also contends Toyooka describes that the “optical paths [are] arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path for optical alignment with optical fibers in an optical fiber ribbon,” as recited in claim 1. IPR1647 Pet. 22–24, 28 (citing Ex. 1004 ¶¶ 20, 21, 27, Fig. 1). In particular, Petitioner relies on Toyooka’s disclosure that the cores in multicore connector 12 “may be arranged in a one-dimensional form” to show that the optical paths are in a “generally planar array.” IPR1647 Pet. 22–23, 28 (quoting Ex. 1004 ¶ 21). Petitioner asserts that “[o]ne of ordinary skill would understand that the cores 12₁ to 12_{2N} of Toyooka are three-dimensional objects, so they cannot exist merely in one-dimensional form.” IPR1647 Pet. 28; *see also* IPR1647 Ex. 1003 ¶ 50 (“To one skilled in the art, given the teachings of a one-dimensional form and the structure shown in Figure 1 of Toyooka, a one dimensional form means a planar array of fibers.”). Petitioner also relies on Toyooka’s disclosure of connecting multicore fiber tape 30 to wiring unit 1 to show that the cores in the multicore connector are “for optical alignment with optical fibers in an optical fiber ribbon.” IPR1647 Pet. 24 (quoting Ex. 1004 ¶ 27).

Patent Owner raises two arguments with respect to the language of claim 1 reciting “said optical paths being arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path for optical alignment with optical fibers in an optical fiber ribbon.” IPR1647 PO Resp. 16–21. First, Patent Owner argues Toyooka does not disclose “optical alignment with optical fibers in an optical fiber ribbon.” IPR1647 PO Resp. 16–18. According to Patent Owner, “Toyooka does not describe the constitution of optical tape 30.” IPR1647 PO Resp. 17. Patent Owner argues that, “under a proper construction of the term ‘optical ribbon,’

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Toyooka does not anticipate claim 1 or its dependent claim 2” because “Toyooka does not provide enough detail about optical tape 30 to say one way or another whether it is an optical ribbon in the sense of having a ribbon common layer.” IPR1647 PO Resp. 18. Patent Owner also highlights deposition testimony in which Dr. DeCusatis states that Toyooka does not specify whether its tape has a ribbon common layer. IPR1647 PO Resp. 17–18 (quoting IPR1647 Ex. 2002, 49:14–50:1, 53:10–14). Patent Owner’s argument is based on its claim construction requiring an optical fiber ribbon to have a ribbon common layer, which we do not adopt for the reasons discussed above. Dr. DeCusatis, Petitioner’s declarant, testifies: “Toyooka shows that the multi-core connector 12 is connected to a multicore optical-fiber tape 30 that interconnects units. (Toyooka, paragraph 27). To one skilled in the art, the optical tape 30 would be understood to be an optical ribbon.” IPR1647 Ex. 1003 ¶ 51. A reference does not have to use identical terminology to anticipate a claim. *Gleave*, 560 F.3d at 1334 (“[T]he reference need not satisfy an *ipsissimis verbis* test . . .”). We find Toyooka uses the term “tape” to refer to an optical ribbon, as Dr. DeCusatis testifies. *See* IPR1647 Ex. 1003 ¶ 51.⁷

Patent Owner’s second argument is that Toyooka does not disclose that the cores in connector 12 are “arranged in a generally planar array,” as

⁷ We also note that the “optical fiber ribbon” recited in claim 1 of the ’600 patent need not be part of the claimed “optical interconnection structure.” Rather, the optical paths of the multi-fiber connector are arranged in a certain way “for optical alignment with optical fibers in an optical ribbon.” Claim 1 of the ’600 patent does not refer to the “optical fiber ribbon” again or incorporate it into the structure that is actually claimed. Thus, although the claim requires optical paths in the claimed module to be arranged so that they are optically aligned with fibers in a ribbon, the particular constitution of the ribbon is not part of the claimed structure.

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recited in claim 1. IPR1647 PO Resp. 18–21. Patent Owner argues that Figure 1 of Toyooka does not illustrate a planar array because it shows a top view of connector 12 and that Toyooka’s arrangement of cores in “one-dimensional form” (Ex. 1004 ¶ 21) could mean something other than a planar arrangement, such as a zigzag pattern. IPR1647 PO Resp. 19–21.

Although Toyooka’s Figure 1 *alone* may not definitively depict a planar configuration, Toyooka’s description of Figure 1 provides context that confirms the planarity of the cores.

In said multicore connector 12, $2N$ pieces of cores 12_1 to 12_{2N} are arranged symmetrically. Herein, the term “symmetrical” means that the multicore connector 12 and the other multicore connector (not shown) to be fitted with said multicore connector 12 can fit together even when they are relatively turned 180 degrees, centering on the central shaft that is parallel to the optical axis direction. In such a multicore connector 12, for example, the $2N$ pieces of cores *may be arranged in a one-dimensional form* or they *may be arranged on a given circumference of a circle*. In this figure [(Figure 1)], the multicore connector 12 comprises $2N$ pieces of cores 12_1 to 12_{2N} , being arranged in one-dimensional form in the order given.

Ex. 1004 ¶ 21 (emphases added). This passage describes the *arrangement* of cores, and it contrasts a circular arrangement from a one-dimensional arrangement. Dr. DeCusatis testifies:

Toyooka shows that the plurality of cores 12_1 to 12_{2N} of the multi-core connector 12 is generally planar in Figure 1. Figure 1 also shows that cores are immediately adjacent to each other, and Toyooka further describes that the plurality of cores 12_1 to 12_{2N} are arraigned [sic] in a given order in one-dimensional form. To one skilled in the art, given the teachings of a one-dimensional form and the structure shown in Figure 1 of Toyooka, a one dimensional form means a planar array of fibers.

IPR1647 Ex. 1003 ¶ 50.

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In its Response, Patent Owner cites deposition testimony in which Dr. DeCusatis testified that Figure 1 of Toyooka is a “perspective view” and that “you can’t tell from a single perspective view how many dimensions are involved.” IPR1647 PO Resp. 19–20 (quoting Ex. 2002, 66:9–15). The following context, however, is useful in understanding Dr. DeCusatis’s testimony.

Q. Looking at figure 1 of Toyooka, it doesn’t necessarily disclose one way or the other whether it’s one-dimensional form, correct?

A. Well, the language in Toyooka refers to figure 1 and says that figure 1 contains a one-dimensional form.

Q. I understand that, but my question is a little bit different. Looking at figure 1 itself doesn’t disclose one way or the other whether it’s one-dimensional or not, correct?

....

A. I’m not sure I understand your question. The figure has features that have call-out numbers on them, and the call-out numbers are described in the text. And the text refers to those call-out numbers by calling that structure one-dimensional form.

Q. Okay, I understand that. *I’m not asking you about the text. I’m asking about the figure.* Looking at the figure, can one determine one way or the other whether it’s one or two-dimensional form?

....

A. Well, figure 1 shows a perspective view of this module and the fibers and connectors that are in it. So anything that shows a single perspective view, it’s not possible to tell whether you’re looking at one-dimension or more than one dimensions.

Q. That was my question. From figure 1 itself of Toyooka, you can’t tell one way or the other whether it’s one-dimensional or two-dimensional form, correct?

A. Well, as I said, the figure is a perspective view that’s meant to show logical wiring connections inside the module. I’m

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not sure if figure 1 is even supposed to describe a physical interconnection. To the extent that it is, you can't tell from a single perspective view how many dimensions are involved.

IPR1647 Ex. 2002, 64:20–66:15 (emphasis added). From the entire context, it is clear that the examining attorney asked Dr. DeCusatis to determine if Toyooka discloses planar cores from the figure alone without taking into account Toyooka's written description of the figure. Dr. DeCusatis's testimony prior to that instruction was based on both the text and the figures of Toyooka, and it is consistent with his declaration testimony. IPR1647 Ex. 2002, 64:20–65:16; IPR1647 Ex. 1003 ¶ 50.

Patent Owner also posits that Toyooka's disclosure that the arrangement is symmetrical could implicate other patterns, such as a zigzag pattern. IPR1647 PO Resp. 20. We agree that a zigzag pattern may be symmetrical as described in Toyooka, meaning that two connectors "can fit together even when they are relatively turned 180 degrees, centering on the central shaft that is parallel to the optical axis direction." Ex. 1004 ¶ 21. Toyooka, however, does not describe a symmetrical zigzag pattern. Rather, Toyooka gives two examples of symmetrical arrangements—"arranged in a one-dimensional form" or "arranged on a given circumference of a circle"—and expressly discloses that, in Figure 1, "the multicore connector 12 comprises $2N$ pieces of cores 12_1 to 12_{2N} , *being arranged in one-dimensional form* in the order given." Ex. 1004 ¶ 21 (emphasis added).

