

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LIFE SPINE, INC.,
Petitioner,

v.

GLOBUS MEDICAL, INC.,
Patent Owner.

IPR2022-01599
Patent 8,845,732 B2

Before DEVON ZASTROW NEWMAN, CYNTHIA M. HARDMAN, and
MICHAEL A. VALEK, *Administrative Patent Judges*.

HARDMAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

This is a Final Written Decision in an *inter partes* review challenging the patentability of claims 1, 7–13, and 16 of U.S. Patent No. 8,845,732 B2 (“the ’732 patent,” Ex. 1001). We have jurisdiction under 35 U.S.C. § 6.

Petitioner has the burden of proving unpatentability of the challenged claims by a preponderance of the evidence. 35 U.S.C. § 316(e). Having reviewed the parties’ arguments and cited evidence, for the reasons we discuss below, we find that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 7–13, and 16 are unpatentable as obvious over the cited prior art.

A. Procedural History

Petitioner Life Spine, Inc. filed a Petition requesting *inter partes* review of claims 1, 7–13, and 16 of the ’732 patent. Paper 2 (“Pet.”). Patent Owner Globus Medical, Inc. filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). With our authorization, Petitioner filed a Preliminary Reply and Patent Owner filed a Preliminary Sur-reply. Paper 9 (“Prelim. Reply”); Paper 10 (“Prelim. Sur-reply”). In view of the then-available record, we instituted an *inter partes* review. Paper 11 (“Inst. Dec.”).

After institution, Patent Owner filed a Response to the Petition. Paper 14 (“PO Resp.”). Petitioner filed a Reply. Paper 21 (“Reply”). Patent Owner filed a Sur-reply. Paper 27 (“Sur-reply”).

On January 19, 2024, we held an oral hearing, the transcript of which is of record. Paper 33.

B. Real Parties in Interest

Petitioner and Patent Owner each identify themselves as the real party in interest. Paper 24 (Petitioner’s Updated Mandatory Notices), 1; Paper 5 (Patent Owner’s Mandatory Notices), 1.

C. Related Matters

The parties identify *Globus Medical, Inc. v. Life Spine, Inc.*, 1:21-cv-01445 (D. Del.), as involving the ’732 patent. Paper 24, 1; Paper 5, 1. The parties also identify as related matters patent applications related to the ’732 patent, i.e., 17/192,231, 17/409,079, 17/410,335, 17/589,029, and 17/931,913. Paper 24, 1–2; Paper 5, 1. The parties also identify related *inter partes* review proceedings, i.e., IPR2022-01434, IPR2022-01435, IPR2022-01600, IPR2022-01601, IPR2022-01602, IPR2022-01603, and IPR2023-00041. Paper 24, 1; Paper 5, 1.

D. The ’732 Patent (Ex. 1001)

The ’732 patent, titled “Expandable Fusion Device and Method of Installation Thereof,” relates to an expandable device for insertion between adjacent vertebrae to facilitate fusion. Ex. 1001, code (54), 1:15–19, 1:61–65. According to the Specification, a need exists for a fusion device that is “capable of being installed inside an intervertebral disc space at a minimum to no distraction height and . . . a fusion device that can maintain a normal distance between adjacent vertebral bodies when implanted.” *Id.* at 1:53–57. The ’732 patent purports to meet this need with a fusion device including first and second endplates and a central ramp capable of moving in a first direction to push the endplates outwardly into an expanded configuration. *Id.* at 1:65–2:2.

The Specification describes exemplary expandable fusion devices, such as that depicted in Figure 60 of the '732 patent, reproduced below.

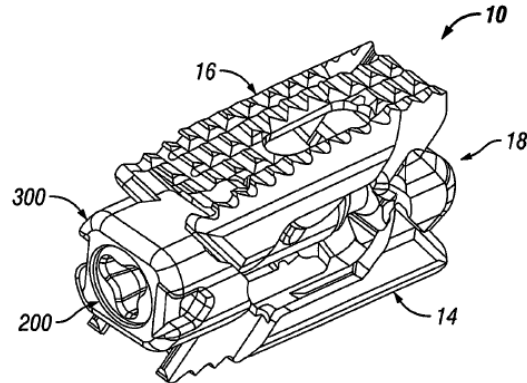


FIG. 60

Figure 60 of the '732 patent is a perspective view of expandable fusion device 10 in an expanded position. *Id.* at 5:1–3. Expandable fusion device 10 includes first endplate 14, second endplate 16, central ramp 18, actuator assembly 200, and driving ramp 300. *Id.* at 21:39–42. Actuator assembly 200 functions to pull central ramp 18 and driving ramp 300 together, which forces apart endplates 14 and 16. *Id.* at 21:42–45.

Figure 58 of the '732 patent, reproduced below, is an exploded view of the expandable fusion device in Figure 60. *Id.* at 4:62–64.

