

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

STERLITE TECHNOLOGIES INC.

Petitioner

v.

AFL TELECOMMUNICATIONS, LLC.

Patent Owner

Case No.: IPR2025-00127

U.S. Patent No. 11,287,591

Issued: March 29, 2022

Title: OPTICAL FIBER CABLE

PETITION FOR *INTER PARTES* REVIEW

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PETITIONER’S EXHIBIT LIST

- Ex-1001: U.S. Patent No. 11,287,591 to Shimizu et al. (“the ‘591 Patent”)
- Ex-1002: USPTO Assignment for the ‘591 Patent
- Ex-1003: International Patent Application No. PCT/JP2019/039740 by Shimizu et al., with Publication No. WO2020075734A1 (“the PCT Parent”)
- Ex-1004: Japanese Patent Application No. 2018-192706 by Shimizu et al. (“the Priority Application”), with English translation submitted by Patent Owner during prosecution of European counterpart patent application
- Ex-1005: U.S. Patent No. 6,160,940 to Summers et al. (“Summers”)
- Ex-1006: U.S. Patent Publication No. 2016/0299311A1 by Kaji et al. (“Kaji”)
- Ex-1007: International Patent Application No. PCT/US2018/016129 by Pausan et al., with Publication No. WO2018144529A1 (“Pausan”)
- Ex-1008: AFL and Dura-Line sales catalog, “Enterprise Blown Fiber Solutions” (2015) (“eABF NPL”)
- Ex-1009: International Patent Application No. PCT/JP2020/023810 by Sato et al., with Publication No. WO2020256019A1 (“Sato-1”)
- Ex-1010: Certified translation of Sato-1
- Ex-1011: Japanese Patent Application No. 2019-113810 by Sato et al. (“First Sato Priority Application”)
- Ex-1012: Certified translation of the First Sato Priority Application

- Ex-1013: Japanese Patent Application No. 2019-134351 by Hashimoto et al
("Second Sato Priority Application")
- Ex-1014: Certified translation of the Second Sato Priority Application
- Ex-1015: Japanese Patent Application No. 2019-176737 by Osada et al. ("Third
Sato Priority Application")
- Ex-1016: Certified translation of the Third Sato Priority Application
- Ex-1017: Japanese Patent Application No. 2019-182643 by Nagao et al.
("Fourth Sato Priority Application")
- Ex-1018: Certified translation of the Fourth Sato Priority Application
- Ex-1019: U.S. Patent No. 6,963,686 to Moon ("Moon")
- Ex-1020: Klaus Nothofer et al., *Experience in the Application of Various
Microduct Cable Designs*, Proc. 54th IWCS, 437-442 (November
2006) ("Nothofer NPL")
- Ex-1021: P. Lépine et al., *Cable blowing, cable floating: which method to
adopt?*, Proc. OC&I/NOC, 63-70 (July 2006) ("Lépine NPL")
- Ex-1022: U.S. Patent No. 7,087,841 to Fett et al. ("Fett")
- Ex-1023: Joint Claim Construction Chart, dated August 21, 2024, filed in *AFL
Telecommunications, LLC. v. Sterlite Technologies, Inc.*, Case No.
1:23-cv-01202-RGA (D. Del.)

- Ex-1024: Fumiaki Sato et al., *Design of Ultra-High-Density Optical Fiber Cable with Rollable 4-Fiber Ribbons*, SEI Technical Review, No. 77, 29-32 (October 2013) (“Sato-2”)
- Ex-1025: U.S. Patent No. 4,844,575 to Kinard et al. (“Kinard”)
- Ex-1026: Corning Optical Communications LLC., Publication No. AEN096-BEN Rev. 1, *Microduct Cable Air-Assisted Installation Considerations*, Applications Engineering Note (July 2015) (“Corning NPL”)
- Ex-1027: U.S. Patent No. 9,625,670 to Chen et al. (“Chen”)
- Ex-1028: U.S. Patent Publication No. 2002/0136509A1 by Watson (“Watson”)
- Ex-1029: Brandon Johnson, *Air Jetting Bandwidth for a Real-Time Future-Ready Network*, Cabling Installation & Maintenance, Vol. 24 No. 2, 21–25 (February 2016)
- Ex-1030: U.S. Patent Publication No. 2015/0277074A1 by Villiger et al. (“Villiger”)
- Ex-1031: Scheduling Order, dated March 20, 2024, issued in *AFL Telecommunications, LLC. v. Sterlite Technologies, Inc.*, Case No. 1:23-cv-01202-RGA (D. Del.)

Ex-1032: Amended Complaint, dated December 5, 2023, filed in *AFL Telecommunications, LLC. v. Sterlite Technologies, Inc.*, Case No. 1:23-cv-01202-RGA (D. Del.)

LISTING OF CLAIMS

Claim 1		
		An optical fiber cable comprising:
[1.1]		a sheath; and
[1.2]		a core that is housed in the sheath and comprises an intermittently-adhered optical fiber ribbon comprising:
[1.3]		optical fibers; and
[1.4]		adhesive portions that intermittently adhere the optical fibers together in a longitudinal direction, wherein
[1.5]		recesses and protrusions are disposed alternately in a circumferential direction on an outer circumferential surface of the sheath,
[1.6]		the recesses each comprise:
	[1.6a]	two connecting portions respectively connected to radial inner ends of two adjacent protrusions;
	[1.6b]	and a bottom surface positioned between the two connecting portions, and
[1.7]		in a transverse cross-sectional view, a cross-sectional area of the recesses that is enclosed by closed curves tangent to radial outer ends of the protrusions and all the recesses is 1.3 mm ² or greater and 4.8 mm ² or less.
Claim 2		
		The optical fiber cable according to claim 1, wherein the two connecting portions have a convex surface shape that is radially inward.
Claim 3		
		The optical fiber cable according to claim 1, wherein the optical fiber cable has a compressive strength of 12.8 N/mm ² or greater and 32.4 N/mm ² or less.
Claim 4		
		The optical fiber cable according to claim 1, wherein the core further comprises a wrapping tube that wraps the intermittently-adhered optical fiber ribbon.

Claim 5		
		The optical fiber cable according to claim 4, wherein the wrapping tube comprises:
[5.1]	[5.1a]	a wrap portion where a first end portion of the wrapping tube overlaps with a second end portion of the wrapping tube;
	[5.1b]	and a non-wrap portion positioned between the first end portion and the second end portion.
Claim 6		
		The optical fiber cable according to claim 5, wherein the wrapping tube comprises:
[6.1]		a wrap rate R of the optical fiber cable is calculated as $R = W1 \div (W1 + W2) \times 100$, where W1 is a circumferential length of the wrap portion and W2 is a circumferential length of the non-wrap portion, and
[6.2]		the wrap rate R is 5% or greater and 20% or less.
Claim 7		
		The optical fiber cable according to claim 1, wherein a twist angle of the sheath per 1 m along the longitudinal direction of the optical fiber cable is 10 degrees/m or greater and 180 degrees/m or less.
Claim 8		
		The optical fiber cable according to claim 1, wherein a radius of curvature of each outer circumferential surface of the protrusions is smaller than a radius of the sheath.
Claim 9		
		The optical fiber cable according to claim 1, further comprising:
[9.1]		tensile strength members embedded inside the protrusions on the sheath,
[9.2]		wherein the protrusions and the tensile strength members have a spirally twisted shape centered on a central axis of the optical fiber cable.

Claim 10	
	The optical fiber cable according to claim 1, further comprising:
[10.1]	tensile strength members embedded inside the protrusions on the sheath,
[10.2]	wherein the tensile strength members are made of poly-paraphenylene benzobisoxazole fiber reinforced plastics (PBO-FRP).
Claim 11	
	The optical fiber cable according to claim 1, further comprising:
[11.1]	tensile strength members embedded in the sheath,
[11.2]	wherein in a transverse cross-sectional view, the tensile strength members are disposed inside each of the protrusions on the sheath.
Claim 12	
	The optical fiber cable according to claim 1, further comprising:
[12.1]	intermittently-adhered optical fiber ribbons,
[12.2]	wherein an SZ-shaped twist is applied to the sheath by twisting the intermittently-adhered optical fiber ribbons in an SZ shape.
Claim 13	
	The optical fiber cable according to claim 1, wherein the sheath comprises:
[13.1]	a base material; and
[13.2]	a low friction material having a friction coefficient smaller than a friction coefficient of the base material, and
[13.3]	the low friction material is disposed at least on tops of the protrusions.

Claim 14		
		An optical fiber cable comprising:
[14.1]		a sheath;
[14.2]		a core that is housed in the sheath and comprises an intermittently-adhered optical fiber ribbon comprising:
[14.3]		optical fibers; and
[14.4]		adhesive portions that intermittently adhere the optical fibers together in a longitudinal direction; and
[14.5]		tensile strength members and ripcords embedded in the sheath,
[14.6]		wherein recesses and protrusions are disposed alternately in a circumferential direction on an outer circumferential surface of the sheath,
[14.7]		the recesses each comprise:
	[14.7a]	two connecting portions respectively connected to radial inner ends of two adjacent protrusions; and
	[14.7b]	a bottom surface positioned between the two connecting portions, and
[14.8]		in a transverse cross-sectional view, the ripcords are positioned inside some of the protrusions, and
[14.9]		the tensile strength members are positioned inside the remaining protrusions.

I. INTRODUCTION

Pursuant to 35 U.S.C. § 311 and 37 C.F.R. § 42.100 *et seq.*, Sterlite Technologies Inc. (“Sterlite” or “Petitioner”) requests *inter partes* review (“IPR”) of claims 1-4, 8, and 13-14 (“Challenged Claims”) of U.S. Patent 11,287,591 (“the ‘591 Patent”) (Ex-1001), assigned to AFL Telecommunications, LLC. (“AFL” or “Patent Owner”) (Ex-1002).

II. CLAIM SPECIFIC PRIORITY DATES

For a claim in a later-filed application to be entitled to an earlier filing date, the earlier application must satisfy the written description requirement of 35 U.S.C. § 112 ¶ 1. *See* 35 U.S.C. §§ 120 and 365. If a claim limitation is not expressly disclosed in a prior application to which priority is sought, the party seeking priority must show “that a person of ordinary skill would have understood . . . that the [prior] description requires” the later claimed limitation. *Hyatt v. Boone*, 146 F.3d 1348, 1353 (Fed. Cir. 1998). Entitlement to priority is decided on a claim-by-claim basis. If even a single feature of a claimed invention was first disclosed in a later-filed application, and if that feature is not inherent in the parent application, then the claim is only entitled to the filing date of the later-filed application. *Lockwood v. Am. Airlines, Inc.*, 877 F. Supp. 500, 507 (S.D. Cal. 1994), *aff’d*, 107 F.3d 1565 (Fed. Cir. 1997).

A. Claims 1-9 and 11-12 – Critical Date

The ‘591 Patent issued on March 29, 2022, from U.S. Application No. 17/255,581, filed on December 23, 2020, which is a National Stage Entry of International Patent Application No. PCT/JP2019/039740 (“the PCT Parent”) (Ex-1003), filed on October 9, 2019. (Ex-1001, Face). The ‘591 Patent claims foreign priority through the PCT Parent to Japanese Application No. 2018-192706 (“the Priority Application”) (Ex-1004), filed on October 11, 2018. (Ex-1001, Face). Thus, the earliest possible priority date available to the ‘591 Patent is October 11, 2018 (“Critical Date”).

B. Claims 10 and 13-14 – No Earlier than the PCT Parent Filing Date

The ‘591 Patent and the PCT Parent each disclose embodiments where “in the transverse cross-sectional view, [] the ripcords 40 are positioned inside some of the plurality of protrusions 11 and the tensile strength members 30 are positioned inside the other protrusions 11”, as required by elements [14.8] and [14.9] of independent claim 14. (Ex-1001, FIG. 13A, and 17:4-8; and Ex-1003, FIG. 13A). Notably absent in the priority application is any disclosure that supports the particular arrangement of tensile strength members and ripcords required by elements [14.8] and [14.9]. Instead, the Priority Application merely discloses that “[i]n addition to the tensile strength member 30 [], a ripcord or the like may be embedded in the sheath 10.” (Ex-1004, 5:11-12). Consequently, priority for

independent claim 14 of the ‘591 Patent is limited to the PCT Parent’s actual filing date (i.e., October 9, 2019) – not the Priority Application’s earlier Critical Date.