We find that Toyooka's "one-dimensional" arrangement of cores describes optical paths "arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path," as recited in claim 1. This finding is supported by the disclosure of Toyooka and the

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testimony of Dr. DeCusatis, as discussed above. Ex. 1004 ¶ 21, Fig. 1; IPR1647 Ex. 1003 ¶ 50.

For the foregoing reasons, we find Toyooka discloses an “optical interconnection module” having

an optical interconnection section formed in a wall of said module, said optical interconnection section having a multi-fiber connector with multiple optical paths formed therein, said optical paths being arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path for optical alignment with optical fibers in an optical fiber ribbon, as recited in claim 1 of the '600 patent.

c. Optical connector station

Claim 1 further recites that the claimed “optical interconnection module” has “an optical connector station formed in a wall of said module having a plurality of optical fiber connectors.” Petitioner contends “single-core connectors 14₁ to 14_{2N}” of Toyooka’s wiring unit describe “an optical connector station formed in a wall of said module having a plurality of optical fiber connectors,” as recited in claim 1. IPR1647 Pet. 24 (citing Ex. 1004 ¶ 20, Fig. 1). Toyooka discloses that optical-fiber wiring unit 1 “comprises 2N pieces of single-core connectors 14₁ to 14_{2N} being arranged--side by side in the order given--on the other lateral surface of the box 10.” Ex. 1004 ¶ 20. Dr. DeCusatis testifies that “[e]ach connector 14₁ to 14_{2N} is respectively connected to one of the plurality of optical fibers 16₁ to 16_{2N} to interconnect the single-core connectors 14₁ to 14_{2N} to the multi-core connector 12.” IPR1647 Ex. 1003 ¶ 52 (citing Ex. 1004 ¶ 23). We agree with Dr. DeCusatis’s testimony because Toyooka discloses that “each of the cores 12₁ to 12_{2N} of the multicore connector 12 is connected with the respective one of the single-core connectors 14₁ to 14_{2N}, said connection

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being achieved on a one-to-one basis by means of the respective one of the single-core optical fibers 16₁ to 16_{2N}.” Ex. 1004 ¶ 23. Thus, we find single-core connectors 14₁ to 14_{2N} disclose a plurality of optical fiber connectors because connectors 14₁ to 14_{2N} connect to optical fibers 16₁ to 16_{2N}.

Ex. 1004, Fig. 1.

Therefore, we find Toyooka discloses an “optical interconnection module” having “an optical connector station formed in a wall of said module having a plurality of optical fiber connectors,” as recited in claim 1 of the ’600 patent.

d. Optical interconnection arrangement

Claim 1 further recites “said optical paths and said optical connectors being optically interconnected by optical fibers disposed in said cavity, fiber pairs being formed by the optical fibers.” Petitioner contends that “single-core optical fibers 16₁ to 16_{2N}” of Toyooka’s wiring unit describe “optical fibers disposed in said cavity” that form fiber pairs and that optically interconnect the cores of the multicore connector (i.e., “said optical paths”) and single-core connectors 14₁ to 14_{2N} (i.e., “said optical connectors”). IPR1647 Pet. 24–25 (citing Ex. 1004 ¶ 23, Fig. 1). Toyooka discloses that, “within said box 10, each of the cores 12₁ to 12_{2N} of the multicore connector 12 is connected with the respective one of the single-core connectors 14₁ to 14_{2N}, said connection being achieved on a one-to-one basis by means of the respective one of the single-core optical fibers 16₁ to 16_{2N}.” Ex. 1004 ¶ 23. Toyooka also discloses that “each of the two single-core connectors *constituting each connector pair* is connected, by means of an optical fiber, to each of the two symmetrically situated cores of the multicore connector 12.” Ex. 1004 ¶ 23 (emphasis added). Thus, Toyooka discloses

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optically connecting pairs of single-core connectors with pairs of cores in the multicore connector using optical fibers within the wiring unit. Therefore, we find Toyooka discloses “said optical paths and said optical connectors being optically interconnected by optical fibers disposed in said cavity, fiber pairs being formed by the optical fibers,” as recited in claim 1 of the ’600 patent.

Claim 1 further recites:

at least one of the fiber pairs being routed to a respective connector station that is in optical communication with said optical paths, said at least one optical fiber pair being optically interconnected with at least two of said optical paths, said at least two optical paths selected from optical paths not being immediately adjacent to each other.

Petitioner contends Toyooka discloses that adjacent single-core connectors form in pairs and optically interconnect with cores in the multicore connector. IPR1647 Pet. 25, 29 (citing Ex. 1004 ¶¶ 23, 24, Fig. 1).

Furthermore, Petitioner contends that Toyooka discloses that at least two of the cores (i.e., “optical paths”) that connect to a connector pair via a fiber pair are not immediately adjacent to each other. Pet. 25, 29. We are persuaded that Toyooka discloses this subject matter. In particular, Toyooka discloses that “each of the single-core connectors 14₁ and 14₂, which constitute a connector pair, is connected to the respective one of the symmetrically situated cores 12₁ and 12_{2N} of the multicore connector 12 via the respective one of the optical fibers 16₁ and 16₂.” Ex. 1004 ¶ 24; *see also* Ex. 1004 ¶ 42 (cited at IPR1647 Dec. on Inst. 22) (“[I]n the optical-fiber wiring unit shown in the above-mentioned embodiment, 2N pieces of single-core connectors are provided to thereby form an N number of connector pairs; however, N pieces of two-core connectors may be provided in place

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thereof.”). In Figure 1 of Toyooka, the pair consisting of single-core connectors 14_{2N-1} and 14_{2N} (bottom left in Figure 1) is connected to adjacent cores in the multicore connector, but all other connector pairs are connected to non-adjacent cores. For example, Figure 1 of Toyooka shows a pair of fibers (16_1 and 16_2) connected, respectively, to cores 12_1 and 12_{2N} , which are not adjacent. Similarly, fibers 16_3 and 16_4 are connected, respectively, to cores 12_2 and 12_{2N-1} , which are not adjacent. Thus, Toyooka discloses multiple instances in which fiber pairs are made from cores in the multicore connector that are not immediately adjacent to each other.

Therefore, we also find Toyooka discloses
at least one of the fiber pairs being routed to a respective connector station that is in optical communication with said optical paths, said at least one optical fiber pair being optically interconnected with at least two of said optical paths, said at least two optical paths selected from optical paths not being immediately adjacent to each other,
as recited in claim 1 of the '600 patent.

e. Determination of unpatentability of claim 1 of the '600 patent

For the reasons discussed above, we find Toyooka describes all of the limitations of claim 1 of the '600 patent. Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that claim 1 of the '600 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

3. Dependent Claim 2 of the '600 Patent

Claim 2 of the '600 patent recites: “The optical interconnection module of claim 1, at least 80% of said fiber pairs being optically interconnected with optical paths selected from optical paths not being immediately adjacent to each other.” Petitioner argues:

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While Figure 1 of Toyooka explicitly illustrates only 75% of the pairs of optical fibers 16_1 - 16_{2N} being routed to non-adjacent cores 12_1 - 12_{2N} of the multicore connector 12, Toyooka teaches that N can be any integer. (Ex. 1004, ¶ 20). Thus, if more than twelve fibers were illustrated in Figure 1 rather than eight, something Toyooka anticipates, and the fiber routing method taught by Toyooka was continued according to ¶ 24, the 80% threshold would be reached. Thus, Toyooka teaches the limitations of claim 2.

Pet. 29–30.