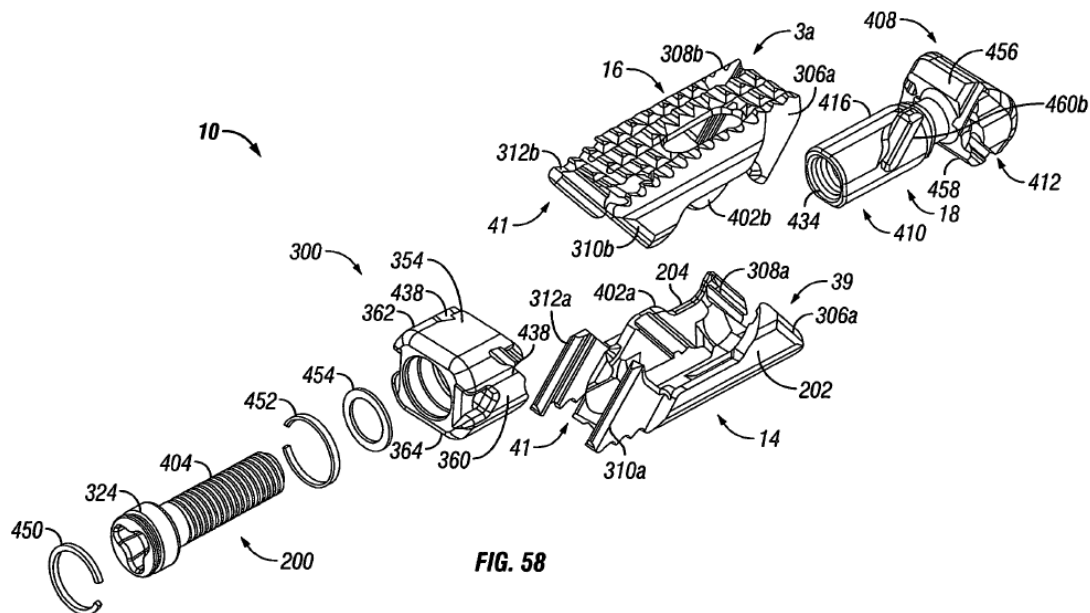


Figure 58 of the '732 patent depicts central ramp 18 with first end 408 and second end 410, expansion portion 412, second expansion portion 414, and rod-receiving extension 416 extending longitudinally from expansion portion 412 of central ramp 18. *Id.* at 22:47–52. Driving ramp 300 includes side portions 360 and 362, each having ramped portion 438. *Id.* at 23:14–19.

Figure 61 of the '732 patent, reproduced below, is a side cross-section view of the expandable fusion device in Figure 58 in an expanded position.

Id. at 5:4–6.

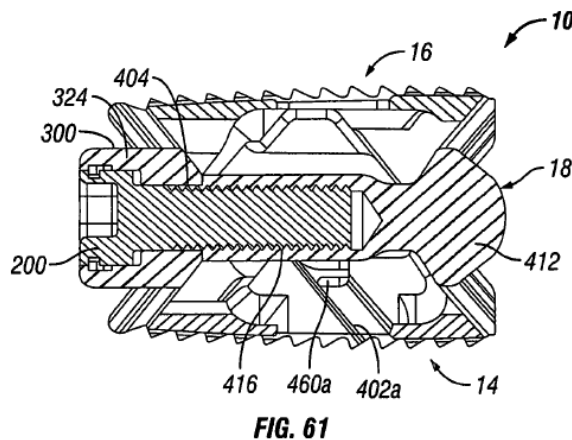


Figure 61 of the '732 patent depicts the expandable fusion device having actuator assembly 200, which includes head portion 324 and extension 404. *Id.* at 22:33–35. Rod-receiving extension 416 of central ramp 18 is threaded to receive threading of extension 404 of actuator assembly 200. *Id.* at 22:64–67.

In operation, expandable fusion device 10 is inserted into an intervertebral disc space and seated into position. *Id.* at 23:28–30. To expand the device, an instrument is used to engage head portion 324 of actuator assembly 200. *Id.* at 23:45–46. Rotating actuator assembly 200 in a first direction pulls central ramp 18 linearly towards actuator assembly 200 and pushes driving ramp 300 linearly towards central ramp 18. *Id.* at 23:47–51, 24:5–8. Ramped portions of central ramp 18 and driving ramp 300 push against corresponding ramped portions of endplates 14 and 16, which pushes the endplates outward into an expanded position. *Id.* at 23:56–61, 24:9–14.

The Specification describes an exemplary technique for endoscopically inserting the expandable fusion devices into the intervertebral disc space between adjacent vertebrae. *Id.* at 5:51–6:8, 26:3–46. An access path to the intervertebral disc space is created, for example, by using a posterolateral approach. *Id.* at 26:5–8. The expandable fusion device 10 is placed into the intervertebral disc space and expanded to the desired height. *Id.* at 26:37–39. A bone graft or similar bone-growth inducing material may be introduced around or within the expandable fusion device 10. *Id.* at 6:9–18, 26:39–41.

E. Challenged Claims

Petitioner challenges claims 1, 7–13, and 16 of the '732 patent. Claims 1, 13, and 16 are independent. Claim 1, reproduced below with bracketed lettering added,¹ is illustrative:

1. [a] A system for intervertebral fusion comprising:
 - [b] a dilator having a proximal end and a tapered distal end for penetrating soft tissue;
 - [c] a cannula having a proximal end and a distal end; and
 - [d] an intervertebral implant sized for insertion into an intervertebral space through the cannula, [e] wherein the intervertebral implant comprises a first endplate, a second endplate, and a central ramp disposed between the first endplate and the second endplate, [f] wherein the central ramp is configured to move in a first direction and cause the first and second endplates to move outwardly and away from one another,
 - [g] a driving ramp disposed between the first endplate and the second endplate at an opposite end of the intervertebral implant from the central ramp, [h] wherein the driving ramp has a longitudinal through bore, [i] wherein the driving ramp is configured to engage ramped surfaces of the first endplate and ramped surfaces of the second endplate; and
 - [j] an actuation member comprising a head portion and an actuation member extension that extends through an unthreaded opening in a longitudinal through bore of the driving ramp to be received within an opening in the central ramp extension, [k] wherein rotational movement of the actuation member in the first direction pulls the central ramp towards the driving ramp;
 - [l] wherein when the actuation member is rotated, the driving ramp is fixed with respect to the actuation member and

¹ For ease of reference, we use the same bracketed lettering Petitioner uses in the Petition. *See* Pet. 123.

the central ramp is moved in either the first direction or a second direction.

Ex. 1001, 27:12–41.