Petitioner notes that priority for dependent claims 10 and 13 is also limited to PCT Parent’s actual filing date inasmuch as similar deficiencies exist with respect to the subject matter defined by claims 10 and 13. Specifically, while the ‘591 Patent (Ex-1001, FIGS. 12A-C, and 15:40-60) and the PCT parent (Ex-1003, FIGS. 12A-C) each disclose embodiments that support dependent claim 13 at-large, the priority application notably lacks any such support for claim 13. Likewise, claim 10 requires tensile strength members made of poly-paraphenylene benzobisoxazole fiber reinforced plastics (PBO-FRP). The ‘591 patent (Ex-1001, FIGS. 12A-C, and 15:40-60) and the PCT parent (Ex-1003, FIGS. 12A-C) each disclose embodiments where optical fiber cables include tensile strength members explicitly made of PBO-FRP. The ‘591 patent (Ex-1001, Tables 5-6, and 12:66-13:3) and the PCT parent (Ex-1003, Tables 5-6) further describe how attributes of an optical fiber cable change when its tensile strength members are made of different materials or even different variants of FRP. The Priority Application lacks any such disclosure regarding how attributes of an optical fiber cable change based on material of its tensile strength members. Instead, the priority application generally describes various materials that may be used to implement tensile strength members. (Ex-1004, 5:8-10).

III. IDENTIFICATION OF CLAIMS AND GROUNDS

The '591 Patent: Per Section II, claims 10 and 13-14 priority date October 9, 2019, corresponding to filing date of the PCT Parent. Remaining claims have earliest possible priority date of Critical Date or October 11, 2018. The '591 Patent is subject to the AIA provisions of 35 U.S.C. §§ 102 and 103.

Summers (Ex-1005): issued on December 12, 2000, and is prior art under §102(a)(1).

Kaji (Ex-1006): published on October 13, 2016, and is prior art under §102(a)(1).

Pausan (Ex-1007): published on August 9, 2018, and is prior art under §102(a)(1).

eABF NPL (Ex-1008): was publicly available on or around October 26, 2015, and is prior art under §102(a)(1).

Sato-1 (Ex-1009): was filed on June 17, 2020, designating the United States, and published on December 24, 2020. Per 35 U.S.C. §374, Sato-1 is deemed a U.S. patent document publication under 35 U.S.C. § 122(b) for purposes of § 102. Sato-1 claims priority from Japanese Patent Application Nos. 2019-113810 (Ex-1011), 2019-134351 (Ex-1013), 2019-176737 (Ex-1015), and 2019-182643 (Ex-1017) filed on June 19, 2019, July 22, 2019, September 27, 2019, and October 3, 2019, respectively. Therefore, the latest effective filing date for Sato-1 is October 3,

2019. Accordingly, Sato-1 is prior art under §102(a)(2) with respect to claims 10 and 13-14 of the ‘591 Patent, per Section II.

Petitioner requests cancelation of the Challenged Claims on the following grounds:

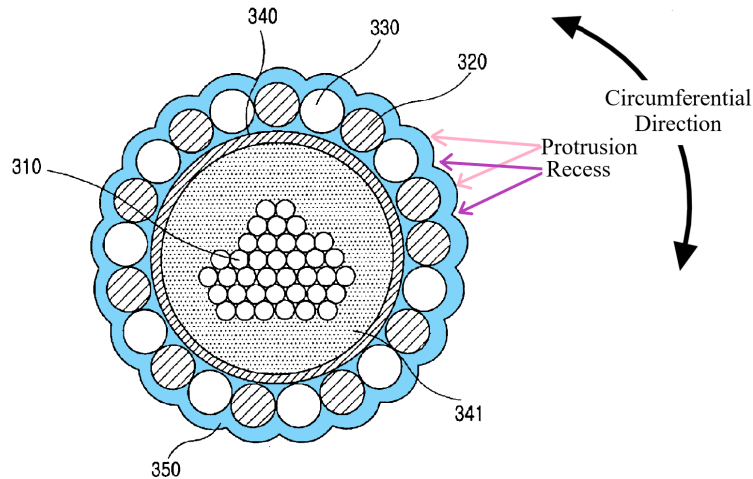
Ground	Prior Art	Claims	Basis
1	Summers in view of Kaji	1-4, 8, and 13	§ 103
2	Pausan in view of eABF NPL	1-4 and 8	§ 103
3	Sato-1	14	§ 102/103

IV. THE ‘591 PATENT

A. Technology Background

The ‘591 Patent identifies Moon (Ex-1019) as illustrating a known optical fiber cable with a sheath and a plurality of optical fibers housed in the sheath. (Ex-1001, 1:16-29). The ‘591 Patent describes the optical fibers of Moon as being housed in a tube in a twisted shape. (Ex-1001, 1:22-23). The ‘591 Patent notes that the optical fibers of Moon may alternatively be “collectively coated with a UV curable resin to form a tape core wire.” (Ex-1001, 1:24-25).

Annotated FIG. 3 of Moon below shows, as described by the ‘591 patent, the outer circumferential surface of Moon’s sheath (in blue) is formed with recesses (in purple) and protrusions (in pink) alternately disposed in the circumferential direction. (Ex-1001, 1:20-22) (Ex-1019, FIG. 3).



Moon describes its sheath as being “formed with an outer surface that in cross-section is flexuous”. (Ex-1019, 3:63-64). Moon states that “the flexuous shape of the outer sheath affords easy air-blown installation of the optical fiber cable.” (Ex-1019, 4:53-54).

The ‘591 Patent does not identify any aspect of the outer surface shape of Moon’s sheath as being disadvantageous in terms of air-blowing characteristics. (Ex-1001, 1:29-51). Instead, the ‘591 Patent identifies the outer surface shape of Moon’s sheath as being disadvantageous in terms of sheath strength. Specifically, the ‘591 Patent asserts that because its recesses are formed as V-shaped grooves, Moon’s sheath tends to crack since stress tends to concentrate on an inner end portion of the groove when force is applied to its protrusions in a circumferential direction. (Ex-1001, 1:30-34).

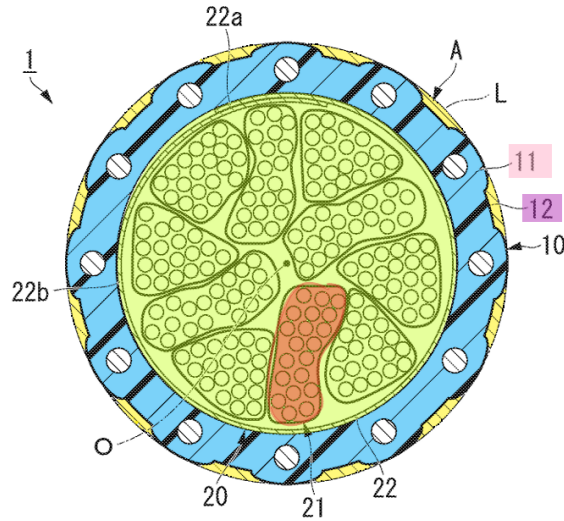
The ‘591 Patent describes Moon’s cable as being disadvantageous in terms of air-blowing characteristics when configured such that its “optical fibers are

simply twisted and housed in the tube lacks the rigidity of the optical fiber cable.” (Ex-1001, 1:35-38). The ‘591 Patent notes that rigidity of Moon’s cable can be obtained when alternatively configured with the optical fibers being collectively coated in resin. (Ex-1001, 1:38-41).

Yet, the ‘591 Patent describes that alternative configuration of Moon’s cable as being disadvantageous in terms of reducing the cable diameter because the core becomes large when the optical fibers are collectively coated in resin. (Ex-1001, 1:41-46). The ‘591 Patent also describes that alternative configuration of Moon’s cable as being disadvantageous in terms of transmission loss because collectively coating the optical fibers in resin applies increased strain on the optical fibers. (*Id.*).

B. The ‘591 Patent Specification

Within that context, the ‘591 Patent purports to “provide an optical fiber cable which is advantageous in terms of air-blowing characteristics, diameter reduction, and transmission loss while increasing the strength of the sheath.” (Ex-1001, 2:2-5). Annotated FIG. 6 of the ‘591 Patent below shows one such optical fiber cable.



Annotated FIG. 6 above shows that the ‘591 Patent’s optical fiber cable 1 has a sheath 10 (in blue) and a core 20 (in green), which is housed in the sheath 10, and which includes an intermittently-adhered optical fiber ribbon 21 (in red). (Ex-1001, 3:5-9). Annotated FIG. 6 above also shows that a plurality of recesses 12 (in purple) and protrusions 11 (in pink) are formed on the outer circumferential surface of sheath 10. (Ex-1001, 4:22-23). Annotated FIG. 6 above further shows a cross-sectional area A (in yellow) of space defined by all of its recesses 12 and a closed curve L when that curve contacts a radial outer end of each of its protrusions 11 in a transverse cross-sectional view. (Ex-1001, 8:61-66). The ‘591 Patent describes the cross-sectional area A as “the difference in the cross-sectional area of the optical fiber cable [shown in FIG. 6] with respect to the cross-sectional area of the virtual optical fiber cable having the closed curve L as the outer circumferential surface.” (Ex-1001, 8:66-9:4).

The ‘591 Patent associates the intermittently-adhered optical fiber ribbon 21 with its sheath 10 being advantageous in terms of air-blowing characteristics, diameter reduction, and transmission loss. Specifically, the ‘591 Patent discloses that intermittently adhering optical fibers of its intermittently-adhered optical fiber ribbon 21 in a longitudinal direction ensures rigidity of its optical fiber cable 1, which “is advantageous in buckling resistance and air-blowing characteristics.” (Ex-1001, 4:62-5:4). The ‘591 Patent states with reference to its intermittently-adhered optical fiber ribbon 21 that “the diameter of the optical fiber cable 1 can be reduced, and an increase in transmission loss can be suppressed” compared with a configuration where optical fibers are collectively coated with a resin. (Ex-1001, 5:4-7).

The ‘591 Patent expressly associates the outer surface shape formed by the recesses 12 and protrusions 11 with its sheath 10 having increased strength. (Ex-1001, 4:40-61). Specifically, the ‘591 Patent discloses that each recess 12 has a bottom portion 12b positioned between two connecting portions 12a that each connect to a radial inner end of an adjacent protrusion 11. (Ex-1001, 4:40-45). The ‘591 Patent asserts that, even with a force in the circumferential direction acting on the protrusion 11, stress does not concentrate in recesses 12 “since each of the recesses 12 has the two connecting portions 12a and the bottom surface 12b positioned between the connecting portions 12a.” (Ex-1001, 4:55-61). The ‘591

Patent discloses that the strength of its sheath 10 can be further increased by forming the connecting portion 12a of its recess 12 into a curved surface shape that is radially inward convex. (Ex-1001, 5:8-12).

The '591 Patent also indirectly associates the outer surface shape formed by the recesses 12 and protrusions 11 with air-blowing characteristics of its sheath 10. Specifically, the '591 Patent discloses a configuration in which a radius of curvature of an outer circumferential surface of its protrusion 11 is smaller than a radius of its sheath 10 (i.e., the radius of its optical fiber cable 1). (Ex-1001, 5:24-26). The '591 Patent states that “[a]ccording to this configuration, the contact area between the protrusion 11 and the micro-duct [] becomes smaller. Therefore, the workability when the optical fiber cable 1 is inserted into the micro-duct can be improved.” (Ex-1001, 5:27-31).

The '591 Patent describes an air-blowing test with reference to Table 3 that was used to determine an optimum or workable range for the cross-sectional area A of all its recesses 12. (Ex-1001, 8:47-9:53). A lower bound of that range was determined using an optical fiber cable (i.e., Test Example 3-6) with a cross-sectional area A value of 0.0 square millimeters (“mm²”). (Ex-1001, 8:33-48, Table 3). With its cross-sectional area A being equal to zero (e.g., 0.0 mm²), Test Example 3-6 lacks any protrusions 11 or recesses 12 inasmuch as it lacks space defined by the closed curve L shown above in Annotated FIG. 6. (See Ex-1001,

8:61-66). In other words, Test Example 3-6 and the “virtual optical fiber cable having the closed curve L as the outer circumferential surface” would have the same cross-sectional area. (Ex-1001, 8:66-9:4). The ‘591 Patent states, “in Test Example 3-6, since the sheath 10 is **not formed with an uneven shape**, the friction between the inner surface of the micro-duct D and the optical fiber cable is large, and progress [] is stopped.” (Ex-1001, 9:45-48) (emphasis added).

In contrast, the ‘591 Patent discloses that “**an uneven shape is formed** on the outer circumferential surface of the sheath 10” when recesses 12 and protrusions 11 are disposed alternately on that outer circumferential surface. (Ex-1001, 4:22-30) (emphasis added). The ‘591 Patent discloses that workability when the optical fiber cable 1 is inserted into the micro-duct can be improved by reducing the contact area between the micro-duct and the protrusions 11 that form the uneven shape on the outer circumferential surface of its sheath 10. (Ex-1001, 5:24-31). Thus, the ‘591 Patent indirectly associates the outer surface shape formed by the recesses 12 and protrusions 11 with air-blowing characteristics of its sheath 10.