Toyooka discloses: “The following description is provided on the general assumption that the number of cores is $2N$ (wherein N represents an integral number equal to or greater than 2).” Ex. 1004 ¶ 20. In describing the wiring scheme of Figure 1, Toyooka discloses that “the single-core connectors 14_{2n-1} and 14_{2n} constituting a connector pair are each connected to the respective ones of symmetrically situated cores 12_n and 12_{2N+1-n} of the multicore connector 12 via the respective ones of the optical fibers 16_{2n-1} and 16_{2n} .” Ex. 1004 ¶ 24 (cited at IPR1647 Pet. 29–30). Thus, Toyooka describes its wiring scheme in a manner so as to be applicable to any integral number N greater than or equal to two, and in Toyooka’s wiring scheme, only one fiber pair is optically connected to adjacent cores in the multicore connector. In particular, in Figure 1, only the fiber pair consisting of 16_{2N} and 16_{2N-1} is optically connected to adjacent cores 12_N and 12_{N+1} . Ex. 1004 ¶ 24, Fig. 1. Furthermore, Toyooka describes setting N equal to six such that there would be 12 cores in the multicore connector and 12 single-core connectors. Ex. 1004 ¶ 43 (cited at IPR1647 Dec. on Inst. 23) (“[S]ix sets of subunits ($N = 6$ in Figure 1), [each]⁸ consisting of a 12-core connectors and 12 single-core connectors, are provided in the optical-fiber wiring unit.”).

⁸ The brackets are in the translation as provided.

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When N equals six, therefore, one fiber pair (16_{11} and 16_{12}) will be connected to adjacent cores 12_6 and 12_7 , and the other five fiber pairs are optically interconnected with non-adjacent cores, which is greater than 80% of the fiber pairs (5/6).

Therefore, we find Toyooka describes all of the limitations of claim 2 of the '600 patent. Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that claim 2 of the '600 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

4. Claim 1 of the '227 Patent

Although claim 1 of the '600 patent is directed to “[a]n optical interconnection module,” claim 1 of the '227 patent is directed to a “[a] universal breakout harness for reversing the polarity of optical fibers.” The '227 patent describes that a “breakout harness” may be “either loaded in a module (see FIGS. 2–4) or by itself (see FIG. 5).” Ex. 1001, 3:51–52. Therefore, the breakout harness of claim 1 of the '227 patent may be in a module but need not be. As discussed with respect to claim 1 of the '600 patent, Toyooka discloses a wiring unit, i.e., a module.

Although there are slight differences in wording between claim 1 of the '600 patent and claim 1 of the '227 patent, both claims recite generally the same subject matter, and Petitioner’s contentions with respect to Toyooka are similar as to each claim.

a. Multi-fiber connector

Claim 1 of the '227 patent recites that the claimed “universal breakout harness” has “a multi-fiber connector with multiple optical paths formed therein, the optical paths being arranged in a generally planar array with

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each optical path being immediately adjacent to at least one other optical path.” Claim 1 of the ’600 patent recites nearly identical subject matter, and Petitioner’s contentions are similar as to both claims. In particular, Petitioner contends “multicore connector 12” of Toyooka discloses “a multi-fiber connector with multiple optical paths formed therein.” IPR1648 Pet. 19, 30–31 (citing Ex. 1004 ¶¶ 20, 23, Fig. 1). Petitioner also contends Toyooka describes that the “the optical paths [are] arranged in a generally planar array with each optical path being immediately adjacent to at least one other optical path.” IPR1648 Pet. 19–20, 30–31 (citing Ex. 1004 ¶¶ 20, 21, Fig. 1). In particular, Petitioner relies on Toyooka’s disclosure that the cores in multicore connector 12 “may be arranged in a one-dimensional form” to show that the optical paths are in a “generally planar array.” IPR1648 Pet. 19–20, 30–31 (quoting Ex. 1004 ¶ 21).

For the reasons explained with respect to the same subject matter of claim 1 of the ’600 patent, we find Toyooka discloses “a multi-fiber connector with multiple optical paths formed therein, the optical paths being arranged in a generally planar array with each optical path being immediately adjacent to at least one other optical path.” In particular, we find Toyooka’s multicore connector discloses a “multi-fiber connector” and that Toyooka’s “one-dimensional” arrangement of cores in the multicore connector describes optical paths “arranged in a generally planar array with the paths being immediately adjacent to at least one other optical path.” Ex. 1004 ¶¶ 20, 21, 23, Fig. 1; IPR1648 Ex. 1003 ¶¶ 58–59.

b. Optical fibers of an optical ribbon

Claim 1 of the ’227 patent recites the following three limitations that involve “optical fibers of an optical ribbon”:

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a plurality of optical fibers of an optical ribbon disposed in the optical paths formed in the multi-fiber connector; and

a plurality of optical fiber connectors disposed opposite the multi-fiber connector, the plurality of optical fiber connectors defining a plurality of pairs of optical paths for receiving the optical fibers of the optical ribbon;

wherein the optical fibers of the optical ribbon are separated and routed between the optical paths formed in the multi-fiber connector and the pairs of optical paths defined by the plurality of optical fiber connectors.

We will refer to these limitations collectively as the “optical ribbon limitations.”

With respect to the first of the optical ribbon limitations, Petitioner contends:

Limitation 1.b calls for a plurality of optical fibers of an optical ribbon disposed in the optical paths formed in the multi-fiber connector. Toyooka discloses that the optical fibers 16_1 to 16_{2N} are an optical ribbon and disposed in the plurality of cores 12_1 to 12_{2N} formed in the multicore connector 12. Figure 1 of Toyooka illustrates that the fibers 16_1 to 16_{2N} are grouped and aligned and arrayed in a planar array, so Figure 1 illustrates that the fibers 16_1 to 16_{2N} formed in the cores 12_1 to 12_{2N} of the multicore connector 12 are a ribbon.

IPR1648 Pet. 31; *see also* IPR1648 Pet. 20–21 (Petitioner’s claim chart, citing Ex. 1004 ¶ 20, Fig. 1).

As to the second limitation, Petitioner contends “single-core connectors 14_1 to 14_{2N} ” of Toyooka’s wiring unit describe “a plurality of optical fiber connectors disposed opposite the multi-fiber connector, the plurality of optical fiber connectors defining a plurality of pairs of optical paths for receiving the optical fibers of the optical ribbon.” IPR1648 Pet. 21–22 (citing Ex. 1004 ¶¶ 20, 22, 23); IPR1648 Pet. 31–32.

As to the third limitation, Petitioner cites Toyooka's disclosure of the routing of optical fibers 16_1 to 16_{2N} between multicore connector 12 and pairs of connectors 14 to show that Toyooka discloses the claimed separation and routing. IPR1648 Pet. 22–23, 32 (citing Ex. 1004 ¶¶ 20, 22–24, Fig. 1).

Thus, Petitioner contends that “fibers 16_1 to 16_{2N} formed in the cores 12_1 to 12_{2N} of the multicore connector 12 are a ribbon” and that these fibers are separated and routed to connectors 14_1 to 14_{2N} . Pet. 31–32. Figure 1 of Toyooka is reproduced below.

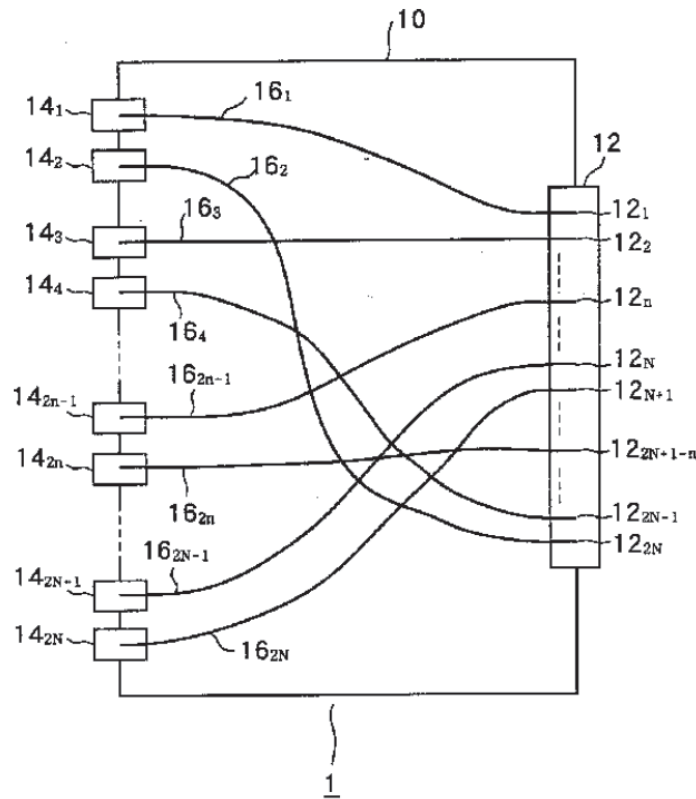


Figure 1 depicts an optical fiber wiring unit having “multicore connector 12” on one side of “box 10” and “single-core connectors 14_1 to 14_{2N} ” on the other side of box 10. Ex. 1004 ¶ 20.