Challenged independent claims 13 and 16 are similar to claim 1, but have a few notable differences. For example, unlike claim 1, claim 13 requires that “when the intervertebral implant is in an unexpanded configuration, the first ramped surfaces of the first endplate and the first ramped surfaces of the second endplate overlap.” *Id.* at 28:51–54. Additionally, unlike claim 1, claim 16 recites that the central ramp further comprises “a ramped expansion portion.” *Id.* at 30:5–8.

Challenged claims 7–12 depend directly or indirectly from independent claim 1 and recite additional features of the first and second endplates of the intervertebral implant. *Id.* at 27:55–28:32.

F. Asserted Grounds of Unpatentability

We instituted trial based on the following grounds of alleged unpatentability:

Ground	Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
1	1, 7–13, 16	§ 103(a)	Chung, ³ Boehm ⁴ and/or Song ⁵
2	1, 7–13, 16	§ 103(a)	Chung, Boehm and/or Song, Baynham ⁶

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended several provisions of 35 U.S.C., including § 103. The ’732 patent issued from Application No. 13/531,943, filed June 25, 2012, and claims priority, as a continuation-in-part, to Application No. 12/875,637, filed on September 3, 2010. Ex. 1001, codes (21), (63). Following Petitioner, we apply a priority date of September 3, 2010 (*see* Pet. 5), but under either date (June 25, 2012 or September 3, 2010), the pre-AIA version of 35 U.S.C. § 103 applies. On the current record, our analyses herein would be the same under either priority date.

³ Chung et al., KR 20-0290058, issued September 26, 2002 (“Chung,” Ex. 1005). Exhibit 1005 includes a certified English translation on pages 1–12 and the original Korean document on pages 13–22. When citing Chung, we refer to the page numbers indicated by the six-digit page numbering scheme applied at the bottom center of the exhibit. For convenience we drop the lead-in zeros.

⁴ Boehm, Jr. et al., U.S. Patent Pub. 2003/0176926 A1, published September 18, 2003 (“Boehm,” Ex. 1028).

⁵ Song, U.S. Patent Pub. 2009/0062833 A1, published March 5, 2009 (“Song,” Ex. 1029).

⁶ Baynham et al., U.S. Patent Pub. 2007/0270968 A1, published November 22, 2007 (“Baynham,” Ex. 1007).

Ground	Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
3	8, 10, 11, 13	§ 103(a)	Chung, Boehm and/or Song, Varela ⁷ , <i>or</i> Chung, Boehm and/or Song, Baynham, Varela
4	1, 7–13	§ 103(a)	Olmos, ⁸ Boehm and/or Song
5	1, 7–13	§ 103(a)	Olmos, Boehm and/or Song, Chung
6	8, 10, 11, 13	§ 103(a)	Olmos, Boehm and/or Song, Varela, <i>or</i> Olmos, Boehm and/or Song, Chung, Varela

Inst. Dec. 8–9, 50; Pet. 3–4. Petitioner supports its contentions with the Declaration and Reply Declaration of Troy D. Drewry (Exs. 1002, 1072), and the Declaration of Paul Hatch (Ex. 1064), among other evidence. Patent Owner supports its contentions with the Declaration of Brad Culbert (Ex. 2013), among other evidence. The record also contains a transcript of Mr. Culbert’s deposition (Ex. 1041).

II. ANALYSIS

A. Principles of Law

“In an [inter partes review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800

⁷ Varela, U.S. Patent Pub. 2011/0172774 A1, published July 14, 2011 (“Varela,” Ex. 1030). The parties sometimes call this reference “Varela-’774.”

⁸ Olmos et al., U.S. Patent Pub. 2008/0140207 A1, published June 12, 2008 (“Olmos,” Ex. 1006).

F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review). To prevail, Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e).

A claim is unpatentable as obvious 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. *See* 35 U.S.C. § 103(a) (2006); *see also KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved based on 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) any objective indicia of nonobviousness.⁹ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). An obviousness determination requires finding a reason to combine the asserted prior art teachings, accompanied by a reasonable expectation of achieving what is claimed in the challenged patent. *See Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016). “[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *KSR*, 550 U.S. at 419–20.

⁹ Patent Owner does not assert objective indicia supporting nonobviousness of the challenged claims. *See generally* PO Resp.

B. Level of Ordinary Skill in the Art

We consider the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art as of September 3, 2010. *See Graham*, 383 U.S. at 17–18; *supra* 8 n.2. Petitioner contends that a person of ordinary skill in the art (sometimes abbreviated herein as “POSITA”):

would have had a bachelor’s degree in mechanical engineering or biomedical engineering and two or more years of experience in biomechanical engineering, biomedical engineering, and/or spinal implant devices. A person could also have qualified as a POSITA with some combination of more formal education (*e.g.*, an M.D.) and less technical experience or less formal education and more technical or professional experience in the foregoing fields, and would have had further appreciation of various technical concepts in this field, as explained by Prof. Drewry.

Pet. 5 (citing Ex. 1002 (Drewry Decl.) ¶¶ 31–32). Patent Owner does not dispute Petitioner’s proposal. *See* PO Resp. 9.

We adopt Petitioner’s proposed level of ordinary skill in the art because it is consistent with the cited prior art and is undisputed on this record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (indicating that the prior art itself may reflect an appropriate skill level).

Based on their statements of qualifications and curricula vitae, we find Petitioner’s declarant Mr. Drewry, and Patent Owner’s declarant Mr. Culbert, qualified to provide technical opinions from the perspective of a person of ordinary skill in the art in this proceeding. *See* Ex. 1002 (Drewry Decl.) ¶¶ 7–13 (Mr. Drewry’s statement of qualifications); Ex. 1003 (Mr. Drewry’s curriculum vitae); Ex. 2013 (Culbert Decl.) ¶¶ 3–9,

13–18 (Mr. Culbert’s statement of qualifications); Ex. 2014 (Mr. Culbert’s curriculum vitae).