C. Preliminary Statement

Air-blown installation of an optical fiber cable into an existing conduit or duct has been well known in the art since at least 2006. (*See* Ex-1020, 440(4.1-4.2); Ex-1021, 2; and Ex-1022, 1:22-32). Per Section (II)(B), the ‘591 Patent

indirectly associates the outer surface shape formed by the recesses 12 and protrusions 11 with air-blowing characteristics of its sheath 10. Yet, outer surface geometries of an optical fiber cable were also well known in the art by 2006 or earlier as effecting air-blown installation performance. For instance, providing an optical fiber cable with a flexuous (Ex-1019, 4:53-54), textured (Ex-1020, 440(4.1)), ribbed (Ex-1022, 1:36-61), or uneven shape was well known by 2006 to improve air-blown installation performance by reducing friction (“cable/duct friction”) between respective surfaces of the optical fiber cable and an existing duct or other surfaces within an existing duct. Such profiles were known to reduce cable/duct friction by reducing surface area contact between the cable and other surfaces within the existing duct and/or providing channels for air flow. (See Ex-1019, 4:53-54; Ex-1020, 440(4.1); and Ex-1022, 1:36-61).

V. CLAIM CONSTRUCTION

Claims are given the same construction as they are given in district court pursuant to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). Soley for purposes of this Petition, Petitioner believes the Board should apply the agreed-upon claim constructions in the co-pending district court litigation to the terms “radial inner ends,” “radial outer ends,” and “convex surface shape that is radially inward” in the Challenged Claims. (Ex-1024, 1). Otherwise, Petitioner proposes

that the remaining claim terms in the Challenged Claims be afforded their plain and ordinary meaning.

VI. DETAILED EXPLANATION OF THE CHALLENGE

A. Ground 1 – Claims 1-4, 8, and 13 are obvious over Summers in view of Kaji

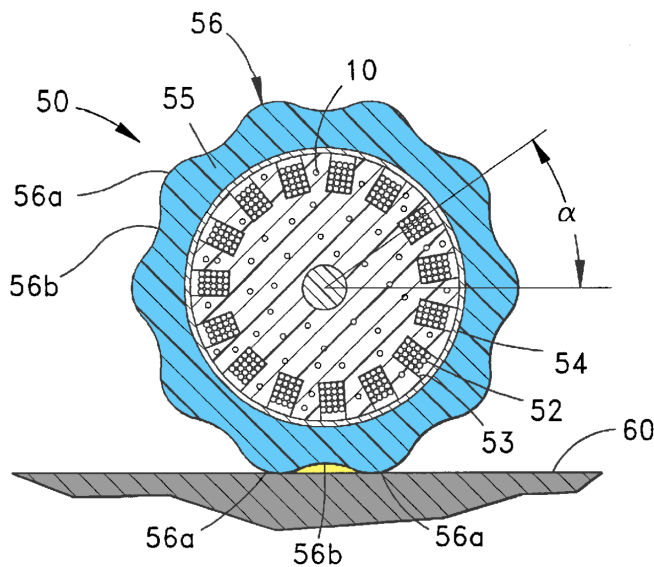
Per Section IV(C), outer surface geometries of an optical fiber cable such as an uneven shape were well known in the art as improving air-blown installation performance by reducing cable/duct friction. Summers (Ex-1005) discloses one such optical fiber cable.

While most limitations of claims 1-4, 8, and 13 would be obvious to a person of ordinary skill in the art (“POSITA”) based on Summers alone, the teachings of Kaji (Ex-1006) confirm that the “intermittently-adhered optical fiber ribbon” limitation was conventional and well-known in the art before the Critical Date. Summers and Kaji are in the same field inasmuch as they each relate to fiber optic cables. (Ex-1005, 1:12-13; Ex-1006, [0001]).

1. Independent Claim 1

Claim 1 is directed to “[a]n optical fiber cable.” Summers discloses “a fiber optic cable that is suitable for installation in a cable passageway.” (Ex-1005, 1:12-

13).¹ Summers states that its fiber optic cable “may be implemented as a fiber optic cable 50”. (Ex-1005, 3:53-56). Annotated FIG. 6 below shows fiber optic cable 50.



a. [1.1] “a sheath”

Annotated FIG. 6 above shows that Summers discloses element [1.1] by its fiber optic cable 50 (“optical fiber cable”) including a cable jacket 55 (in blue). (Ex-1005, 3:57-58). A POSITA would recognize that “jacket” and “sheath” may be used interchangeably in the context of communication cables such as cables with one or more optical fibers. (See Ex-1022, 2:3-4, 12-17).

Summers describes its cable jacket 55 as having an undulated profile 56 to “minimiz[e] the surface area contact between cable jacket 55 and surface 60.” (Ex-

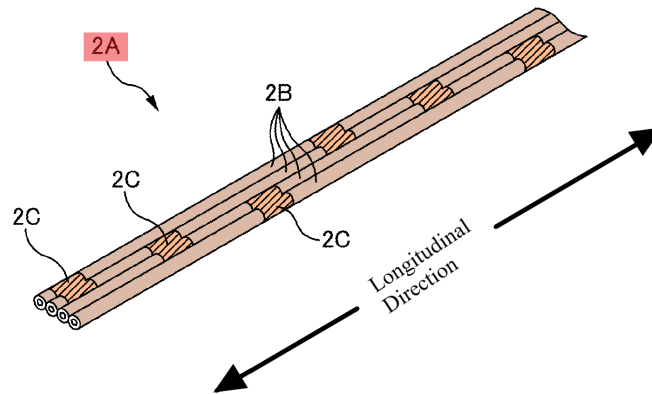
¹ Summers describes various examples of cable passageways such as “duct”. (Ex-1005, 1:20-25).

fiber ribbon 52. (Ex-1005, 2:40-44, 4:49-52). Summers also discloses its cable jacket 55 “can be applied over other types of fiber optic cable components which require cable jackets, for example, ... fiber bundle[s] or optical ribbon types having a parallel, helical, or SZ feature.” (Ex-1005, 6:27-35).

Yet, Summers is silent on how to implement multi-fiber optical fiber ribbons such as its four-fiber ribbons 52. A POSITA would have been motivated to look to similar references in the same field such as Kaji for further guidance on how to implement multi-fiber optical fiber ribbons such as the four-fiber ribbon 52 of Summers.

Kaji discloses such guidance for implementing multi-fiber optical fiber ribbons by providing a “manufacturing method of an optical cable [that includes] an optical fiber bundle [2] configured from a plurality of optical fibers.” (Ex-1006, [0035]). Kaji describes its optical fiber bundle 2 as including an “intermittently-fixed optical fiber tape 2A [that] is configured from three or more cores of [] optical fibers 2B that are arranged parallel to each other.” (Ex-1006, [0041]).

Annotated FIG. 2 below shows that Kaji configures its intermittently-fixed optical fiber tape 2A (in red) from multiple optical fibers 2B (in brown) using multiple connection parts 2C (in orange).



Kaji discloses that the connection parts 2C are intermittently disposed in a length direction (“longitudinal direction”) of the optical fibers 2B for connecting or adhering adjacent optical fibers 2B.² (Ex-1006, [0041]). Kaji further discloses that, external to the connection parts 2C, adjacent cores of the optical fibers 2B are otherwise not bound by each other. (*Id.*) Per Kaji, “[t]his enables the intermittently-fixed optical fiber tape 2A to be rolled up...or stored folded onto itself, enabling a high density of the optical fibers 2B to be packed in the optical cable 1.” (*Id.*; see also Ex-1024, generally).

A POSITA would have been motivated to modify Summers’ fiber optic cable 50 to include Kaji’s intermittently-fixed optical fiber tape 2A to obtain the predictable result of enabling a higher density of optical fibers to be packed in Summers’ fiber optic cable 50, as contemplated by Kaji. Moreover, a POSITA would have had a reasonable expectation of success because such modification

² Per the ‘591 Patent, “the longitudinal direction of ...the optical fiber 21 a[] is simply referred to as the longitudinal direction.” (Ex-1001, 3:16-18).

would amount to nothing more than a simple substitution of Summers' four-fiber ribbons 52 with Kaji's intermittently-fixed optical fiber tape 2A by known methods of cable manufacturing. For instance, Summers discloses that its fiber optic cable component 10 "can be fed into a fiber optic cable manufacturing line where optical fiber ribbons [52] or individual optical fibers can be stranded into respective recesses [53]." (Ex-1005, 4:49-52). In that context, such modification would merely involve stranding Kaji's intermittently-fixed optical fiber tape 2A into respective recesses or slots 53 of Summers' fiber optic cable 50. A POSITA would thus appreciate that such modification is accomplished without additional change to Summers' fiber optic cable 50.

Accordingly, element [1.2] is obvious over Summers in view of Kaji.

c. [1.3] "*optical fibers; and*"

Per Section VI(A)(1)(b), Summers discloses element [1.3] inasmuch as four-fiber ribbon 52 of Summers includes multiple (e.g., four) optical fibers. (Ex-1005, 2:40-44, 4:49-52). Alternatively, element [1.3] is obvious over Summers in view of Kaji's teachings regarding its intermittently-fixed optical fiber tape 2A being configured from multiple optical fibers 2B, per Section VI(A)(1)(b).

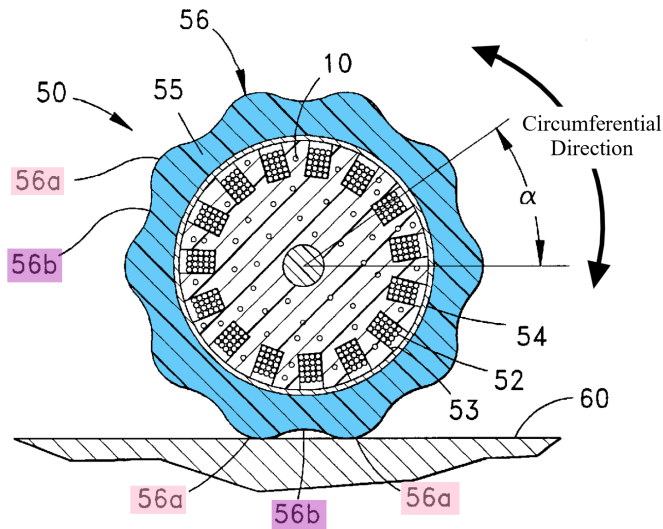
d. [1.4] "*adhesive portions that intermittently adhere the optical fibers together in a longitudinal direction, wherein*"

Summers in combination with Kaji renders element [1.4] obvious. For instance, per Section VI(A)(1)(b), a POSITA would have been motivated to modify Summers' fiber optic cable 50 to include Kaji's intermittently-fixed optical fiber tape 2A with connection parts 2C that are intermittently disposed in a length direction ("longitudinal direction") of the optical fibers 2B for connecting or adhering adjacent optical fibers 2B.

e. [1.5] *"recesses and protrusions are disposed alternately in a circumferential direction on an outer circumferential surface of the sheath,"*

Annotated FIG. 6 below shows that Summers discloses "recesses" as hollows 56b (in purple) and "protrusions" as crests 56a (in pink) that are disposed alternately in a circumferential direction on an outer circumferential surface of the cable jacket 55 (in blue).³ (Ex-1005, 2:40-41, 2:66-3:2, and 3:53-56).

³ Per the '591 Patent, "the central axis of the optical fiber cable 1 is referred to as the central axis O." (Ex-1001, 3:14-15). The '591 Patent discloses with reference to FIG. 1A that "[i]n the transverse cross-sectional view, ... a direction revolving around the central axis O is referred to as a circumferential direction." (Ex-1001, 3:20-24).



Summers describes the crests 56a and the hollows 56b disposed on its cable jacket 55 as forming an undulated profile 56. (Ex-1005, 2:46-51, 3:57-64, claim 3). Summers characterizes the crests 56a and the hollows 56b that form the undulated profile 56 as “surface irregularities” of its fiber optic cable 50. (*Id.*).

Accordingly, Summers discloses element [1.5].

- f. [1.6] *“the recesses each comprise: two connecting portions respectively connected to radial inner ends of two adjacent protrusions; and a bottom surface positioned between the two connecting portions, and”*

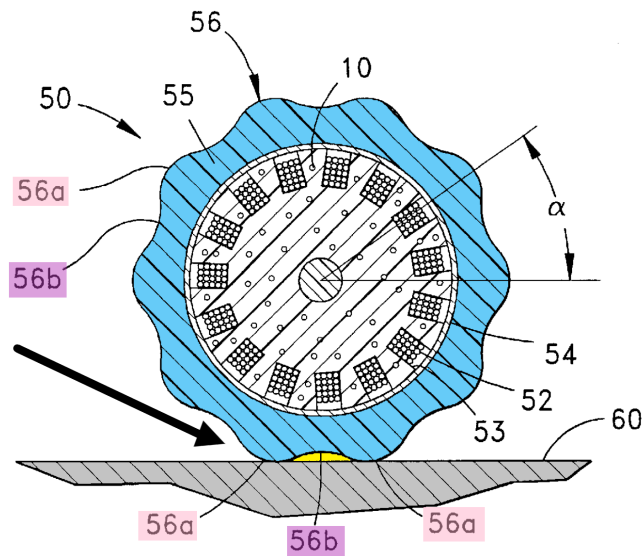
Element [1.6] recites that each claimed recess includes [1.6a] two connecting portions respectively connected to radial inner ends of two adjacent protrusions and [1.6b] a bottom surface positioned between the two connecting portions. Summers discloses or renders obvious elements [1.6a] and [1.6b] by teaching that while its surface irregularities (e.g., hollows 56b, per Section

VI(A)(1)(e)) are described with reference to an undulated profile, other surface irregularities can be used that will exhibit a suitably low resistance to a cable pulling force. (Ex-1005, 6:7-19). Examples of such surface irregularities include configuring an apex of any hollow 56b to “be more sharply defined to roughly come to a rounded-off point...or can be truncated with flat zones.” (Ex-1005, 6:7-14; *see also id.*, 2:53-55). Summers also states that “the surface irregularities can include, e.g., ... teat-like extensions, lines, grooves, etc.” (Ex-1005, 6:14-16).

g. [1.7] “in a transverse cross-sectional view, a cross-sectional area of the recesses that is enclosed by closed curves tangent to radial outer ends of the protrusions and all the recesses is 1.3 mm² or greater and 4.8 mm² or less.”