Patent Owner argues that Toyooka does not disclose these limitations because fibers 16_1 to 16_{2N} are not an “optical ribbon” under Patent Owner’s

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proposed construction. IPR1648 PO Resp. 17–27. As discussed above, however, we do not adopt Patent Owner’s proposed construction of “optical ribbon.” Based on our construction of “optical ribbon” as encompassing “optical fibers that are bonded together in a generally planar array or optical fibers that are grouped and aligned in a generally planar array,” we are persuaded by Petitioner’s contentions as to the optical ribbon limitations, and we find Toyooka describes the subject matter of the optical ribbon limitations. In particular, Toyooka discloses that fibers 16_1 to 16_{2N} disclose an optical ribbon because, when they are disposed in the multicore connector, they are aligned with cores of the multicore connector that are “arranged in a one-dimensional form” (Ex. 1004 ¶ 21), i.e., fibers 16_1 to 16_{2N} are grouped and aligned in a generally planar array. Therefore, we find Toyooka discloses the first optical ribbon limitation.

As to the second optical ribbon limitation, Toyooka discloses that “each of the cores 12_1 to 12_{2N} of the multicore connector 12 is connected with the respective one of the single-core connectors 14_1 to 14_{2N} , said connection being achieved on a one-to-one basis by means of the respective one of the single-core optical fibers 16_1 to 16_{2N} .” Ex. 1004 ¶ 23. As shown in Figure 1 of Toyooka, connectors 14_1 to 14_{2N} are on the other side of the wiring unit from the multicore connector (i.e., “disposed opposite the multi-fiber connector”). Ex. 1004 ¶ 20 (The optical-fiber wiring unit of Figure 1 “also comprises $2N$ pieces of single-core connectors 14_1 to 14_{2N} being arranged--side by side in the order given--*on the other lateral surface* of the box 10.” (emphasis added)). Toyooka also discloses that the connectors form in pairs for input and output. Ex. 1004 ¶ 22 (“[T]he two single-core connectors 14_{2n-1} and $14_{2n} \dots$, being situated next to each other, constitute a connector pair wherein one is used as a single-core connector for input and

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another as a single-core connector for output.”). Therefore, we find Toyooka discloses “a plurality of optical fiber connectors disposed opposite the multi-fiber connector, the plurality of optical fiber connectors defining a plurality of pairs of optical paths for receiving the optical fibers of the optical ribbon.”

As to the third optical ribbon limitation, Toyooka discloses that fibers 16_1 to 16_{2N} are separated and routed from the multicore connector to connectors 14_1 to 14_{2N} on the other side of the wiring unit. Ex. 1004, Fig. 1. The claimed separation and routing is evident from Figure 1 of Toyooka, which shows that symmetrical fibers in the core are paired at connectors 14_1 to 14_{2N} . For example, fibers 16_1 and 16_3 are next to each other in the multicore connector, but they are separated and routed to different connector station pairs. Therefore, the fibers in the core are separated and routed from the arrangement in the core to their respective connector stations. Ex. 1004 ¶ 24 (“[T]he single-core connectors 14_{2n-1} and 14_{2n} constituting a connector pair are each connected to the respective ones of symmetrically situated cores 12_n and 12_{2N+1-n} of the multicore connector 12 via the respective ones of the optical fibers 16_{2n-1} and 16_{2n} .”), Fig. 1.

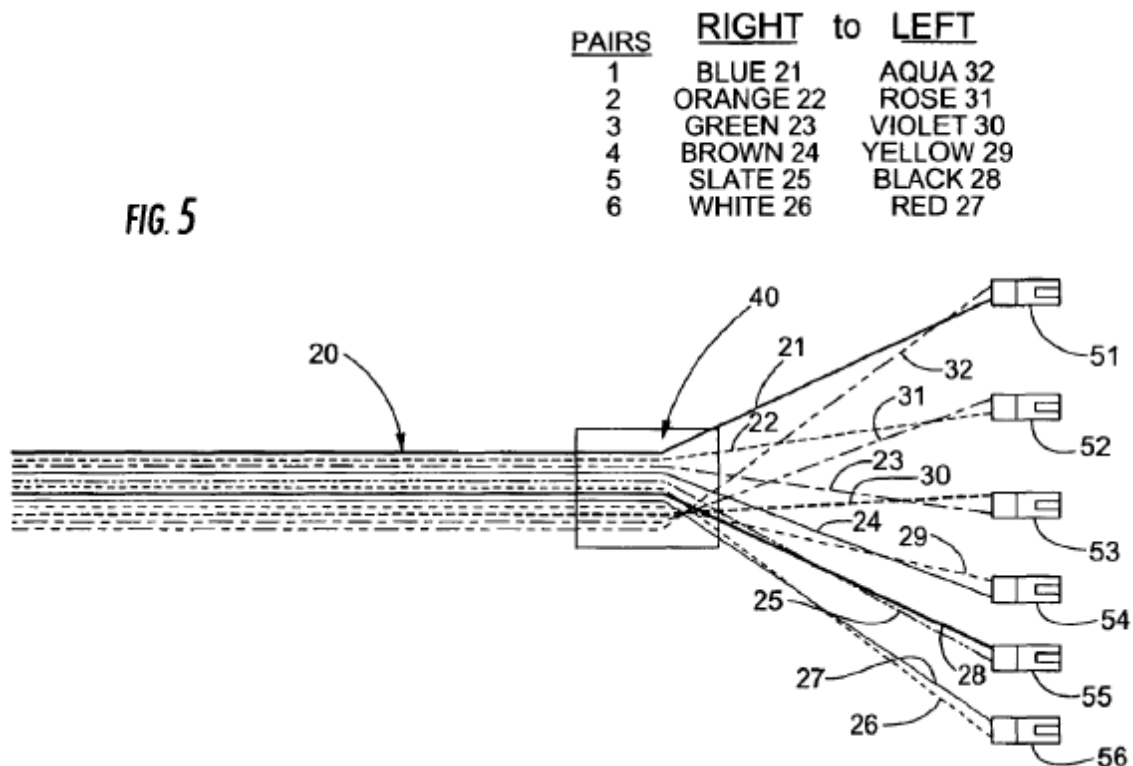
We further provide the following discussion of Patent Owner’s arguments to highlight that Toyooka describes the claimed subject matter under other interpretations of “optical ribbon” because Toyooka describes the subject matter described in the specification of the ’227 patent.

Turning first to Patent Owner’s characterization of the claimed subject matter, Patent Owner argues that “Figure 5 of the ’227 patent shows fibers of optical ribbon 20 disposed in the optical paths formed in multi-fiber connector 40” and that “[t]his preferred embodiment satisfies the language

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of claim 1.” IPR1648 PO Resp. 17 (citing Ex. 1001, Fig. 5; IPR1648 Ex. 2001 ¶¶ 35–41). Figure 5 of the ’227 patent is reproduced below.



The ’227 patent states that Figure 5 “is a schematic view of a breakout harness without a module according to the present invention.” Ex. 1001, 2:40–41. Patent Owner argues:

[T]he technique contemplated in Toyooka is **not** the same technique described and illustrated in the ’227 patent. Ex. 2001, ¶¶ 35–46. In the ’227 patent, the fibers of optical ribbon 20 are disposed in the optical paths formed in multi-fiber connector 40, at which point those **same fibers** are separated and routed to the individual connectors on the right

IPR1648 PO Resp. 23 (citing Ex. 1001, Fig. 5; Ex. 2001 ¶ 40).

In addition, Patent Owner’s declarant, Mr. Pearson, provides testimony attempting to explain how the limitations of claim 1 of the ’227 patent are found in Figure 5.

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First, there is “a multi-fiber connector,” namely “MTP” or “MPO” connector 40. (’227 Patent at 3:52-59)

Second, there is “an optical ribbon disposed in the optical paths formed in the multi-fiber connector,” namely the “optical fiber ribbon 20” that enters into connector 40. (’227 Patent at 3:57-59)

Third, there is “a plurality of optical fiber connectors disposed opposite the multi-fiber connector,” namely the “optical connectors at stations 51-56.” (’227 Patent at 3:30-31).