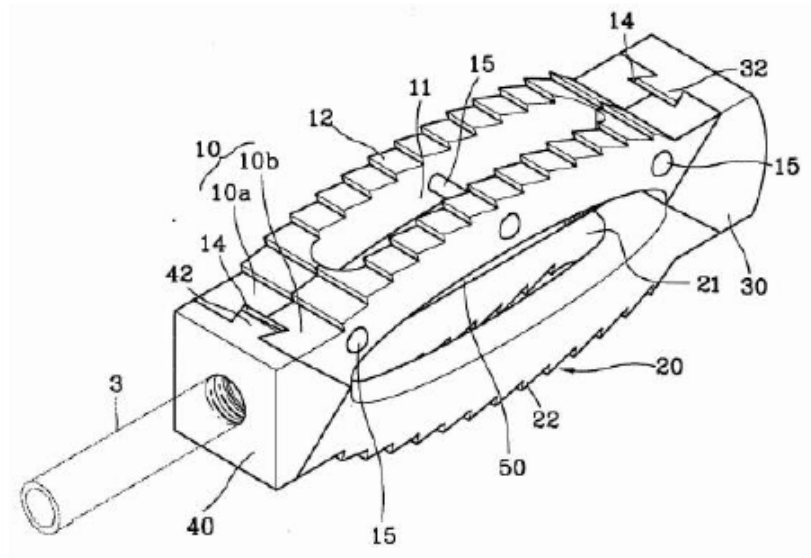
Petitioner also relies on a Declaration from Mr. Hatch (Exhibit 1064), whose primary experience is in product and industrial design. *See* Ex. 1064 (Hatch Decl.) ¶ 6; *see also id.* ¶¶ 5–10, 13 (Mr. Hatch’s statement of qualifications); Ex. 1065 (Mr. Hatch’s curriculum vitae). Patent Owner does not dispute that Mr. Hatch is qualified to provide technical opinions from the perspective of a person of ordinary skill in the art in this proceeding. *See generally* Sur-reply. At a minimum, on this record, we consider Mr. Hatch qualified to testify as an expert on issues with which he is “very familiar,” including “the creation and interpretation of technical drawings used to illustrate and describe mechanical structures.” Ex. 1064 (Hatch Decl.) ¶ 13.

C. Overview of Asserted Prior Art

1. Chung (Ex. 1005)

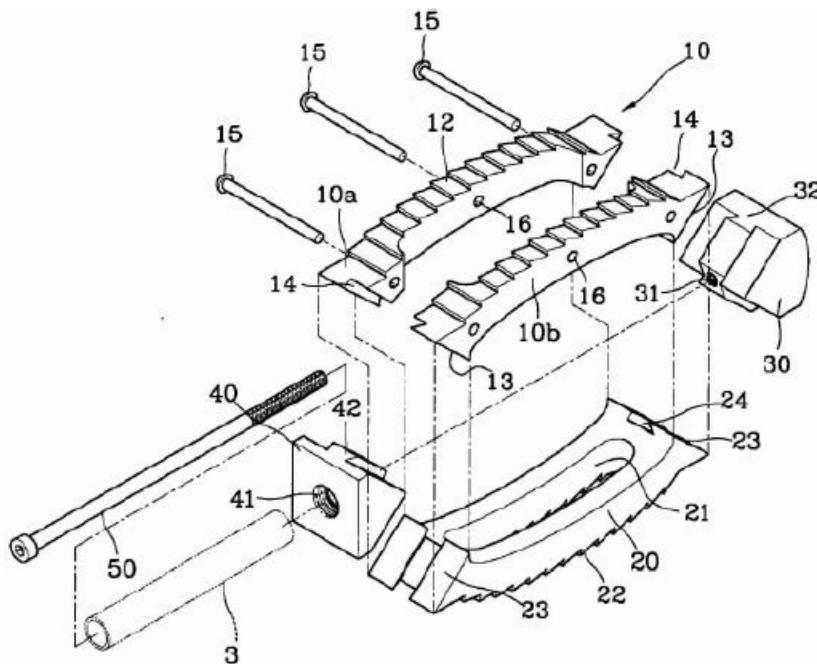
Chung, titled “A lumbar holder,” relates “to a medical device for correcting the back.” Ex. 1005, code (54), 2, 4. Chung discloses “a lumbar holder that is inserted between the back bones consisting of the lumbar in order to fix the back bones robustly while freely adjusting the height in order to maintain the appropriate space according to the patient’s state.” *Id.* at 4.

Chung’s Figure 1, reproduced below, is a perspective view of a lumbar holder.



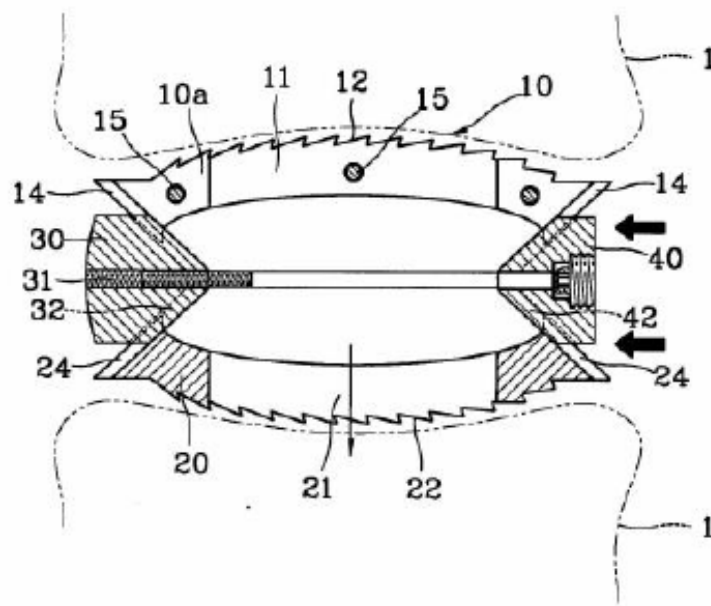
Id. at 3. Chung's Figure 1 depicts main holder bodies 10 and 20, lead wedge 30, and opposing wedge 40. *Id.* at 6.