Summers identifies Kinard (Ex-1025) as illustrating a known fiber optic cable design having a noncircular profile jacket that is difficult to install in cable passageways. (Ex-1005, 1:60-64). Summers characterizes Kinard’s cable as having an oval profile cable jacket (Ex-1025, FIG. 10) that “present[s] a substantial amount of surface area contact with the cable passageway”. (Ex-1005, 1:60-64). Summers discloses that such surface area contact renders installation difficult by way of “frictional resistance”. (Ex-1005, 1:28-31). Summers’ stated objectives include providing a fiber optic cable that is “easy to install in a cable passageway” and that “presents minimal resistance” during installation. (Ex-1005, 2:3-8).

Within that context, Summers discloses that the surface irregularities (i.e., the hollows 56b and the crests 56a) of its “cable 50 can be configured so that at least two crests 56a will support the cable [50] on ...virtually any surface [e.g., surface 60] of or in a cable passageway.” (Ex-1005, 3:57-64). Summers further discloses that in doing so “at least one hollow 56b is between the [at least two] crests, thereby minimizing the surface area contact between cable jacket 55 and surface 60.” (*Id.*). Annotated FIG. 6 below shows that Summers discloses that its crests 56a (in pink) and hollows 56b (in purple) are dimensioned such that, in a transverse cross-sectional view, a cross-sectional area (a subset of that cross-sectional area in yellow) of all hollows 56b is greater than zero (i.e., non-zero) such as 0.1 mm^2 .



While Summers discloses a non-zero (e.g., 0.1 mm^2) cross-sectional area corresponding to each hollow 56b disposed on its cable jacket 55, Summers does

not disclose that cross-sectional area being 1.3 mm² or greater and 4.8 mm² or less. For at least three distinct reasons, the “1.3 mm² or greater and 4.8 mm² or less” limitation recited by element [1.7] does not render any Challenged Claim patentable inasmuch as it would have been obvious to a POSITA to configure Summers’ cable 50 with the cross-sectional area of all hollows 56 being 1.3 mm² or greater and 4.8 mm² or less.

First, it is well established that merely changing the **size** of a device **is not patentable**. *In Gardner v. TEC Syst., Inc.*, 725 F.2d 1338 (Fed. Cir. 1984) (en banc); *Powers-Kennedy Contracting v. Concrete Mixing & Conveying*, 282 U.S. 175, 185 (1930) (“[A] mere change in proportion would involve no more than mechanical skill and would not amount to invention.”).

Any purported benefit that the ‘591 Patent attributes to an optical fiber cable with element [1.7] is discussed in the context of installing optical fiber cables in micro-ducts. (Ex-1001, 8:47-9:53). Specifically, the ‘591 Patent describes an optical fiber cable with element [1.7] as functioning as an air flow path to reduce cable/duct friction during installation. (Ex-1001, 8:48-58).

Of note, each of the Challenged Claims are directed to an optical fiber cable – not a method of installing optical fiber cables. Moreover, the Challenged Claims each lack any recitation of a “micro-duct”. Rather, each Challenged Claim recites various structural limitations such as element [1.7] that define a respective optical

fiber cable. *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990) (“[A]pparatus claims cover what a device *is*, not what a device *does*.”) (emphasis original).

Second, **overlap between** prior art **ranges** and a claimed range **establishes** a *prima facie* case of **obviousness** that is only rebuttable by demonstrating that the claimed range provides benefits that are different in kind or unexpected. *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003). Furthermore, that overlap itself provides sufficient motivation to establish obviousness. *In re Applied Materials*, 692 F.3d 1289, 1295 (Fed. Cir. 2012) (citing *Peterson*).

Here, Summers discloses or suggests a range for the recited “cross-sectional area” that overlaps (partially or otherwise) the claimed range of 1.3 mm² or greater and 4.8 mm² or less. As discussed above with reference to Annotated FIG. 6, Summers discloses a non-zero (e.g., 0.1 mm²) cross-sectional area corresponding to each hollow 56b disposed on its cable jacket 55. That non-zero value establishes a lower-bound of the range that Summers discloses for the recited “cross-sectional area”.

An upper-bound of that range is established via Summers’ stated objectives. Specifically, the stated objectives of Summers include “provid[ing] a fiber optical cable [] that presents minimal resistance [] during installation. (Ex-1005, 2:5-8). To that end, Summers expressly states that “crests [56a] according to the present

invention are shaped to define substantially narrowed contact interfaces with a cable passageway surface or other **surfaces *in a cable passageway***.” (Ex-1005, 5:55-61) (emphasis added); *see also (id.*, 2:46-51, 3:57-64, claim 3). As such, a cross-sectional area corresponding to each hollow 56b disposed on Summers’ cable jacket 55 must be less than a cross-sectional area defined by an existing cable passageway. Therefore, a cross-sectional area defined by an existing cable passageway establishes an upper-bound of the range that Summers discloses for the recited “cross-sectional area”.

With its lower and upper bounds being established by a non-zero value and a cross-sectional area defined by an existing cable passageway, respectively, the range that Summers discloses for the recited “cross-sectional area” overlaps (partially or otherwise) the claimed range of 1.3 mm² or greater and 4.8 mm² or less. For instance, cable passageways with inner diameters of 8 millimeters (“mm”) or less were well known in the art by the Critical Date. (*See* Ex-1020, 438-9; Ex-1022, 3:19-23; and Ex-1026, 2). Cable passageways with circular profiles were also well known in the art by the Critical Date. (*See* Ex-1028, 2:66-3:35, FIG. 2; Ex-1028, [0046], FIG. 3; and Ex-1029, 24 or 27 of 37). A cross-sectional area defined by a cable passageway having a circular profile with an inner diameter of 8 mm is about 50.26 mm² or $\pi * (8 \text{ mm}/2)^2$. In such instance, the range that Summers discloses for the recited “cross-sectional area” is a non-zero value (e.g., 0.1 mm²)

or greater and about 50.26 mm² or less, which overlaps the claimed range of 1.3 mm² or greater and 4.8 mm² or less.⁴ That overlap renders the claimed range of 1.3 mm² or greater and 4.8 mm² or less presumptively obvious, with the ‘591 Patent appearing devoid of any alleged criticality or unexpected results to rebut that presumption.

Third, routine experimentation to determine optimum or workable ranges of a **result-effective variable** is **obvious** to a POSITA and ordinarily within the skill of the art. *In re Applied Materials*, 692 F.3d 1289, 1295-6 (Fed. Cir. 2012) (“[D]iscovery of an optimum value of a result effective variable is ordinarily within the skill of the art.”) (quoting *In re Boesch*, 617 F.2d 272, 276 (C.C.P.A.

⁴ Petitioner notes that 8 mm was identified above as the largest inner diameter of known cable passageways. Cable passageways with an inner diameter of 2 mm were generally known. (See Ex-1022, 3:19-23). Replacing the inner diameter value of 8 mm with a lower value (e.g., 3.6 mm) would reduce the upper bound of Summers’ range by reducing the cross-sectional area of the cable passageway that establishes it. Similarly, other elements within cable passageway such as Summers’ fiber optic cable component 10 would further reduce the upper bound of Summers’ range by further reducing (e.g., occupying a portion of) the cross-sectional area of the cable passageway that establishes it.

1980)); *id.*, at 1297 (“A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective.”).

Here, a POSITA knew that cable/duct friction affects installation of a cable into an existing duct. (Ex-1007, [012]; Ex-1021, 8 (concluding with reference to cable blowing (or air-blown installation): “[f]riction must be optimized, i.e. kept as low as possible.”); Ex-1026, generally; and Ex-1030, [0006]). Outer surface geometries (e.g., narrowed contact interfaces or protrusions) of a cable with an uneven shape were known to effect cable/duct friction by controlling surface area contact between the cable and surfaces within an existing duct. (Ex-1027, 2:49-3:35, FIG. 2; Ex-1030, [0033] (characterizes its jacket shape as variable to “minimize contact area between the jacket and the duct that the cable is being injected into.”); and *see also id.*, [0011] (identifies Ex-1005 as prior art), and [0039]-[0040] (substantially replicates Ex-1005, 5:62-6:35)). Outer surface geometries (e.g., a cross-sectional area of space defined by narrowed contact interfaces or protrusions) of a cable with an uneven shape were also known to affect cable/duct friction by providing channels for air flow. (Ex-1027, 2:49-3:35, FIG. 2; Ex-1007, [017]-[018] (identifies Ex-1022 as prior art that reduces cable/duct friction by allowing airflow through channels that are defined by ribs 4 it forms on an outer jacket surface); and *see also id.*, [019] identifies **Ex-1005** as prior art). This known relationship between outer surface geometries of a cable

with an uneven shape and cable/duct friction is sufficient to render element [1.7] obvious. *See In re Applied Materials*, 692 F.3d, at 1297 (“A recognition in the prior art that a property is affected by the variable is sufficient to find the variable result-effective.”). Element [1.7] is further rendered obvious by that known relationship, coupled with Summers’ disclosure of a range overlapping the claimed range.

Per Section VI(a)(1), Summers in view of Kaji renders obvious claim 1.

2. Claim 2

Claim 2 further recites that the two connecting portions of each claimed recess “have a convex surface shape that is radially inward.”

Per Section VI(A)(1)(e), Summers’ hollow 56b discloses the claimed recess. Per Section VI(A)(1)(f), Summers discloses or suggests the recited two connecting portions by teaching that other surface irregularities can be used to implement its hollow 56b. Examples provided for the other surface irregularities include teat-like extensions and configuring an apex of any hollow 56b to “be more sharply defined to roughly come to a rounded-off point...or can be truncated with flat zones.” (Ex-1005, 6:7-16; *see also id.*, 2:53-55). Therefore, Summers in view of Kaji renders obvious claim 2.

3. Claim 3

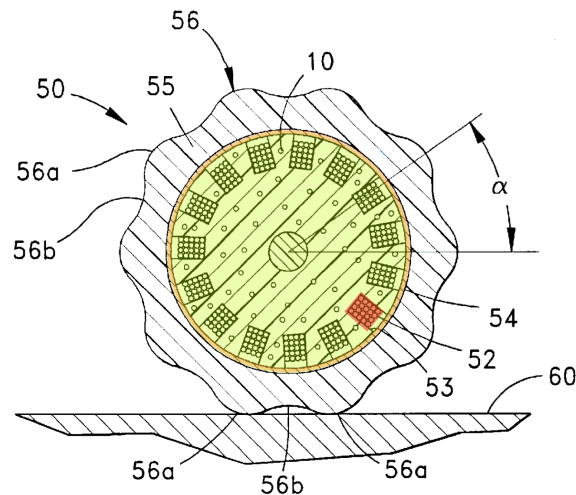
Claim 3 further recites the claimed optical fiber cable “has a compressive strength of 12.8 N/mm² or greater and 32.4 N/mm² or less.”

With reference to Table 1, the ‘591 Patent discloses an air-blowing test performed using eight different optical fiber cables identified as Test Examples 1-1 to 1-8. (Ex-1001, 5:40-7:38). Test Examples 1-1 to 1-7 are only generally described as having different compressive strengths while Test Example 1-8 is described as a loose tube type optical fiber cable. (Ex-1001, 5:65-6:3). Table 1 provides some additional high-level details about each Test Example, such as diameter, cross-sectional area, compressive strength, and air-blowing test result. Based on the compressive strength of each Test Example with a “good (OK)” air-blowing test result, the ‘591 Patent states that “the compressive strength of the optical fiber cable may be 12.8 N/mm²] or more and 32.4 N/mm² or less.” (Ex-1001, 7:36-38). The ‘591 Patent lacks any disclosure that associates compressive strength with any structure of an optical fiber cable. Therefore, a POSITA would understand compressive strength as an inherent property of the optical fiber cable defined by claim 1 having a value that necessarily falls within the range recited by claim 3. Per Section VI(A)(1), Summers in view of Kaji renders obvious claim 1, and thus renders obvious claim 3.

4. Claim 4

Claim 4 recites that the claimed core “further comprises a wrapping tube that wraps the intermittently-adhered optical fiber ribbon.”