Fourth, this plurality of optical fiber connectors defines “optical paths for receiving the optical fibers of the optical ribbon.” As shown on the right side of Figure 5 above, the fibers of optical ribbon 20 are received by these connectors.

Fifth, “the optical fibers of the optical ribbon are separated and routed between the optical paths formed in the multi-fiber connector and the pairs of optical paths defined by the plurality of optical fiber connectors.” As shown in Figure 5 above, optical ribbon 20 is separated after it enters multi-fiber connector 40. Those same fibers are then routed to the connector pairs formed at stations 51-56 on the right.

Sixth, the routing forms pairs of fibers that were “not immediately adjacent to each other” within the optical ribbon. For example, the fiber pair in station 51 in the upper-right is formed from two fibers that were not adjacent to each other within ribbon 20.

IPR1648 Ex. 2001 ¶¶ 36–41.

Patent Owner and Mr. Pearson both argue, therefore, that the fibers to the right of connector 40 in Figure 5 are the *same fibers* as the fibers to the left of connector 40, as opposed to fibers that are optically connected to fibers to the left of connector 40. The claim language and the specification of the ’227 patent, however, indicate otherwise. Starting with the claim language, claim 1 of the ’227 patent recites “a multi-fiber connector with multiple optical paths formed therein.” We agree with Mr. Pearson that

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connector 40 in Figure 5 corresponds to the claimed “multi-fiber connector.”

IPR1648 Ex. 2001 ¶ 36. However, the claimed “multi-fiber connector” has

“multiple optical paths formed therein.” If, as Patent Owner and Mr.

Pearson assert, the fibers to the right of connector 40 in Figure 5 are the same fibers as those to the left of connector 40, then the “multiple optical paths” in the multi-fiber connector would have no meaning because the fibers themselves have their own optical paths. Rather, the multi-fiber connector would merely have channels or conduits within which the fibers would be situated.

The specification of the ’600 and ’227 patents explains that connector 40 “contains *multiple optical paths*, the optical paths being arranged in a generally planar array. The optical paths being immediately adjacent to at least one other optical path *for optical alignment with the optical fibers in an optical fiber ribbon.*” Ex. 1001, 2:63–67 (emphases added). Connector 40 contains “optical paths,” which are paths through which light travels, such as the light from the fibers within ribbon 20 connected to connector 40. During oral argument, Patent Owner’s counsel confirmed that an optical path is a signal path. Tr. 26:5–6 (Patent Owner’s counsel stating “from my reading of the ’227 and the ’600 patents, I take optical path to mean signal path.”). However, Patent Owner’s counsel argued that the specification of the ’600 and ’227 patents describes two types of connectors, a “pass-through type” connector and a “biconic connector”:

[T]he specification discloses kind of this pass-through type of multifiber connector that I just described and then what might sometimes be referred to as a biconic connector, which is more kind of standard as you think about it. There is an optical ribbon that comes in and there is a separate optical ribbon that leaves the

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multifiber connector. And so the discussion I was describing there in column 2 for the '600 patent at lines 42 to 45 is the pass-through. And then further down lines 57 through 60 where it talks about the optical paths -- just to be sure, optical paths I think you can think about as a signal path or a signal propagation path being immediately adjacent to at least one other optical path for optical alignment with the optical fibers in an optical fiber ribbon.

Tr. 18:12–22.

JUDGE GALLIGAN: I'm having a little trouble understanding. So what is the point of a connector if it doesn't connect to anything?

MR. HAYES: As I mentioned --

JUDGE GALLIGAN: It's just a jacket that goes around it?

MR. HAYES: That's right. It's a structure. It's a jacket. It keeps the individual fibers from getting stripped back. It keeps your separation and routing point where you want it. It's a structure in which you can take the harness and hook it to the equipment and keep it in place.

JUDGE GALLIGAN: That would be known as a connector?

MR. HAYES: Pass-through connector, yes.

Tr. 22:1–10; *see also* Tr. 18:7–10 (Patent Owner's counsel stating: "So in that case the connector is acting more like in the context, for example, of a harness in its structure that protects it is fibers from, for example, stripping further back. It maintains where that spread-out or the fan-out of the fibers is on your optical ribbon.").

We do not agree that the '600 and '227 patents describe a "pass-through type" connector as described by Patent Owner during the oral argument.⁹ As support, Patent Owner cites the following disclosure of the

⁹ Patent Owner's current position is inconsistent with an earlier position it took that, in Figure 5 of the '227 patent, "[t]he optical fibers of the ribbon

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'600 and '227 patents: "Module 60 is optically associated with an optical fiber ribbon 20, for example, having twelve distinctly colored optical fibers 21–32 disposed in a matrix." Ex. 1001, 2:50–53 (corresponding to the '600 patent, 2:42–45 (cited at Tr. 18:16–17)). This disclosure undermines Patent Owner's argument because the module is still "optically associated" with the ribbon, which would not happen in a pass-through type connector as described by Patent Owner's counsel because such a connector allegedly merely holds fibers in place rather than provides any optical coupling. However, even if the '600 and '227 patents describe such a pass-through connector, a contention with which we do not agree, the connector that is claimed in claim 1 of the '227 patent has "multiple optical paths formed therein." A jacket or structure that merely holds fibers in place would have no need for its own optical paths because the optical paths would be in the fibers held by such a structure. Therefore, the "pass-through type" connector described by Patent Owner during the oral argument is not the "connector" recited in claim 1 of the '227 patent or described in the specification of the '600 and '227 patents.

The '600 and '227 patents describe that the module is optically associated with the ribbon via the optical paths of the connector:

The epoxy and polish connector is a twelve-fiber connector achieving very high density in a small space, it contains multiple optical paths, the optical paths being arranged in a generally planar array. The optical paths being immediately adjacent to at least one other optical path for optical alignment with the optical fibers in an optical fiber ribbon.

are connected to *optical fibers from within the module* that are also 'ribbonized' (bonded together in a planar array) before they are placed into the connector." IPR1648 Prelim. Resp. 3 (emphasis added).

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Ex. 1001, 2:61–67. The '600 and '227 patents state that “the optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60.”

Ex. 1001, 3:30–33. Thus, the '600 and '227 patents describe a connector having multiple optical paths on one side of the module and fibers within the module that connect the optical paths of the connector to optical fiber connectors on the other side of the module. Ex. 1001, 2:57–67, 3:3:14–34, Figs. 2, 5. This is the structure described in Figure 2 of the '600 and '227 patents and in Figure 5 of the '227 patent. See Tr. 24:4–5 (Counsel for Patent Owner: “So Figure 5, the only difference between Figure 5 and Figure 2 is Figure 5 removes the module.”).

When claim 1 of the '227 patent is viewed in light of the specification, it is clear that Toyooka describes the subject matter claimed. Figure 2 of Toyooka is reproduced below.

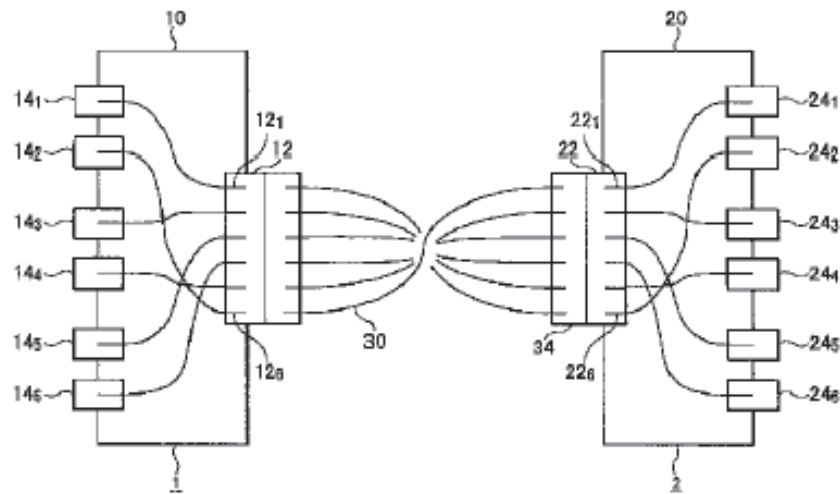


Figure 2 of Toyooka “is a diagram that illustrates the connection configuration of the optical-fiber wiring unit, as is claimed by the present embodiment, and a multicore optical-fiber tape.” Ex. 1004 ¶ 25. Toyooka explains that optical fiber wiring units 1 and 2 are “identical to what has

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been described with reference to Figure 1” except that N equals three in Figure 2 (i.e., there are six fibers). Ex. 1004 ¶ 26.