Chung's Figure 2, reproduced below, is an exploded view of the lumbar holder in Figure 1 above.



Id. at Ex. 1005, 3, 10. Chung's Figure 2 depicts groove fastening screw 50, which fastens to screw hole 31 of lead wedge 30. *Id.* at 6. Opposing wedge 40 has penetrating hole 41, which has a raised spot to hold the head of groove fastening screw 50. *Id.* at 7. Tightening or loosening groove fastening screw 50 adjusts the distance between lead wedge 30 and opposing wedge 40, and the wedges slide along guiding surfaces 13 and 23 of holder bodies 10 and 20 to widen or narrow the space between the holder bodies. *Id.* at 6–7.

Chung's Figure 4 is reproduced below.



Id. at 10. Chung's Figure 4 is a cross-section view of a lumbar holder inserted between vertebrae. *Id.* at 3. Chung discloses that, in operation, the lumbar holder is inserted between vertebrae and a wrench is used to tighten groove fastening screw 50, which brings lead wedge 30 and opposing wedge 40 together such that the wedges push main holder bodies 10 and 20 outward into contact with the vertebrae. *Id.* at 7. Conversely, loosening groove

fastening screw 50 moves lead wedge 30 and opposing wedge 40 apart, which pulls main holder bodies 10 and 20 together. *Id.*

2. *Boehm (Ex. 1028)*

Boehm, titled “Device and Method for Lumbar Interbody Fusion,” “relates to a device and method for performing interbody spinal fusion, stabilization and restoration of the disc height in the spine.” Ex. 1028, code (54), ¶ 2. Boehm discloses “a collapsible and expand[able] interbody fusion spacer device.” *Id.* ¶ 16.

We reproduce below Boehm’s Figure 5.

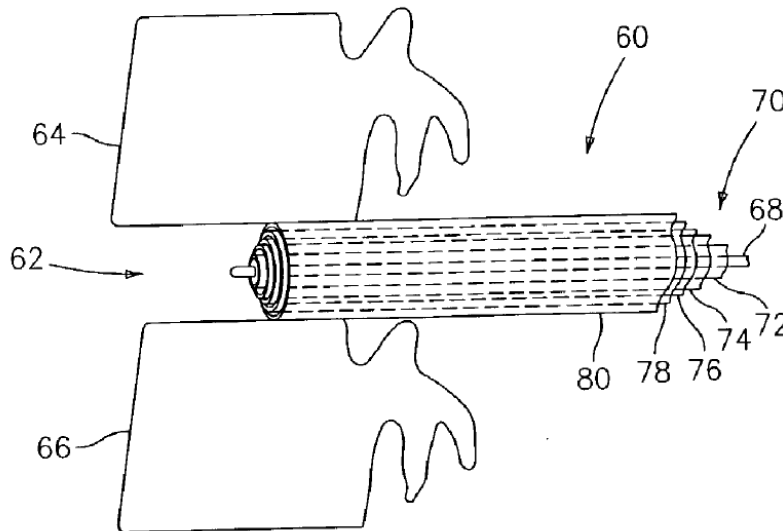


FIG. 5

Boehm’s Figure 5 depicts dilator system 60 for enlarging disc space 62 between vertebra 64, 66. *Id.* ¶ 32. Guide needle 68 is inserted into disc space 62 and a series of successively-larger dilators 70 are placed over the guide needle to enlarge the disc space. *Id.* Once dilators 70 are in place, guide needle 68 and the dilators other than outermost dilator 80 are removed

so that an expandable intervertebral disc spacer (not shown) can be passed through dilator 80 into disc space 62. *Id.* ¶ 32.

3. Song (Ex. 1029)

Song, titled “Device and Method for Placement of Interbody Device,” “relates to a device for percutaneously preparing an interbody space and placing a device within the interbody space of the spine.” Ex. 1029, code (54), ¶ 1. Song discloses “a method and means of placing an interbody device percutaneously into the space between vertebrae with a substantially posterior, posterolateral, or lateral approach.” *Id.* ¶ 9.

We reproduce below Song’s Figure 2C.

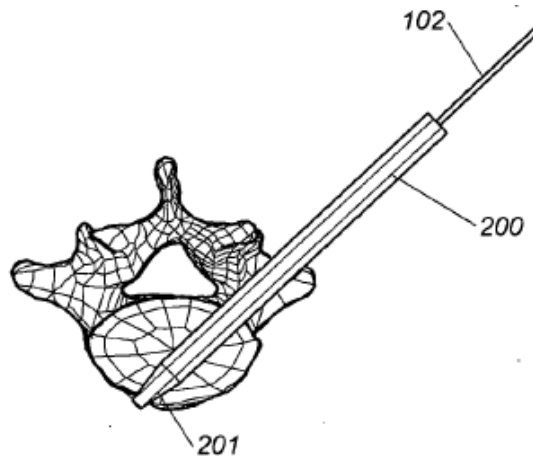
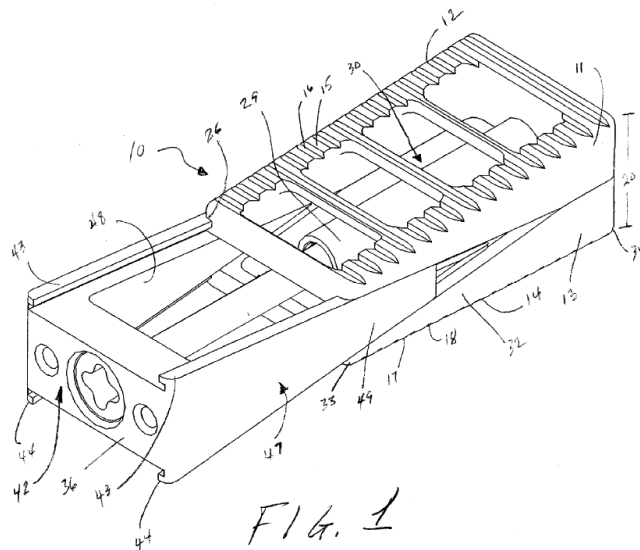