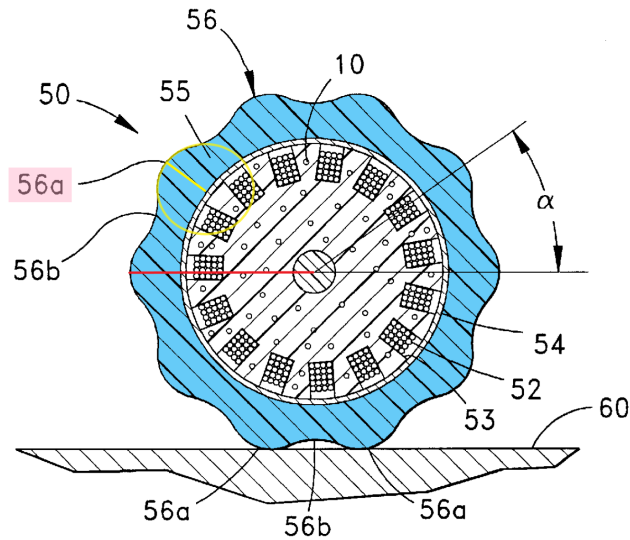
Annotated FIG. 6 below shows that Summers discloses that its fiber optic cable component 10 (in green) includes a wrapping tube 54 (in orange) that wraps its four-fiber ribbon 52 (in red). (Ex-1005, 3:56-57). Therefore, Summers in view of Kaji renders obvious claim 4.



5. Claim 8

Claim 8 further recites that “a radius of curvature of each outer circumferential surface of the protrusions is smaller than a radius of the sheath.”

Annotated FIG. 6 below shows that Summers discloses that a radius of curvature (in yellow) of each outer circumferential surface of its crests 56a is smaller than a radius (in red) of its cable jacket 55. Therefore, Summers in view of Kaji renders obvious claim 8.



In the event Patent Owner asserts it is improper to rely on Summers’ relative dimensions, the Board has found relative dimensions in patent drawings to be sufficient in similar circumstances. *See Unified Patents, LLC v. Oceana Innovations LLC*, IPR2020-01463, Paper 27 at 49 (P.T.A.B. Feb. 14, 2022) (“relying on [the prior art’s] relative horizontal and vertical dimensions”) shown in figures to find that it discloses “first and second sides that are longer than each of the third sides”). Moreover, the ‘591 Patent discloses with reference to this claimed feature that “the contact area between the protrusions 11 and the micro-duct [] becomes smaller.” (Ex-1001, 5:24-29). Similarly, Summers discloses that “crests [56a] ... are shaped to define substantially narrowed contact interfaces with a cable passageway surface ..., thereby minimizing surface area contact.” (Ex-1005, 5:55-61).

6. Claim 13

Claim 13 recites that the claimed sheath comprises [13.1] a base material; and [13.2] a low friction material having a friction coefficient smaller than a friction coefficient of the base material. Claim 13 further recites that [13.3] the low friction material is disposed at least on tops of the protrusions.

Per Section VI(A)(1)(a), Summers' cable jacket 55 discloses the claimed sheath. Per Section VI(A)(1)(e), Summers' crests 56a disclose the claimed protrusions. Summers discloses element [13.1] by disclosing that its "[c]able jackets 45,55 can be formed of a suitable plastic material, for example polyethylene." (Ex-1005, 3:65-4:1). Summers discloses element [13.2] by disclosing that "to reduce resistance ..., [its cable jackets 55] can include a friction reducing additive therein." (*Id.*; *see also id.*, 4:7-14). By describing that additive as "friction reducing", Summers clearly contemplates that its additive has a smaller friction coefficient than its plastic material (e.g., polyethylene). Summers discloses element [13.3] by disclosing that "[t]he friction reducing additive can function by migrating to the surface of cable jackets 45,55." Per Section VI(A)(1)(e), Summers describes the crests 56a disposed on its cable jacket 55 as forming an undulated profile 56 and characterizes the crests 56a as "surface irregularities" of its fiber optic cable 50.

Therefore, Summers in view of Kaji renders obvious claim 13.

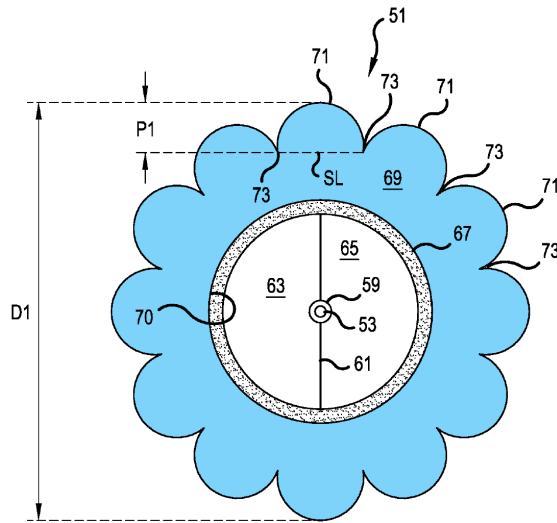
B. Ground 2 – Claims 1-4 and 8 are obvious over Pausan in view of the eABF NPL

Per Section IV(C), outer surface geometries of an optical fiber cable such as an uneven shape were well known in the art as improving air-blown installation performance by reducing cable/duct friction. Summers (Ex-1005) discloses one such cable and Pausan (Ex-1007) discloses another.

While most limitations of claims 1-3, 8, and 13 would be obvious to a POSITA based on Pausan alone, the teachings of the eABF NPL confirm that the “intermittently-adhered optical fiber ribbon” limitation was conventional and well-known in the art before the Critical Date. Pausan and the eABF NPL are in the same field inasmuch as they each relate to fiber optic cables. (Ex-1007, [001]; and Ex-1008, generally).

1. Independent Claim 1

Claim 1 is directed to “[a]n optical fiber cable.” Pausan discloses “a fiber optic cable with improved physical structures to enhance installation of the fiber optic cable into a conduit.” (Ex-1007, [001]). Annotated FIG. 6 below shows a cable 51 that implements Pausan’s fiber optic cable. (Ex-1007, [057]-[064]).



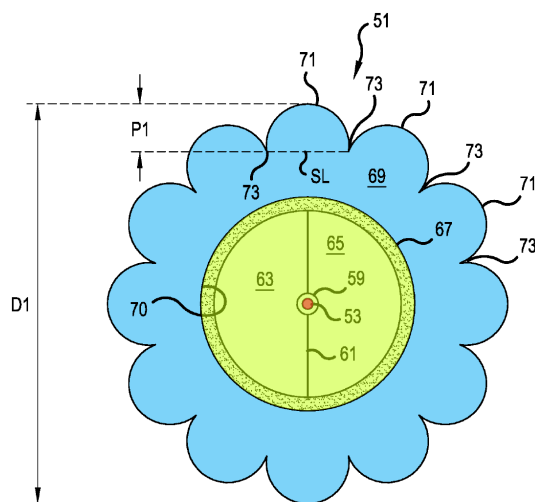
a. [1.1] “a sheath”

Annotated FIG. 6 above shows that Pausan discloses element [1.1] by its cable 51 (“optical fiber cable”) including a jacket 69 (in blue). (Ex-1007, [061]). Per Section VI(A)(1)(a), a POSITA would recognize that “jacket” and “sheath” as interchangeable.

Pausan describes its jacket 69 as having “an undulating thickness entirely around the inner core to form a plurality of alternating projections 71 and valleys 73 on the outer surface of the jacket 69.” (Ex-1007, [061]). The undulating thickness of the jacket 69 provides the cable 51 “with a fluted outer shape for reducing the friction between the cable’s jacket and the interior wall of the conduit.” (Ex-1007, [026], and Title).

b. [1.2] “a core that is housed in the sheath and comprises an intermittently-adhered optical fiber ribbon comprising:”

Annotated FIG. 6 below shows that Pausan discloses a “core” as an “inner core” (in green), which is housed in the jacket 69 (in blue), and which includes an optical fiber 53 (in red). (Ex-1007, [057]-[061]).



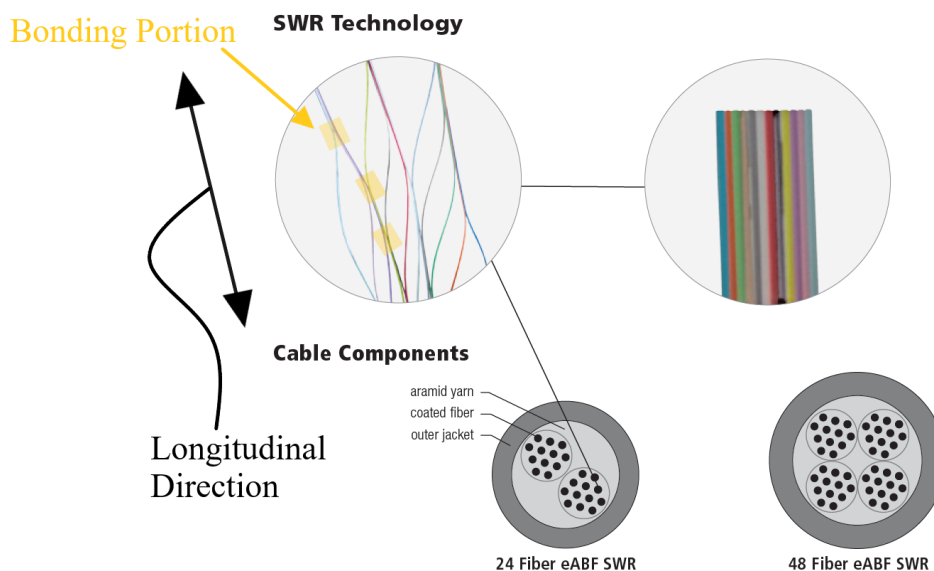
Pausan describes its inner core as including a rigid strength member 57 having a hollow channel 59. (Ex-1007, [058]). Pausan notes that while FIG. 6 shows a single optical fiber 53 residing within hollow channel 59, the diameter of hollow channel 59 may be increased to accommodate more than one optical fiber 53 such as up to twenty-four optical fibers. (*Id.*)

A stated objective of Pausan is to “provide a cable with a single rigid rod with a hollow channel proximate its central axis.” (Ex-1007, [027]). Pausan’s stated objective “provides a fiber optic cable with an extremely small outer diameter, [] and which has a centrally disposed optical fiber to be easily terminated to a connector.” (*Id.*). Per Pausan, the **circular** inner wall 70 of the jacket 69 [] could accommodate a **circular** collar of the connector body to be inserted therein

and to assist in stabilizing the connector attachment to the end of the cable 51.” (Ex-1007, [083]) (emphasis added).

The eABF NPL discloses and describes advantages of a Spider Web Ribbon (“SWR”) fiber bundle that “allows for the design of **round**, high-fiber density **geometry**.” (Ex-1008, 22) (emphasis added). The eABF NPL describes another advantage of its SWR fiber bundle as offering “the installer the ability to quickly and **efficiently install** [multifiber push-on (“MPO”)] multi-fiber **connectors** [] without having to sort out and arrange individual fibers.” (*Id.*) (emphasis added).

Annotated eABF Figure below shows that the eABF NPL configures its SWR fiber bundle from multiple optical fibers using multiple bonding portions (in orange).



The annotated eABF Figure above also shows that the eABF NPL discloses that its bonding portions (in orange) are intermittently disposed in a longitudinal

direction of its optical fibers for bonding or adhering adjacent optical fibers. (*See also* Section VI(A)(1)(b) for use of “longitudinal direction” by the ‘591 Patent). Additionally, the annotated eABF Figure above shows that, external to its bonding portions (in orange), adjacent optical fibers in the eABF NPL’s SWR fiber bundle are otherwise not bound by each other. (*See also* Ex-1024, generally).

A POSITA would have been motivated by the eABF NPL to modify Pausan’s cable 51 to include its SWR fiber bundle to obtain its described advantages of “round, high-fiber density geometry” and efficient connector installation. (Ex-1008, 22). Especially inasmuch as those described advantages align with Pausan’s objective of “provid[ing] a fiber optic cable with an extremely small outer diameter, [] and which has a centrally disposed optical fiber to be easily terminated to a connector.” (Ex-1007, [027]).

Moreover, a POSITA would have had a reasonable expectation of success because such modification would amount to nothing more than a simple substitution of the optical fiber 53 residing within Pausan’s hollow channel 59 with the eABF’s SWR fiber bundle by known methods of cable manufacturing. For instance, Pausan discloses that while a diameter of its hollow channel 59 shown in FIG. 6 is dimensioned “so that a single optical fiber 53 has a loose fit”, that diameter can be re-dimensioned to accommodate additional optical fibers. (Ex-1007, [058]). In that context, such modification would merely involve re-

dimensioning a diameter of Pausan's hollow channel 59 so that the eABF's SWR fiber bundle with its described advantage of "round, high-fiber density geometry" has a loose fit. A POSITA would thus appreciate that such modification is accomplished without additional change to Pausan's cable 51.