As noted above, we are persuaded that Toyooka describes the subject matter of the optical ribbon limitations under our construction of “optical ribbon.” Patent Owner and Mr. Pearson contend that optical ribbon 20 in Figure 5 of the ’227 patent corresponds to the “optical ribbon” of claim 1 of the ’227 patent. 1648 PO Resp. 17, 23; 1648 Ex. 2001 ¶ 37. Toyooka likewise describes multicore optical-fiber tape 30 connecting to the multicore connectors of the wiring units. Ex. 1004, Fig. 2. As shown in Figure 2 of Toyooka, the optical fibers of tape 30 are aligned with the cores of the multicore connectors and, therefore, are “disposed in the optical paths formed in the multi-fiber connector.”

As discussed above, Patent Owner and Mr. Pearson both assert that the fibers to the right of connector 40 in Figure 5 are the *same fibers* as the fibers to the left of connector 40, as opposed to fibers that are optically connected to fibers to the left of connector 40. IPR1648 PO Resp. 23; IPR1648 Ex. 2001 ¶¶ 36–41. The ’600 and ’227 patents, however, describe and claim a connector having optical paths, as explained above, rather than a mere “pass-through type” connector. Therefore, we understand the ’600 and ’227 patents to be describing the fibers to the right of connector 40 in Figures 2 and Figure 5 to be fibers that are optically associated with fibers in the ribbon but not the same pieces of fiber. Ex. 1001, 3:30–33 (“[T]he optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60.”). Understood in this light, Toyooka describes the same configuration—fibers 16₁ to 16_{2N} in the wiring unit depicted in Figure 1 of Toyooka. Ex. 1004, Fig. 1.

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The '600 and '227 patents describe how fibers are “separated and routed,” as claimed, by reference to Figure 2 (and by extension Figure 5).

FIG. 2 illustrates an exemplary fiber wiring scheme for routing of optical fibers from connector 40 to single or multi-fiber connectors located at connector stations 51–56, defined at a break-out section 50 of module 60. Each connector station 51–56 preferably includes one or more connectors. In the module, an exemplary routing scheme is the following With reference to FIG. 2, the fiber pairs are defined as follows: 21–32; 22–31; 23–30; 24–29; 25–28; and 26–27. At least one but preferably at least 80% of the fiber pairs routed to respective connector stations 51–56 are made by fibers not immediately adjacent in the optical fiber ribbon 20. In other words, the optical paths of connector 40 and the optical connectors at stations 51–56 are optically interconnected by optical fibers disposed in cavity 62 of the module 60, the fiber pairs being formed by the optical fibers. At least one of the fiber pairs being in optical communication with respective optical paths in connector 40 and being routed to a respective connector station, the at least two optical paths being selected from optical paths not being immediately adjacent to each other.

Ex. 1001, 3:14–38. According to the '600 and '227 patents, therefore, fibers from ribbon 20 connect to optical paths in connector 40, and the optical paths of connector 40 are routed to particular connector stations via optical fibers within the cavity of the module.

Toyooka illustrates this separation and routing in Figure 1 and describes it as follows: “[T]he single-core connectors 14_{2n-1} and 14_{2n} constituting a connector pair are each connected to the respective ones of symmetrically situated cores 12_n and 12_{2N+1-n} of the multicore connector 12 via the respective ones of the optical fibers 16_{2n-1} and 16_{2n} .” Ex. 1004 ¶ 24. We, therefore, do not agree with Patent Owner’s assertion that “[n]othing in Toyooka describes separating ribbon fibers between multi-core connector 12 and connector 14, as the plain language of claim 1 requires.” See IPR1648

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PO Resp. 29. Rather, fibers from the multicore connector in Toyooka are separated and routed to connector stations on the other side of the wiring unit following the same routing scheme disclosed in the '600 and '227 patents.

For the foregoing reasons, we find Toyooka describes the subject matter of the optical ribbon limitations of claim 1 of the '227 patent.

c. Optical interconnection arrangement

Claim 1 of the '227 patent further recites “wherein the optical fibers in at least one of the pairs of optical paths defined by the plurality of optical fiber connectors are selected from optical fibers disposed in optical paths formed in the multi-fiber connector that are not immediately adjacent to each other.” This limitation is similar to a limitation in claim 1 of the '600 patent. Petitioner contends Toyooka discloses “that at least one pair of single-core connectors 14_1 - 14_{2N} are optically interconnected by two optical fibers 16_1 - 16_{2N} to two non-adjacent cores 12_1 - 12_{2N} of the multicore connector 12.” IPR1648 Pet. 32 (citing Ex. 1004 ¶ 24); *see also* IPR1648 Pet. 23–24 (citing Ex. 1004 ¶ 24, Fig. 1). We are persuaded that Toyooka discloses this subject matter. In particular, Toyooka discloses that “each of the single-core connectors 14_1 and 14_2 , which constitute a connector pair, is connected to the respective one of the symmetrically situated cores 12_1 and 12_{2N} of the multicore connector 12 via the respective one of the optical fibers 16_1 and 16_2 .” Ex. 1004 ¶ 24; *see also* Ex. 1004 ¶ 42 (cited at IPR1648 Dec. on Inst. 23) (“[I]n the optical-fiber wiring unit shown in the above-mentioned embodiment, $2N$ pieces of single-core connectors are provided to thereby form an N number of connector pairs; however, N pieces of two-core connectors may be provided in place thereof.”). In Figure 1 of Toyooka, the

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pair consisting of single-core connectors 14_{2N-1} and 14_{2N} (bottom left in Figure 1) is connected to adjacent cores in the multicore connector, but all other connector pairs are connected to non-adjacent cores.

Therefore, we find Toyooka discloses “wherein the optical fibers in at least one of the pairs of optical paths defined by the plurality of optical fiber connectors are selected from optical fibers disposed in optical paths formed in the multi-fiber connector that are not immediately adjacent to each other.”

d. Determination of unpatentability of claim 1 of the '227 patent

For the reasons discussed above, we find Toyooka describes all of the limitations of claim 1 of the '227 patent. Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that claim 1 of the '227 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

5. Dependent Claim 2 of the '227 Patent

Claim 2 of the '227 patent recites:

The universal breakout harness of claim 1, wherein at least 80% of the optical fibers in the pairs of optical paths defined by the plurality of optical fiber connectors are selected from optical fibers disposed in optical paths formed in the multi-fiber connector that are not immediately adjacent to each other.

This limitation is similar to claim 2 of the '600 patent.

Petitioner argues:

While Figure 1 of Toyooka explicitly illustrates only 75% of the pairs of optical fibers 16_1 - 16_{2N} being routed to non-adjacent cores 12_1 - 12_{2N} of the multicore connector 12, Toyooka teaches that N can be any integer. (Ex. 1004, ¶ 20). Thus, if more than twelve fibers were illustrated in Figure 1 rather than eight, something Toyooka anticipates, and the fiber routing method taught by Toyooka was continued according to paragraph 24, the

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80% threshold would be reached. Thus, Toyooka teaches the limitations of claim 2.

IPR1648 Pet. 33.

As discussed above with respect to claim 2 of the '600 patent, Toyooka describes setting N equal to six in the wiring unit of Figure 1. Ex. 1004 ¶ 43 (cited at IPR1648 Dec. on Inst. 25). Toyooka describes its wiring scheme in a manner so as to be applicable to any integral number N greater than or equal to two, and in Toyooka's wiring scheme, only one fiber pair is optically connected to adjacent cores in the multicore connector. Ex. 1004 ¶¶ 20, 24, Fig. 1). When N equals six, one fiber pair (16₁₁ and 16₁₂) will be connected to adjacent cores 12₆ and 12₇, and the other five fiber pairs are optically interconnected with non-adjacent cores, which is greater than 80% of the fiber pairs (5/6).

Therefore, we find Toyooka describes all of the limitations of claim 2 of the '227 patent. Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that claim 2 of the '227 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

6. Dependent Claims 8–10 of the '227 Patent

Petitioner further contends Toyooka anticipated claims 8–10 of the '227 patent, which depend from independent claim 1. IPR1648 Pet. 25–28, 33–34. Claim 8 recites:

The universal breakout harness of claim 1, wherein the plurality of optical fibers are identified by numbers 1 through X, where X is the total number of optical fibers in the optical ribbon, and the optical fibers are attached to the multi-fiber connector in numerical order from 1 through X and are paired for external connection to successive optical fiber connectors: 1 and X, 2 and X-1, etc., until all fibers are paired.