Fig. 2C

Song’s Figure 2C depicts initial dilator 200 placed over guide wire 102. *Id.* ¶ 50. Initial dilator 200 includes tapered top 201 to ease passage into soft tissue and the disc space. *Id.*

4. Baynham (Ex. 1007)

Baynham, titled “PLIF Opposing Wedge Ramp,” relates to “implants to be placed between vertebrae in the spine.” Ex. 1007, codes (54), (57), ¶ 3. Baynham’s Figure 1 is reproduced below.



Baynham's Figure 1 is a perspective view of spinal fusion device 10 comprising upper section 11 with top surface 12 and lower section 13 with bottom surface 14. *Id.* ¶ 22. Distractor 42 is between upper section 11 and lower section 13. *Id.* ¶ 28.

Baynham's Figure 3 is reproduced below.

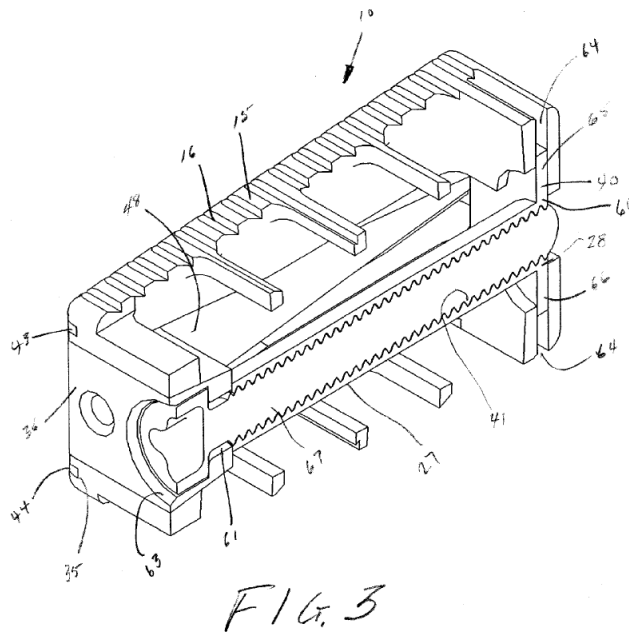
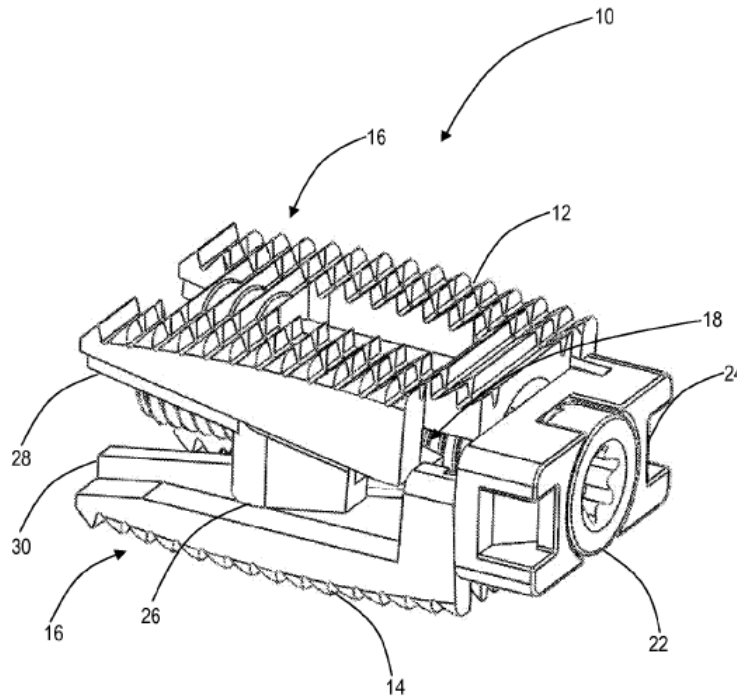


Figure 3 is a cross-section view of spinal fusion device 10 including jack screw 67, which is inserted through bore 61 of distractor 42. *Id.* ¶ 29. Jack screw 67 engages internal threads in tube 27 of link 40. *Id.* ¶ 25. Tightening jack screw 67 draws distractor 42 between the upper and lower sections 11 and 13, increasing the distance between those sections. *Id.*