Accordingly, element [1.2] is obvious over Pausan in view of the eABF NPL.

c. [1.3] *"optical fibers; and"*

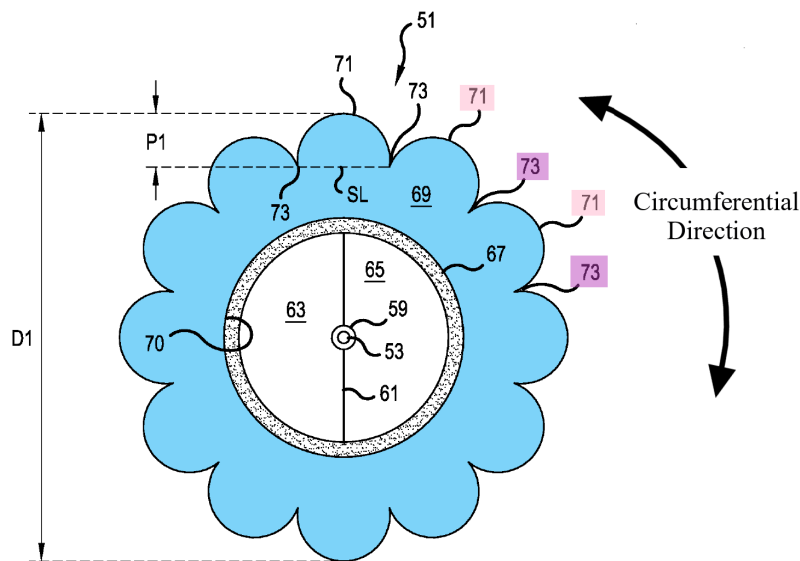
Per Section VI(B)(1)(b), element [1.3] is obvious over Pausan in view of the eABF NPL's teachings regarding its SWR fiber bundle being configured from multiple optical fibers. (Ex-1008, 22).

d. [1.4] *"adhesive portions that intermittently adhere the optical fibers together in a longitudinal direction, wherein"*

Pausan in combination with the eABF NPL renders element [1.4] obvious. For instance, per Section VI(B)(1)(b), a POSITA would have been motivated to modify Pausan's cable 51 to include the eABF's SWF fiber bundle with bonding portions that are intermittently disposed in a longitudinal direction of its optical fibers for bonding or adhering adjacent optical fibers. (Ex-1008, 22).

e. [1.5] *"recesses and protrusions are disposed alternately in a circumferential direction on an outer circumferential surface of the sheath,"*

Annotated FIG. 6 below shows that Pausan discloses “recesses” as valleys 73 (in purple) and “protrusions” as projections 71 (in pink) that are disposed alternately in a circumferential direction on an outer circumferential surface of the jacket 69 (in blue). Per Section VI(A)(1)(b), the circumferential direction shown in Annotated FIG. 6 conforms with the use of “circumferential direction” by the ‘591 Patent.

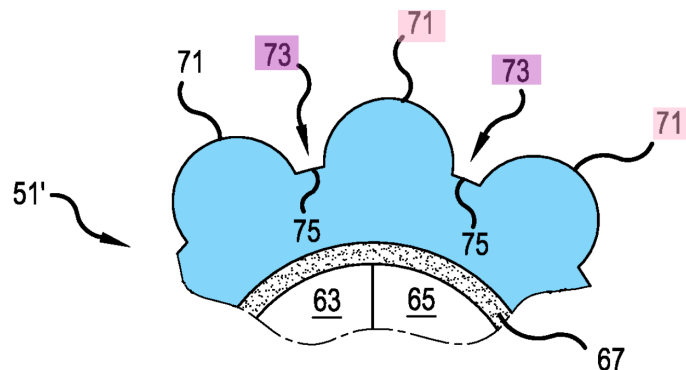


Pausan describes its jacket 69 as having an undulating thickness entirely around its inner core to form the projections 71 and the valleys 73 (Ex-1007, [061]). Per Section VI(B)(1)(a), the undulating thickness provides Pausan’s cable 51 with a fluted outer shape for reducing the friction between the cable’s jacket and the interior wall of the conduit.

Accordingly, Pausan discloses element [1.5].

- f. [1.6] *“the recesses each comprise: two connecting portions respectively connected to radial inner ends of two adjacent protrusions; and a bottom surface positioned between the two connecting portions, and”*

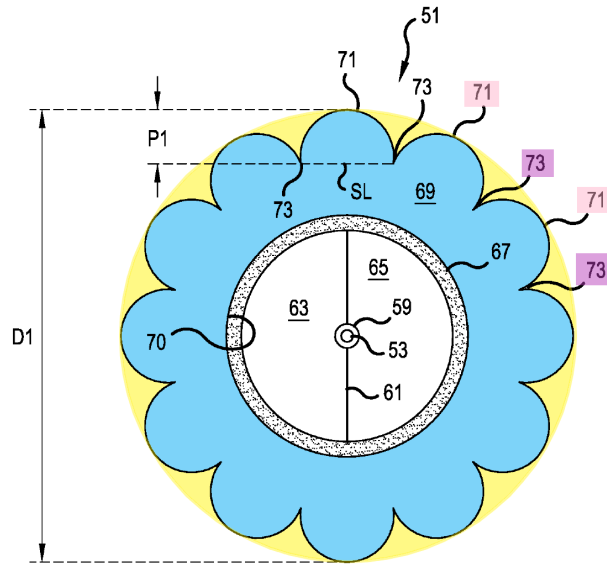
Element [1.6] recites that each claimed recess includes [1.6a] two connecting portions respectively connected to radial inner ends of two adjacent protrusions and [1.6b] a bottom surface positioned between the two connecting portions. Annotated FIG. 7 below shows that Pausan discloses or renders obvious elements [1.6a] and [1.6b] by teaching that “the projections 71 may be slightly spaced from each other so that short segment of a curved floor 75 is formed between the projections 71.”



- g. [1.7] *“in a transverse cross-sectional view, a cross-sectional area of the recesses that is enclosed by closed curves tangent to radial outer ends of the protrusions and all the recesses is 1.3 mm² or greater and 4.8 mm² or less.”*

Pausan's stated objective is to provide its cable 51 "with a fluted outer shape for reducing the friction between the cable's jacket and the interior wall of the conduit." (Ex-1007, [026], and Title). Pausan discloses that reduced surface area contact between a cable and a surface (e.g., an interior wall) within an existing conduit reduces such friction. (Ex-1007, [015]-[016]). Pausan further discloses, with reference to Ex-1022, that providing channels for air flow between a cable and an existing conduit also reduces such friction. (Ex-1007, [017]-[018]).

Within that context, Pausan provides its cable 51 with the fluted outer shape for reducing friction by configuring its jacket 69 to have an undulating thickness entirely around its inner core to form the projections 71 and the valleys 73. (Ex-1007, [061]; *see also* Section VI(B)(1)(a)). Annotated FIG. 6 below shows that Pausan discloses that its projections 71 (in pink) and valleys 73 (in purple) are dimensioned such that, in a transverse cross-sectional view, a cross-sectional area (a subset of that cross-sectional area in yellow) of all valleys 73 is greater than zero (i.e., non-zero) such as 0.1 square millimeters ("mm²").



While Pausan discloses a non-zero (e.g., 0.1 mm²) cross-sectional area corresponding to each valley 73 formed on its jacket 69, Pausan does not disclose that cross-sectional area being 1.3 mm² or greater and 4.8 mm² or less. For at least three distinct reasons, the “1.3 mm² or greater and 4.8 mm² or less” limitation recited by element [1.7] does not render any Challenged Claim patentable inasmuch as it would have been obvious to a PHOSITA to configure Pausan’s cable 51 with the cross-sectional area of all valleys 73 being 1.3 mm² or greater and 4.8 mm² or less.

First, it is well established that merely changing the size of a device is not patentable, as discussed above in Section VI(A)(1)(g).

Second, similar to Summers, Pausan discloses or suggests a range for the recited “cross-sectional area” that overlaps (partially or otherwise) the claimed range of 1.3 mm² or greater and 4.8 mm² or less. As discussed above with reference

to Annotated FIG. 6, and similar to Summers, Pausan discloses a non-zero (e.g., 0.1 mm^2) cross-sectional area corresponding to each valley 73 disposed on its jacket 69. That non-zero value establishes a lower-bound of the range that Pausan discloses for the recited “cross-sectional area”.

Similar to Summers, an upper-bound of that range is established via Pausan’s stated objectives. Specifically, Pausan’s stated objective is to provide its cable 51 “with a fluted outer shape for reducing the friction between the cable’s jacket and the interior wall of the conduit.” (Ex-1007, [026], and Title). To that end, Pausan provides its cable 51 with the fluted outer shape for reducing friction by configuring its jacket 69 to have an undulating thickness entirely around its inner core to form the projections 71 and the valleys 73. (Ex-1007, [061]; *see also* Section VI(B)(1)(a)). As such, a cross-sectional area corresponding to each valley 73 formed on Pausan’s jacket 69 must be less than a cross-sectional area defined by an existing conduit.

For the reasons presented above, Pausan and Summers both disclose a respective range for the recited “cross-sectional area” having lower and upper bounds being established by a non-zero value and an existing duct’s (or conduit’s) cross-sectional area, respectively. Therefore, overlap exists between the range that Pausan discloses for the recited “cross-sectional area” and the claimed range of 1.3 mm^2 or greater and 4.8 mm^2 or less that renders the claimed range obvious for

reasons similar to those discussed in Section VI(A)(1)(g) with respect to Summers, *mutatis mutandis*.

Third, element [1.7] is a result-effective variable because of the known relationship between outer surface geometries (e.g., element [1.7]) of a cable with an uneven shape and cable/duct friction discussed above in Section VI(A)(1)(g). While that known relationship alone is sufficient to render element [1.7] obvious, element [1.7] is further rendered obvious by that known relationship coupled with Pausan's disclosure of a range overlapping the claimed range. *See In re Applied Materials*, 692 F.3d, at 1297.

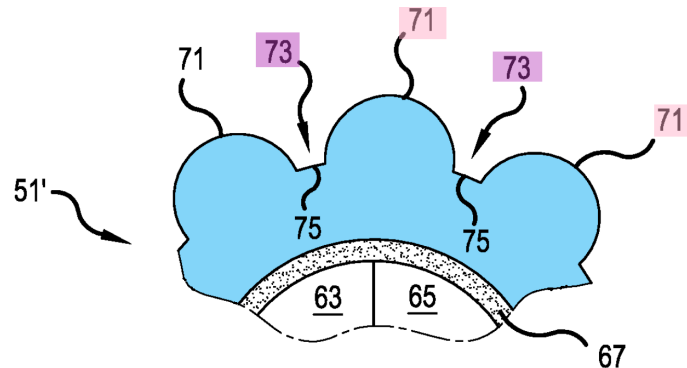
Per Section VI(B)(1), Pausan in view of the eABF NPL renders obvious claim 1.

2. Claim 2

Claim 2 further recites that the two connecting portions of each claimed recess “have a convex surface shape that is radially inward.”

Per Section VI(B)(1)(e), Pausan's valley 73 discloses the claimed recess. Per Section VI(B)(1)(f), Pausan discloses or suggests the recited two connecting portions by teaching that the projections 71 may be slightly spaced from each other so that short segment of a curved floor 75 is formed between the projections 71. The '591 Patent discloses that its FIG. 1B illustrates “the connecting portions 12a are formed in a curved surface shape that is radially inward convex.” (Ex-1001,

4:45-47, FIG. 1B). Annotated FIG. 7 below illustrates Pausan's valley 73 having a shape where its floor 75 interfaces with an adjacent projection 71 that is consistent with the shape of the connecting portions 12a illustrated in FIG. 1B of the '591 Patent. Therefore, Pausan in view of the eABF NPL renders obvious claim 2.



3. Claim 3

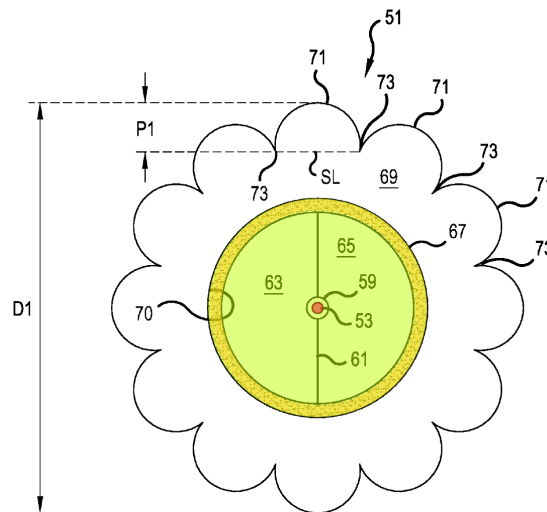
Claim 3 further recites the claimed optical fiber cable “has a compressive strength of 12.8 N/mm² or greater and 32.4 N/mm² or less.”