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Thus, claim 8 requires pairing the first optical fiber with the last fiber, and the second optical fiber with the second-to-last fiber, and so on. Petitioner contends “Toyooka teaches the exact same numbering scheme,” and we agree. IPR1648 Pet. 25–27, 33 (citing Ex. 1004 ¶¶ 21, 24, Fig. 1). We find Toyooka discloses this pairing scheme because it describes that symmetrically situated cores are paired together, as illustrated in Figure 1 and described in Toyooka: “[T]he single-core connectors 14_{2n-1} and 14_{2n} constituting a connector pair are each connected to the respective ones of symmetrically situated cores 12_n and 12_{2N+1-n} of the multicore connector 12 via the respective ones of the optical fibers 16_{2n-1} and 16_{2n} .”). Ex. 1004 ¶ 24. Therefore, in Toyooka, the first and the last fibers from the multicore connector are paired, and the second and the second-to-last fibers are paired, and so on.

Claim 9 depends from claim 8 and further recites that “X,” the number of fibers in the optical ribbon, is equal to 12. As noted above, Toyooka describes setting N equal to six such that there would be 12 cores in the multicore connector and, therefore, 12 fibers. Ex. 1004 ¶ 43 (cited at IPR1648 Dec. on Inst. 26) (“[S]ix sets of subunits ($N = 6$ in Figure 1), [each]¹⁰ consisting of a 12-core connectors and 12 single-core connectors, are provided in the optical-fiber wiring unit.”). Therefore, we find Toyooka discloses the subject matter of claim 9 of the ’227 patent.

Claim 10 depends from claim 8 and recites that “six of the optical fiber connectors are present defining six pairs of optical paths.” Petitioner contends that Toyooka describes this subject matter because Toyooka discloses that single-core connectors define pairs such that Toyooka

¹⁰ The brackets are in the translation as provided.

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discloses six pairs of single-core connectors. IPR1648 Pet. 27–28, 34 (citing Ex. 1004 ¶¶ 20, 23, 24). Toyooka discloses that “two single-core connectors constitute[] each connector pair” and are connected to symmetrical cores in the multicore connector. Ex. 1004 ¶ 23; *see also id.* ¶ 22 (“[T]he two single-core connectors 14_{2n-1} and $14_{2n} \dots$, being situated next to each other, constitute a connector pair wherein one is used as a single-core connector for input and another as a single-core connector for output.”). As we noted in our Decision on Institution (IPR1648 Dec. on Inst. 26), Toyooka also discloses that two-core connectors may be used to service $2N$ fibers rather using $2N$ single-core connectors. *Id.* ¶ 42 (“[I]n the optical-fiber wiring unit shown in the above-mentioned embodiment, $2N$ pieces of single-core connectors are provided to thereby form an N number of connector pairs; however, N pieces of two-core connectors may be provided in place thereof.”). Therefore, in this configuration with N equal to six (Ex. 1004 ¶ 43), Toyooka discloses six two-core connectors (i.e., the claimed “six of the optical fiber connectors”). Therefore, we find Toyooka discloses the subject matter of claim 10 of the ’227 patent.

We find Toyooka describes all of the limitations of claims 8–10 of the ’227 patent. Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that claims 8–10 of the ’227 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

7. Independent Claim 3 of the ’227 Patent

Independent claim 3 is directed to “[a] method of implementing reverse-ribbon positioning in a cabling system” reciting three steps:

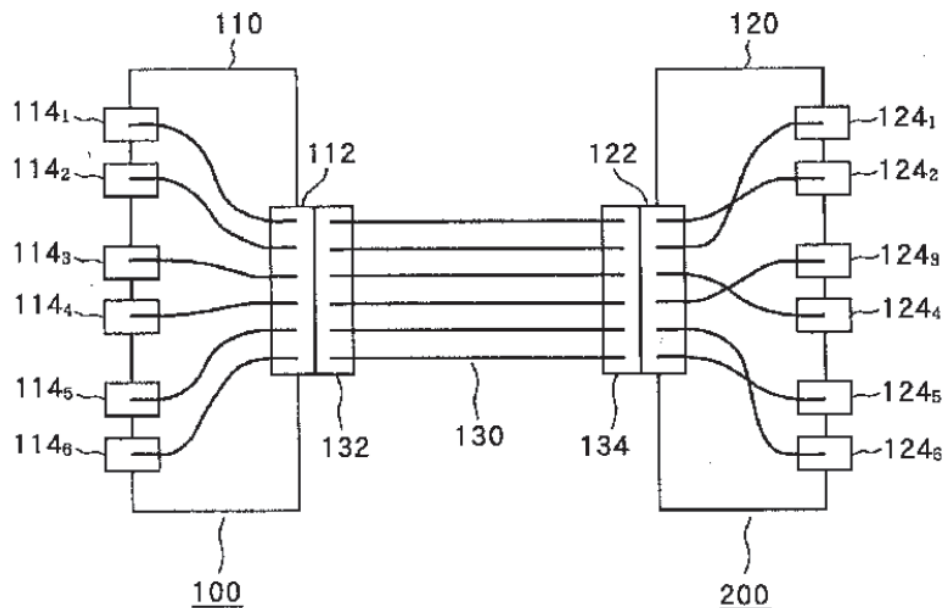
- (1) “assigning a sequential number to each of the optical fibers of an optical ribbon,”
- (2) “installing one end of the optical ribbon into a multi-fiber

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connector with the optical fibers of the optical ribbon arranged in sequential number from left to right,” and (3) “installing the other end of the optical ribbon into a plurality of optical fiber connectors with the optical fibers of the optical ribbon arranged in reverse sequential number from left to right.” Petitioner contends that, to the extent the preamble limits claim 3, “Toyooka teaches reverse-ribbon positioning because Toyooka teaches an optical-fiber wiring unit 110 having straight-through wiring.” IPR1648 Pet. 34; *see also* IPR1648 Pet. 28 (citing Ex. 1004 ¶ 5); *see also* IPR1648 Ex. 1003 ¶ 76 (“According to claim 3’s preamble, claim 3 is a method for reverse-ribbon positioning, which as described above is merely describing straight-through wiring.”). Petitioner contends that the wiring illustrated and described with respect to wiring unit 110 in Figure 5 of Toyooka describes the claimed subject matter. IPR1648 Pet. 28–30, 34–35 (citing Ex. 1004 ¶¶ 5–6, Fig. 5). Figure 5 of Toyooka is reproduced below.

【図 5】



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“Figure 5 is a diagram that shows a connection configuration of conventional optical-fiber wiring units and multicore optical-fiber tape.”

Ex. 1004 ¶ 5.

Petitioner contends that the fibers within wiring unit 110 are an optical ribbon. *See* IPR1648 Ex. 1003 ¶ 78 (“The fibers within module 110 are a ribbon because they a collection of fibers arranged in a generally planar array.”). Petitioner contends that Toyooka describes that these fibers are assigned sequential numbers and installed on one end into multicore connector 112 and installed on the other end into single-core connectors 114₁-114₆. IPR1648 Pet. 34–35 (citing Ex. 1004 ¶ 6, Fig. 5). According to Petitioner, “sequential order on one end of a ribbon and reverse-sequential order on the other end of the ribbon is merely describing straight-through wiring.” IPR1648 Pet. 35. Dr. DeCusatis testifies that the arrangement of fibers is viewed from the perspective of the connector. IPR1648 Ex. 1003 ¶¶ 79–80. Therefore, according to Dr. DeCusatis, “[f]rom left to right from the multicore connector 112 perspective, these fibers would be consecutively numbered.” IPR1648 Ex. 1003 ¶ 79. Dr. DeCusatis further testifies: “The fibers are also installed into a plurality of single-core connectors 114. Because the wiring is straight-through, the fibers would be numbered in reverse-sequential order from left to right from the single-core connector 114 perspective.” IPR1648 Ex. 1003 ¶ 80. Thus, according to Petitioner’s contentions, viewing fibers 1–6 from the perspective of each side of wiring unit 110, those fibers are in ascending order from left to right from the perspective of one side and in descending order from left to right from the perspective of the other side (i.e., sequential and reverse sequential order).