5. Varela (Ex. 1030)

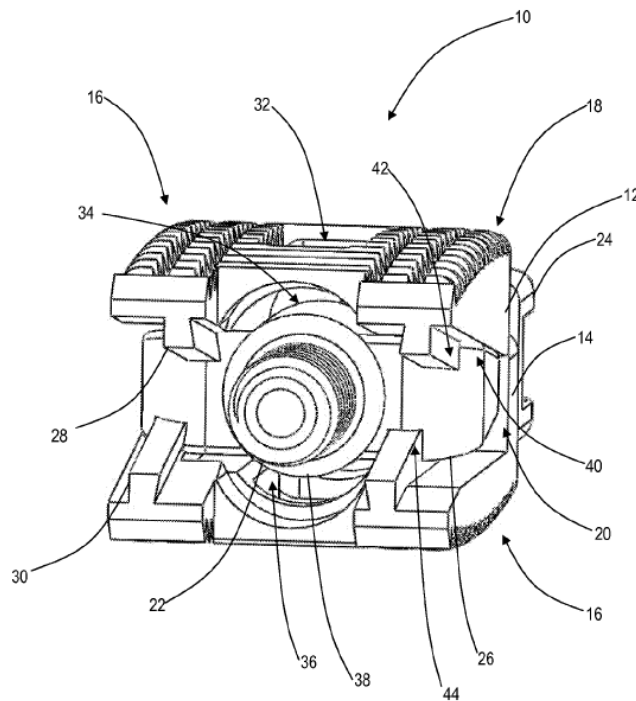
Varela, titled “Expandable Intervertebral Implant and Associated Surgical Method,” relates “to minimally-invasive, surgically-implantable spinal devices and systems.” Ex. 1030, code (54), ¶ 2. Varela discloses an expandable intervertebral implant selectively deployed in the intervertebral space to provide in-situ distracting, realigning, stabilizing, or fusing a portion of the spine. *Id.* ¶ 5.

We reproduce below Varela’s Figure 1.



Varela's Figure 1 depicts expandable intervertebral implant 10 including superior member 12, inferior member 14, and internally-threaded wedge structure 26. *Id.* ¶¶ 33, 35. Rotating screw 22 engages internally-threaded wedge structure 26 to selectively translate the wedge structure along the central axis of expandable intervertebral implant 10. *Id.* The translation causes internally-threaded wedge structure 26 to interact with associated wedge shapes of superior member 12 and inferior member 14 to force the members apart or together depending on the direction of the translation. *Id.*

We reproduce below Varela's Figure 3.



Varela's Figure 3 depicts each of superior member 12 and inferior member 14 including respective track structures 28, 30. *Id.* ¶ 36. In particular, track structures 28, 30 are dove-tailed on one or both sides to engage corresponding channels 42, 44 of wedge structure 26 to secure couple superior member 12 and inferior member 14. *Id.*

6. *Olmos (Ex. 1006)*

Olmos, titled “Intervertebral Implant,” relates to “[a]n adjustable spinal fusion intervertebral implant.” Ex. 1006, code (54), (57). Olmos’s Figure 16A is reproduced below.

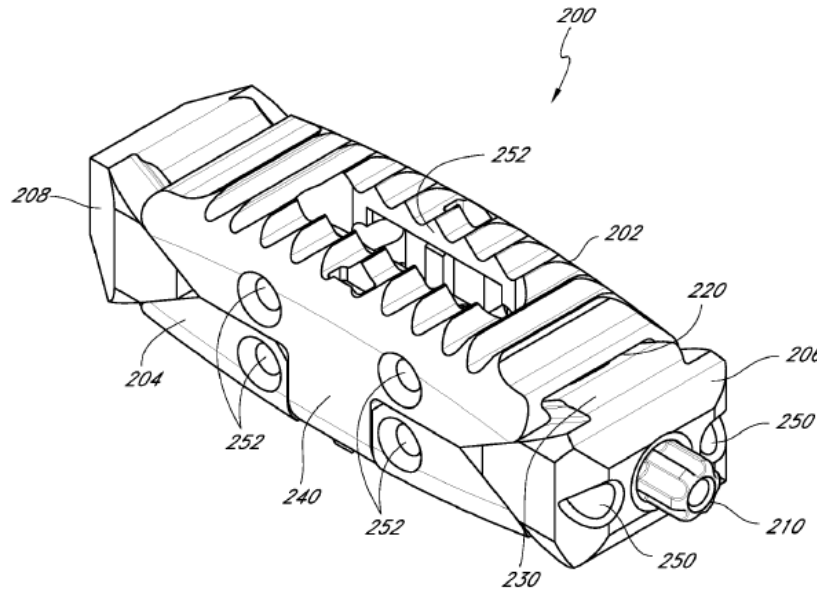


FIG. 16A

Olmos’s Figure 16A is a perspective view of intervertebral implant 200 in an unexpanded state. *Id.* ¶ 152. Implant 200 comprises upper body portion 202, lower body portion 204, proximal wedge member 206, distal wedge member 208, and actuator shaft 210. *Id.* ¶¶ 152, 156. Proximal wedge member 206 includes upper guide member 230 engaging a corresponding slot in upper body portion 202 to enhance stability. *Id.* ¶ 156; *see also id.* (describing that proximal wedge member 208 includes a similar feature).

Olmos's Figure 18 is reproduced below.