Per Section VI(A)(3), a POSITA would understand compressive strength as an inherent property of the optical fiber cable defined by claim 1 having a value that necessarily falls within the range recited by claim 3. Per Section VI(B)(1), Pausan in view of the eABF NPL renders obvious claim 1, and thus renders obvious claim 3.

4. Claim 4

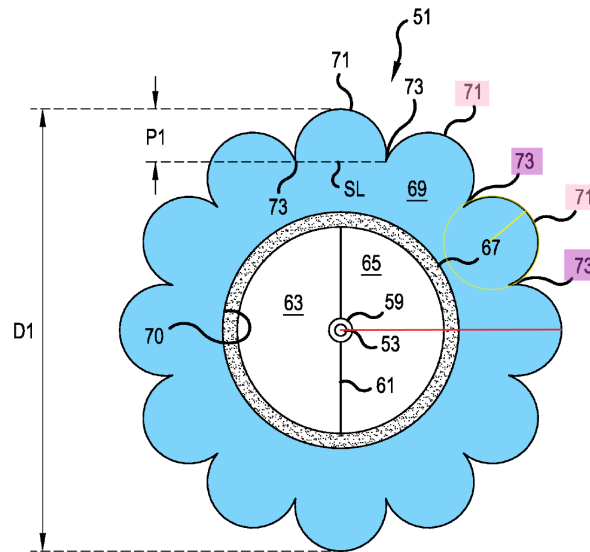
Claim 4 recites that the claimed core “further comprises a wrapping tube that wraps the intermittently-adhered optical fiber ribbon.” The '591 Patent discloses

Annotated FIG. 6 below shows that Pausan discloses that its inner core (in green), which is housed in the jacket 69 includes yarns 67 (in orange) that wrap the optical fiber 53 (in red). (Ex-1007, [060]). Pausan further states that “the yarns 67 may be constructed of aramid yarns [] and may also include a water blocking ability.” (Ex-1007, [071]). Therefore, Pausan in view of the eABF NPL renders obvious claim 4.



Claim 8 further recites that “a radius of curvature of each outer circumferential surface of the protrusions is smaller than a radius of the sheath.”

Annotated FIG. 6 below shows that Summers discloses that a radius of curvature (in yellow) of each outer circumferential surface of its crests 56a is smaller than a radius (in red) of its cable jacket 55. Therefore, Summers in view of Kaji renders obvious claim 8.



In the event Patent Owner asserts it is improper to rely on Pausan’s relative dimensions, the Board has found relative dimensions in patent drawings to be sufficient in similar circumstances. *See Unified Patents, LLC v. Oceana Innovations LLC*, IPR2020-01463, Paper 27 at 49 (P.T.A.B. Feb. 14, 2022) (“relying on [the prior art’s] relative horizontal and vertical dimensions”) shown in figures to find that it discloses “first and second sides that are longer than each of the third sides”). Moreover, the ‘591 Patent discloses with reference to this claimed feature that “the contact area between the protrusions 11 and the micro-duct [] becomes smaller.” (Ex-1001, 5:24-29).

Similarly, Pausan's stated objective is to provide its cable 51 "with a fluted outer shape for reducing the friction between the cable's jacket and the interior wall of the conduit." (Ex-1007, [026], and Title). Pausan discloses that reduced surface area contact between a cable and a surface (e.g., an interior wall) within an existing conduit reduces such friction. (Ex-1007, [015]-[016]). Within that context, Pausan provides its cable 51 with the fluted outer shape for reducing friction by configuring its jacket 69 to have an undulating thickness entirely around its inner core to form the projections 71 and the valleys 73. (Ex-1007, [061]; *see also* Section VI(B)(1)(a)).

C. Ground 3 – Sato-1 Anticipates or Renders Obvious Independent Claim

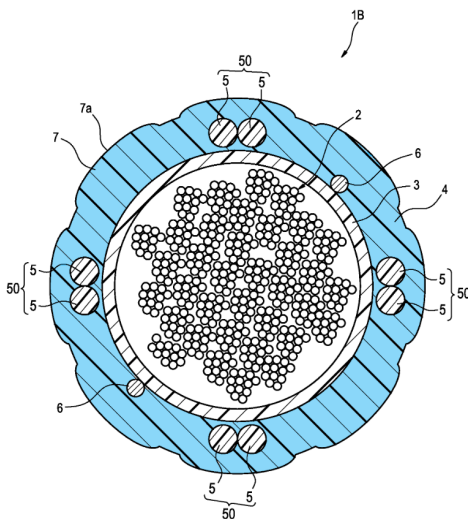
14

Per Section III, Sato-1 (Ex-1009) is prior art under §102(a)(2) with respect to claim 14 of the '591 Patent. Moreover, outer surface geometries of an optical fiber cable such as an uneven shape were well known in the art as improving air-blown installation performance by reducing cable/duct friction, per Section IV(C).

1. Independent Claim 14

Claim 14 is directed to "[a]n optical fiber cable." Sato-1 discloses an optical fiber cable having good air pumping characteristics. (Ex-1009, [0009]). Sato-1 describes good air pumping characteristics in the context of an optical fiber cable being compressed by air or pushed through a duct. (Ex-1009, [0010]). Referencing

FIGS. 3-4, Sato-1 describes optical fiber cable 1A as an example cable with good air pumping characteristics. (Ex-1009, [0060]-[0073]). Annotated FIG. 3 below shows cable 1A.



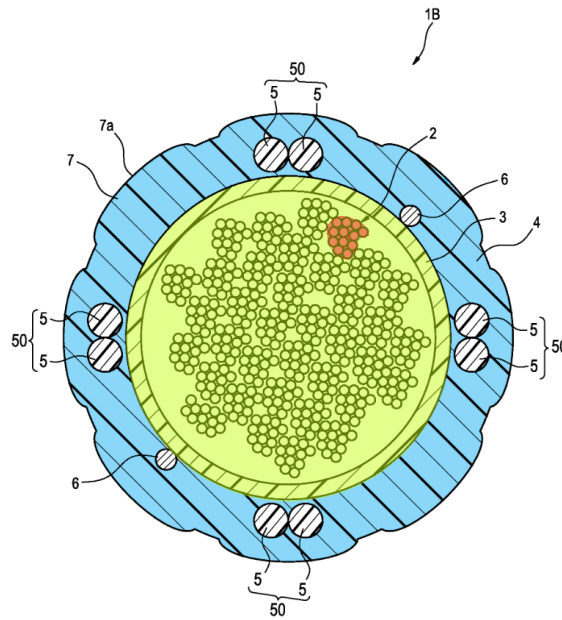
a. [14.1] “a sheath”

Annotated FIG. 3 above shows that Sato-1 discloses element [14.1] by its cable 1B (“optical fiber cable”) including a cable jacket 4 (in blue). (Ex-1009, [0062]). Per Section VI(A)(1)(a), a POSITA would recognize “jacket” and “sheath” as interchangeable.

b. [14.2] “a core that is housed in the sheath and comprises an intermittently-adhered optical fiber ribbon comprising:”

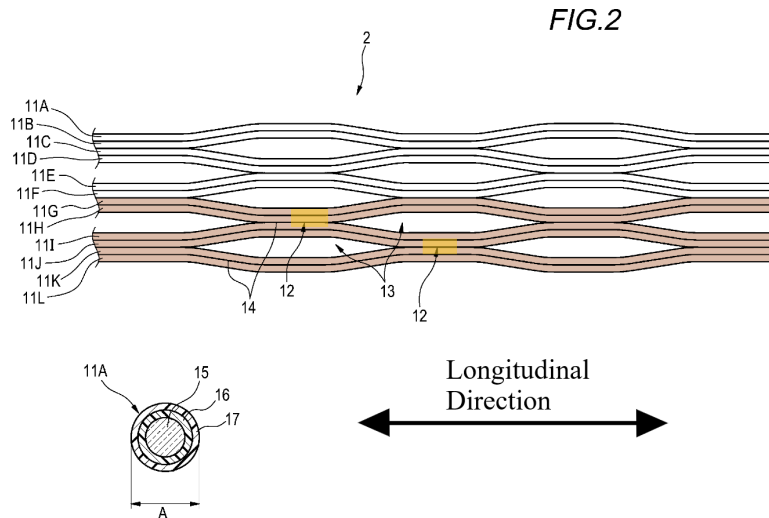
Annotated FIG. 3 below shows that Sato-1 discloses a “core” as components (in green) of cable 1A, which are housed in the cable jacket 4 (in blue), and which includes an “intermittently-adhered optical fiber ribbon” as an intermittently connected optical fiber ribbon 2 (in red). (Sato-1, [0061]; *See also id.*, [0029],

[0118] (describing optical fiber cable 1E shown in FIG. 10, as having a round aggregate core 111 and a cable jacket 113 formed around the aggregate core 111.).



c. [14.3] “optical fibers; and”

Per Section VI(C)(1)(b), Sato-1 discloses that its cable 1B includes an intermittently connected optical fiber ribbon 2. Annotated FIG. 2 below shows that Sato-1 discloses element [14.3] inasmuch as the intermittently connected optical fiber ribbon 2 (in red) includes multiple (e.g., twelve) optical fibers 11A-L (in brown). (Ex-1009, [0012]).

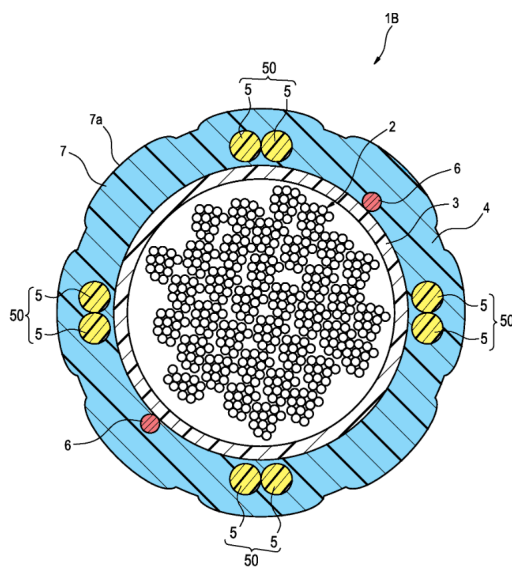


- d. [14.4] *“adhesive portions that intermittently adhere the optical fibers together in a longitudinal direction; and”*

Annotated FIG. 2 above also shows that Sato-1 discloses element [14.4] inasmuch as its intermittently connected optical fiber ribbon 2 (in red) includes “adhesive portions” as connecting portions 12 are intermittently provided to connect its optical fibers 11A-L (in brown) in a longitudinal direction. (Ex-1009, [0036]-[0037]).

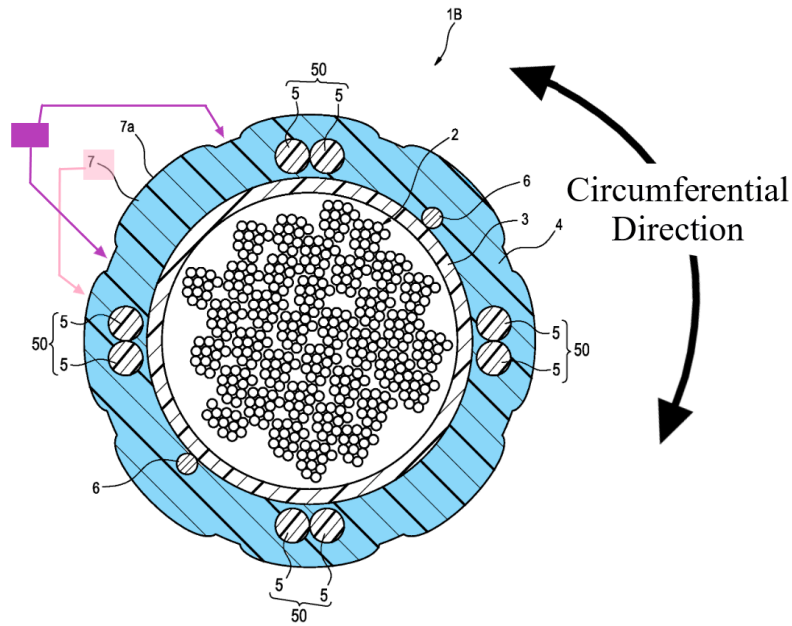
- e. [14.5] *“tensile strength members and ripcords embedded in the sheath,”*

Annotated FIG. 3 below shows that Sato-1 discloses “tensile strength members” as tensile members 5 (in yellow) and “ripcords” as tear strings 6 (in red) that are each embedded in its cable jacket 4 (in blue). Therefore, Sato-1 discloses element [14.5].



- f. [14.6] “wherein recesses and protrusions are disposed alternately in a circumferential direction on an outer circumferential surface of the sheath,”

Annotated FIG. 3 below shows that Summers discloses “protrusions” as projections or protrusions 7 (in pink) and “recesses” as portions (“non-projection portions”) (in purple) on an outer periphery of its cable jacket 4 that are external to its projections 7. (Ex-1009, [0062]-[0063]). Annotated FIG. 3 below also shows that the non-projection portions (in purple) and the projections 7 (in pink) are disposed alternately in a circumferential direction on an outer circumferential surface of the cable jacket 4 (in blue). Per Section VI(A)(1)(b), the circumferential direction shown in Annotated FIG. 3 below conforms with the use of “circumferential direction” by the ‘591 Patent.