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Patent Owner argues that the fibers within box 110 are not an optical ribbon because they are not coated with a ribbon common layer. IPR1648 PO Resp. 31–32. Patent Owner’s argument, therefore, is based on its claim construction requiring a ribbon common layer, which we do not adopt for the reasons discussed above.

Applying the broadest reasonable interpretation of “optical ribbon,” discussed above, we are persuaded by Petitioner’s contention that the optical fibers within module 110 describe an optical ribbon. IPR1648 Pet. 34–35. Toyooka discloses that the fibers within module 110 connect single-core connectors 14, which are arranged “side by side” on one side of the box, with multicore connector 112, which connects to a fiber tape on the other side of the box. Ex. 1004 ¶¶ 5–6, Fig. 5. Therefore, we find that the fibers within box 110 in Figure 5 of Toyooka are grouped and aligned in a generally planar array. Furthermore, based on Petitioner’s declarant’s testimony that numbering of fibers is viewed from the perspective of the connector at each end of the ribbon, we are persuaded that Toyooka describes fibers within module 110 that are in sequential order from left to right from the perspective of multicore connector 112 and that are in reverse sequential order from left to right from the perspective of single-core connectors 114. *See* IPR1648 Ex. 1003 ¶¶ 34–36, 74–81.

We further note Patent Owner acknowledges that claim 3 “requires that one end of the ribbon be installed into a multi-core connector, and the other end of the ribbon be installed into a plurality of connectors.” IPR1648 PO Resp. 30. Furthermore, during oral argument, Patent Owner’s counsel argued that the claimed recitation of “installing the other end of the optical ribbon into a plurality of optical fiber connectors” requires “separat[ing] out the fibers to do that.” Tr. 34:17–24. Thus, according to Patent Owner,

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claim 3 really requires installing separate fibers into the optical fiber connectors, as discussed above in the section addressing claim construction. This is consistent with the disclosure of the '600 and '227 patents of connecting fibers to optical fiber connectors (see Ex. 1001, Figs. 1, 2, and 5), and this is what Toyooka also discloses (Ex. 1004, Fig. 5).

Therefore, we find Toyooka describes all of the limitations of independent claim 3 of the '227 patent. Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that independent claim 3 of the '227 patent is unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

*E. Obviousness over Toyooka and Kang
(Claims 1 and 2 of the '600 Patent)*

Petitioner also contends claims 1 and 2 are unpatentable under 35 U.S.C. § 103(a) as obvious over Toyooka and Kang. IPR1647 Pet. 4, 31–46. Petitioner's obviousness contentions for this ground build upon its anticipation analysis based on Toyooka, which we have discussed above.

With respect to claim 1, Petitioner relies on the same disclosure of Toyooka as in its anticipation ground and additionally argues Kang teaches a “generally planar array” of optical paths in a fiber connector. IPR1647 Pet. 34, 43 (citing Ex. 1005, 4:64–67, Fig. 2). With respect to claim 2, Petitioner also relies on its Toyooka anticipation analysis and additionally argues Kang teaches that standard MPO/MTP connectors include 12 fibers. IPR1647 Pet. 41, 44 (citing Ex. 1005, 1:44–48).

Figure 2 of Kang is reproduced below:

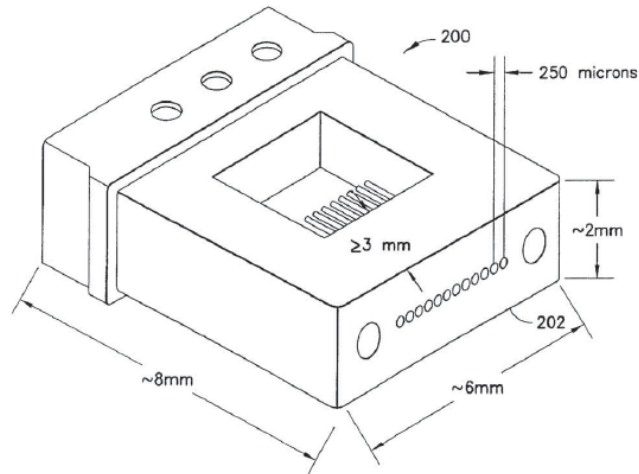


FIG.2
PRIOR ART

Figure 2 “is an enlarged photograph, in perspective view, of a prior art 1x12 ferrule 200 having an outer dimensional shape for use in an MTP, MPO, MPX or SMC connector of the prior art.” Ex. 1005, 1:45–48.

Petitioner contends:

Toyooka discloses a fiber-optic wiring unit that manages fiber polarity that includes a multi-fiber or multicore connector. Kang teaches the structure for a commonly-used multi-fiber connector, known as an MPO/MTP connector. Modifying the multicore connector taught by Toyooka with the structure of the MPO/MTP connector taught by Kang would lead to the predictable result that the fiber-optic wiring unit of Toyooka would function in many fiber optic networks that utilize the standard MPO/MTP connector structure. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Toyooka and Kang. ([Ex. 1003 ¶¶ 67–68]). The motivation to combine Toyooka with Kang would be [to] allow the optical-fiber wiring unit of Toyooka to connect to standardized networks that utilize the MPO or MTP connector standard. (Id.).

IPR1647 Pet. 32.

Patent Owner argues that “nothing in the evidence cited by Petitioner explains why a person of ordinary skill in the art would have been motivated

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or had reason to replace the connector in Toyooka with a different type designed for cable assemblies rather than within the housing of an interconnection module.” IPR1647 PO Resp. 25.

We disagree with Patent Owner because Petitioner expressly provides the following reason that a person of ordinary skill in the art would make the proposed modifications, citing the testimony of Dr. DeCusatis in support: “The motivation to combine Toyooka with Kang would be [to] allow the optical-fiber wiring unit of Toyooka to connect to standardized networks that utilize the MPO or MTP connector standard.” IPR1647 Pet. 32 (citing IPR1647 Ex. 1003 ¶¶ 67–68). Dr. DeCusatis testifies:

It would have been obvious to combine Toyooka and Kang to include standardized connector structures so that the optical-fiber wiring unit of Toyooka could communicate with common, standardized fiber optic networking equipment. Kang teaches the structure of a commonly-used multi-fiber connector known as an MPO. The optical fiber wiring unit 1 of Toyooka could thereby interconnect with standardized optical fiber components ubiquitously used in the fiber optic field by structuring the multicore connector 12 as an MPO.

Modifying the multicore connector 12 of Toyooka with the standardized MPO structure would lead to the predictable result of the optical-fiber wiring unit 1 enabling multi-bit parallel transmission through the MPO structure in networks using standardized connectors. The MPO structure defines connector structure and size, but operates similarly to other multi-fiber connectors. Therefore, the optical-fiber wiring unit of Toyooka would operate and communicate predictably like other cassettes or harnesses implementing MPO connectors.

IPR1647 (citing Ex. 1003 ¶¶ 67–68).

We find Petitioner has set forth articulated reasoning with rational underpinning to support its combination of the teachings of Toyooka and Kang, namely to allow Toyooka’s wiring unit to connect to standardized

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networks that utilize the MPO or MTP standards. IPR1647 Pet. 32;

IPR1647 Ex. 1003 ¶¶ 67–68. For the reasons discussed with respect to our analysis of Petitioner’s anticipation ground based on Toyooka, we find Toyooka describes all of the limitations of claims 1 and 2. We further find Kang discloses a fiber module having a planar array of 12 fibers, as illustrated in Figure 2. IPR1647 Ex. 1005, 1:45–48, Fig. 2. We conclude that the subject matter of claims 1 and 2 would have been obvious based on Toyooka’s wiring module teachings in combination with Kang’s teachings of a planar array of 12 fibers.

Having considered the full record developed during trial, Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 of the ’600 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over the combined teachings of Toyooka and Kang.

III. CONCLUSION

Based on the information presented and the record developed during trial, we determine that Petitioner has shown by a preponderance of evidence that: (1) claims 1 and 2 of the ’600 patent are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka and under 35 U.S.C. § 103(a) as having been obvious over Toyooka and Kang; and (2) claims 1–3 and 8–10 are unpatentable under 35 U.S.C. § 102(b) as anticipated by Toyooka.

IV. ORDER

Accordingly, it is:

ORDERED that claims 1 and 2 of the ’600 patent have been shown to be unpatentable;

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FURTHER ORDERED that claims 1–3 and 8–10 of the '227 patent have been shown to be unpatentable; and

FURTHERED ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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