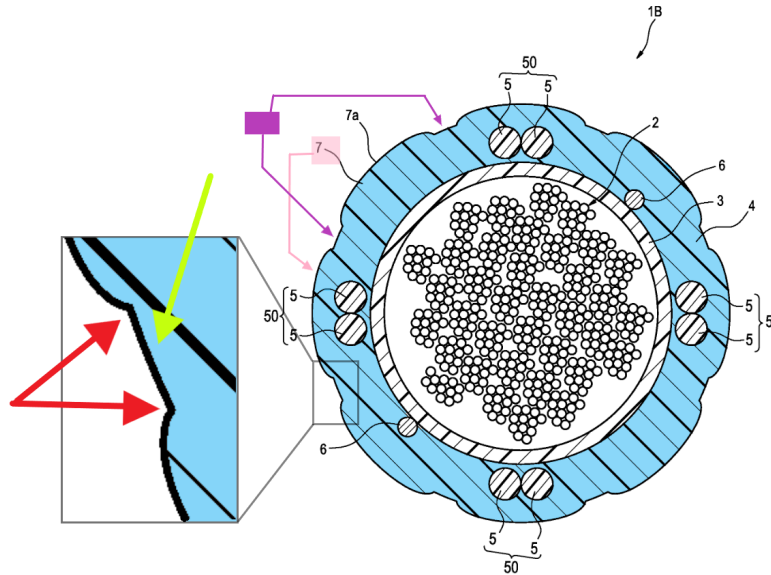


Sato-1 describes the projections 7 disposed on its cable jacket 4 as contacting an inner wall of a duct, to reduce a contact area between the cable jacket 4 and the duct, which reduces friction between the cable jacket 4 and the duct. (Ex-1009, [0063]). Accordingly, Sato-1 discloses element [14.6].

g. [14.7] *“the recesses each comprise: two connecting portions respectively connected to radial inner ends of two adjacent protrusions; and a bottom surface positioned between the two connecting portions, and”*

Element [14.7] recites that each claimed recess includes [14.7a] two connecting portions respectively connected to radial inner ends of two adjacent protrusions and [14.7b] a bottom surface positioned between the two connecting portions. Annotated FIG. 3 below includes an enlarged view (presented in a gray

frame) of a non-projection portion (in purple) disposed on an outer circumferential surface of Sato-1's cable jacket 4 (in blue) between adjacent projections 7 (in pink).

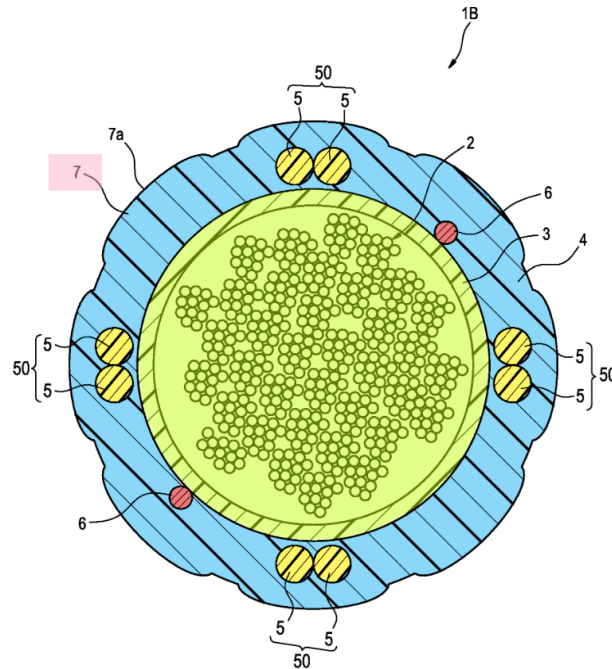


Sato-1's non-projection portion in the enlarged view (presented in a gray frame) of Annotated FIG. 3 includes a connection portion (in red) with each adjacent projection 7 and a bottom portion (in light green) between its connection portions (in red). Accordingly, Sato-1 discloses elements [14.7a] and [14.7b].

h. [14.8] *“in a transverse cross-sectional view, the ripcords are positioned inside some of the protrusions, and”*

The '591 Patent defines “transverse cross-section” as referring to a cross-section that is orthogonal to its longitudinal direction and describes its FIG. 1A as showing a transverse cross-sectional view of its cable 1. (Ex-1001, 3:18-27, FIG.1A). Annotated FIG. 3 of Sato-1 below includes a view of its cable 1B that is

consistent with the transverse cross-sectional view that FIG. 1A of the ‘591 Patent provides of its cable 1. Annotated FIG. 3 below shows that Sato-1 discloses its tear strings 6 (in red) are positioned inside some of the projections 7 (in pink) in its cable jacket (in blue). Therefore, Sato-1 discloses element [14.8].

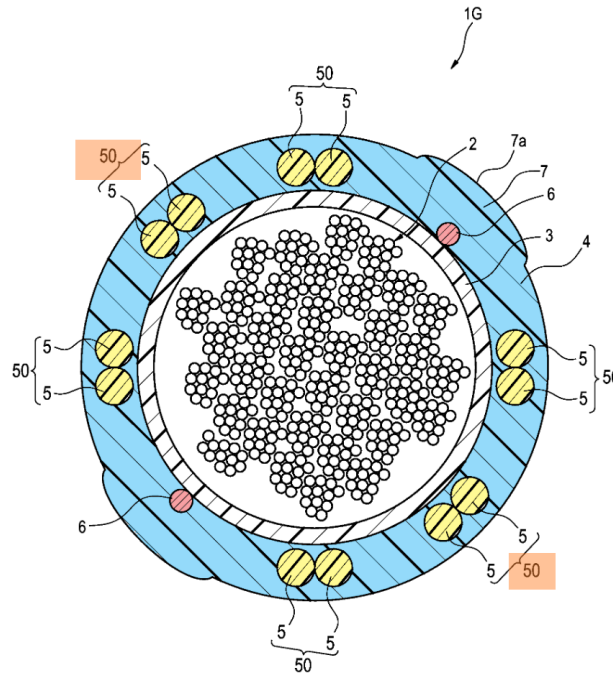


- i. [14.9] *“the tensile strength members are positioned inside the remaining protrusions”*

Annotated FIG. 3 above also shows that Sato-1 discloses its tensile members 5 (in yellow) and its tear strings 6 (in red) are positioned inside different projections 7 (in pink) of its cable jacket (in blue). Annotated FIG. 3 above includes two projections 7 (“empty projections”) without any tensile members 5 or tear strings 6 positioned inside. Annotated FIG. 3 above shows that those empty projections are provided on an outer periphery of Sato-1’s cable jacket 4 at

opposing circumferential positions with respect to its “core” (in green). Sato-1 discloses the tensile members 5 are provided in its cable jacket 4 in groups of two or more tensile members 5 that are collectively referred to as strength member units 50. (Ex-1009, [0031]).

Sato-1 also discloses that various changes and modifications can be made to its cables such as cable 1B. (Ex-1009, [0141]). Annotated FIG. 16 of Sato-1 below depicts cable 1G that shows one such modification.



Sato-1 discloses that cable 1G of Annotated FIG. 16 differs from cable 1B of Annotated FIG. 3 in that cable 1G includes one more pair of tension member units 50 (in orange). A comparison between Annotated FIGS. 3 and 16 above show that the additional pair of tension member units 50 are positioned in portions of cable 1G’s cable jacket 4 that correspond to the empty projections of cable 1B’s cable

jacket 4. Accordingly, Sato-1 discloses element [14.9]. Alternatively, Sato-1's teaching regarding the additional pair of tension member units 50 with reference to FIGS. 3 and 16 renders element [14.9], at least, obvious.

Per Section VI(C)(1), Sato-1 anticipates claim 14 or alternatively renders claim 14 obvious.

VII. DISCRETION SHOULD NOT PRECLUDE INSTITUTION

For the following reasons, the Board should refrain from exercising its discretion to deny the present Petition.

A. §314(a)

As explained below, the six *Fintiv* factors do not support discretionary denial of institution based on the co-pending district court litigation. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential). Even if these factors were considered, they weigh against discretionary denial.

First factor is neutral because no request for stay has been filed with the district court and the Board does not infer how the district court would rule should a stay be requested. *See, e.g., Hulu LLC v. SITO Mobile R&D IP, LLC et al.*, IPR2021-00298, Paper 11 at 10-11 (PTAB May 19, 2021).

Second factor is neutral. Trial is currently schedule for March 2, 2026. (Ex-1031, 11). A final written decision in an IPR arising from this Petition would issue as early as May 2026. However, “an early trial date” is “non-dispositive” and “the

decision whether to institute will likely implicate other factors” that favor institution for reasons outlined below. *Fintiv*, IPR2020-00019, Paper 11 at 5, 9; *see also Intuitive Surgical, Inc. v. Ethicon, LLC*, IPR2018-01703, Paper 7, at 12 (Feb. 19, 2019) (recognizing that, even if a trial will come before a final decision, institution is appropriate to “give[] the district court the opportunity, at its discretion, to conserve judicial resources by staying litigation until the review is complete, [which facilitates] satisfying the AIA’s objective.”).

Third factor favors institution because the district court litigation is in its early stages and investment to date has been minimal. The parties have agreed that no claim construction is necessary; thus, there will not be a *Markman* hearing. (Ex-1024, 1). Fact discovery is not set to close until May 26, 2025. Expert discovery is not set to close until October 6, 2025. *See PEAG LLC v. Varta Microbattery GMBH*, IPR2020-01214, Paper 8 at 17 (Jan. 6, 2021) (finding that since no claim construction hearing had yet been held and discovery was not completed, the little investment in the parallel proceeding weighed against discretionary denial).

Fourth factor favors institution because, in the Amended Complaint (Ex-1032), Patent Owner has only identified a subset of the Challenged Claims addressed by this Petition. (Ex-1032, 7-9). Therefore, it is unlikely that the district court will be addressing validity of each Challenged Claim addressed by this Petition.

Fifth factor is neutral because the *Fintiv* decision “says nothing about situations in which the Petitioner is the same as, or is related to, the district court defendant.” *Cisco Systems, Inc. v. Ramot at Tel Aviv University Ltd.*, IPR2020-00122, Paper 15, 10 (May 15, 2020).

Sixth factor strongly favors institution as patentability challenges set forth above are particularly compelling and rely on references that were not previously considered by the Office, which favors institution regardless of the other factors. Also, there is a significant public interest against “leaving bad patents enforceable,” and institution will further that interest. *Thryv, Inc. v. Click-To-Call Techs., LP*, 140 S. Ct. 1367, 1374 (2020).

B. §325(d)

This Petition does not present “the same or substantially the same prior art or arguments previously were presented to the Office.” 35 U.S.C. §325(d). None of the prior art references used herein were cited during prosecution of U.S. Application No. 17/255,581, which issued as the ‘591 Patent.

VIII. MANDATORY NOTICES

Real Party-in-Interest: Petitioner is the real party-in-interest.

Related Matters: The ‘591 Patent as asserted against Petitioner in *AFL Telecommunications, LLC. v. Sterlite Technologies, Inc.*, No. 1:23-cv-01202-RGA

(D. Del.), which was filed on October 23, 2023. Petitioner is unaware of the ‘591 Patent being asserted against other parties.

Identification of Counsel: Lead Counsel: John H. Scott III (Reg. No. 70,726); Back-up Counsel: Kelly E. Farnan (*Pro Hac Vice* Pending).

Service: Service of any documents may be made at Adams and Reese LLP; 1221 McKinney Street, Suite 4400; Houston, TX 77010 (Telephone: 713.308.0127; Fax: 713.308.4001). Petitioner consents to e-mail service at: John.Scott@arlaw.com and Farnan@RLF.com.

Power of Attorney: A power of attorney is filed herewith.

IX. CERTIFICATION AND FEES

Petitioner certifies that the ‘591 Patent is available for IPR and that Petitioner is not barred or estopped from requesting this IPR on the grounds identified herein.

Please charge any fees to Deposit Account No. 50-2413.

X. CONCLUSION

The Challenged Claims are unpatentable for the reasons set forth above. Pursuant to 37 C.F.R §42.103, the fee set forth in §42.15(a) accompanies this Petition.

Respectfully submitted,

Date: October 31, 2024

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Counsel for Petitioner

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. §42.24(d), Petitioner certifies, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the foregoing Petition for *Inter Partes* Review totals 12,431 words, which is less than the 14,000 words allowed under 37 C.F.R. §42.24.

Date: October 31, 2024

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Counsel for Petitioner

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e) and 42.105, I certify that on October 31, 2024, I caused a true and correct copy of this Petition and all exhibits to be served on the Patent Owner of the '591 Patent at the following correspondence address of record for the '591 Patent:

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Date: October 31, 2024

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