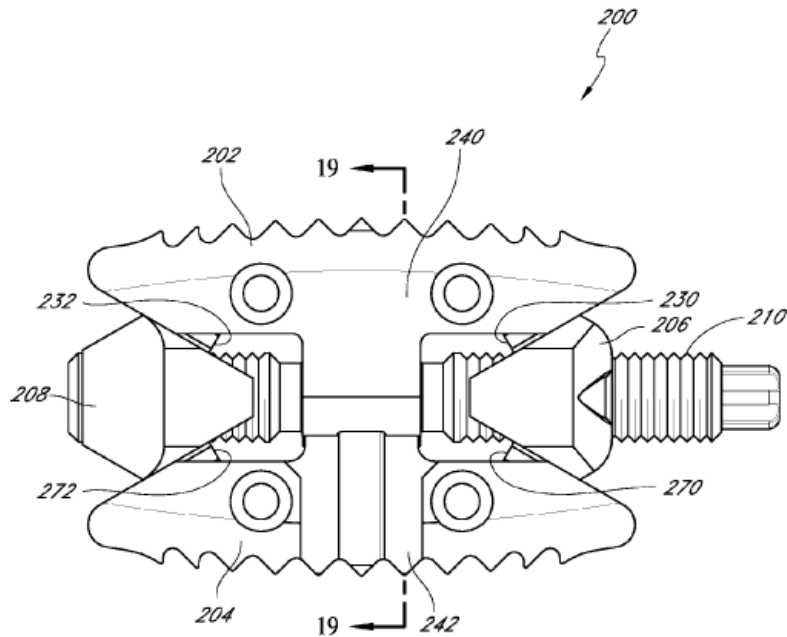


FIG. 18

Figure 18 of Olmos is a side view of intervertebral implant 200 in an expanded state. *Id.* ¶ 168. Actuator shaft 210 includes threads to engage at least one of the proximal and distal wedge members 206 and 208. *Id.* ¶ 159. Rotating actuator shaft 210 causes proximal and distal wedge members 206 and 208 to move towards each other and separate upper and lower body portions 202 and 204. *Id.* ¶ 155. Proximal wedge member 206 includes upper guide member 230 and lower guide member 270 and distal wedge member 208 includes upper guide member 232 and lower guide member 272. *Id.* ¶¶ 156, 167. Olmos discloses that the guide members and corresponding slots in the upper and lower body portions may have a

dovetail shape to ensure secure engagement between the wedge members and the body portions. *Id.*

D. Claim Construction

We interpret a claim “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). Under this standard, we construe the claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.*

“[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention,” “after reading the entire patent” and its prosecution history. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313, 1321 (Fed. Cir. 2005) (en banc). “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of the claim term either in the specification or during prosecution.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). Although extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises can be consulted to understand the meaning of a claim term, extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and is the single best guide to the meaning of a disputed term. *Id.* at 1315.

In the Petition, Petitioner asserts that the claims do not “require constructions differing from their plain and ordinary meaning.” Pet. 5. In

its Preliminary Response, Patent Owner proposed a construction for the claim term “central ramp extension.” *See* Prelim. Resp. 52.

In our Institution Decision, we provided a preliminary construction for the term “central ramp extension.” Inst. Dec. 21–22. After institution, the parties address the construction of the terms “central ramp extension,” “fixed,” and “overlap.” *See, e.g.*, PO Resp. 21–28, 73–75, 86–92; Reply 1–5.¹⁰

As explained below, we maintain our construction of the term “central ramp extension” as meaning “an addition to the central ramp.” Inst. Dec. 21. Additionally, we address the terms “fixed” and “overlap” below. We determine that we need not construe any other claim term. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

¹⁰ Patent Owner asserts that Petitioner’s Reply brief “presents new evidence and arguments beyond the scope of a proper reply” and “[t]he Board should refuse to consider” it. Sur-reply 9–10. This generic objection to the entire Reply fails to provide adequate notice regarding which of Petitioner’s theories and arguments Patent Owner contends are allegedly new and improper. *See, e.g., Rembrandt Diagnostics, LP v. Alere, Inc.*, 76 F.4th 1376, 1383 (Fed. Cir. 2023) (rejecting generic objection to alleged new theories in reply as failing to provide adequate notice of which theories are allegedly new). Accordingly, we reject Patent Owner’s request that we “refuse to consider” the entirety of the Reply. Where Patent Owner’s Sur-reply raises more particularized complaints regarding Petitioner’s allegedly improper new arguments, we address those complaints as appropriate below.

1. “central ramp extension” (Claims 1, 12, 13, 16)

Independent claims 1, 13, and 16, and dependent claim 12, recite a “central ramp extension.” Ex. 1001, 27:35, 28:30, 29:7–8, 30:7; *see also* Pet. 123 (limitation 1[j]), 125 (limitation 12[a]), 126 (limitation 13[l]), 127 (limitation 16[h]).¹¹ Prior to institution, Patent Owner argued that a “central ramp extension” is “a structure that increases the axial length (i.e., extends) of the central ramp.” Prelim. Resp. 52. Petitioner disputed Patent Owner’s proposed construction, arguing that it “improperly reads limitations from disclosed embodiments into the claims.” Prelim. Reply 1.

For the reasons discussed in our Institution Decision, we agreed with Petitioner that Patent Owner’s proposed construction improperly reads in limitations from example embodiments in the Specification. *See* Inst. Dec. 20. We noted that the Specification uses the term “extension” to refer to a variety of additions to a main structure having a variety of shapes, not all of which “increase the length” of the main structure. *Id.* at 21. Accordingly, we construed the term “central ramp extension” in accordance with its plain and ordinary meaning, i.e., “an addition to the central ramp.” *Id.*

Following institution, Patent Owner argues that our construction is inconsistent with the plain and ordinary meaning of the term “central ramp extension” in the context of the Specification and prosecution history. PO Resp. 21–28. Patent Owner acknowledges that the Specification uses the

¹¹ As noted in our Institution Decision, the term “the central ramp extension” in claims 1 and 13 lacks an explicit antecedent basis, but we assume that this term refers to the same “central ramp extension” recited in claim 12. Inst. Dec. 23.

term “extension” in a variety of contexts—i.e., it refers to “a *central ramp* extension, an *endplate* extension, and an *actuator* extension”—but Patent Owner maintains that “[i]n the specification, the central ramp extension *always* increases the length of the central ramp, thereby reducing the distance between the central ramp and driving ramp.” *Id.* at 21. Patent Owner also argues that the Examiner “mapped the central ramp extension to structures in Olmos that increased length,” and “[t]o the extent the Examiner identified other ‘extensions,’ those structures related to the *endplates*, not the *central ramp*.” *Id.* at 25.

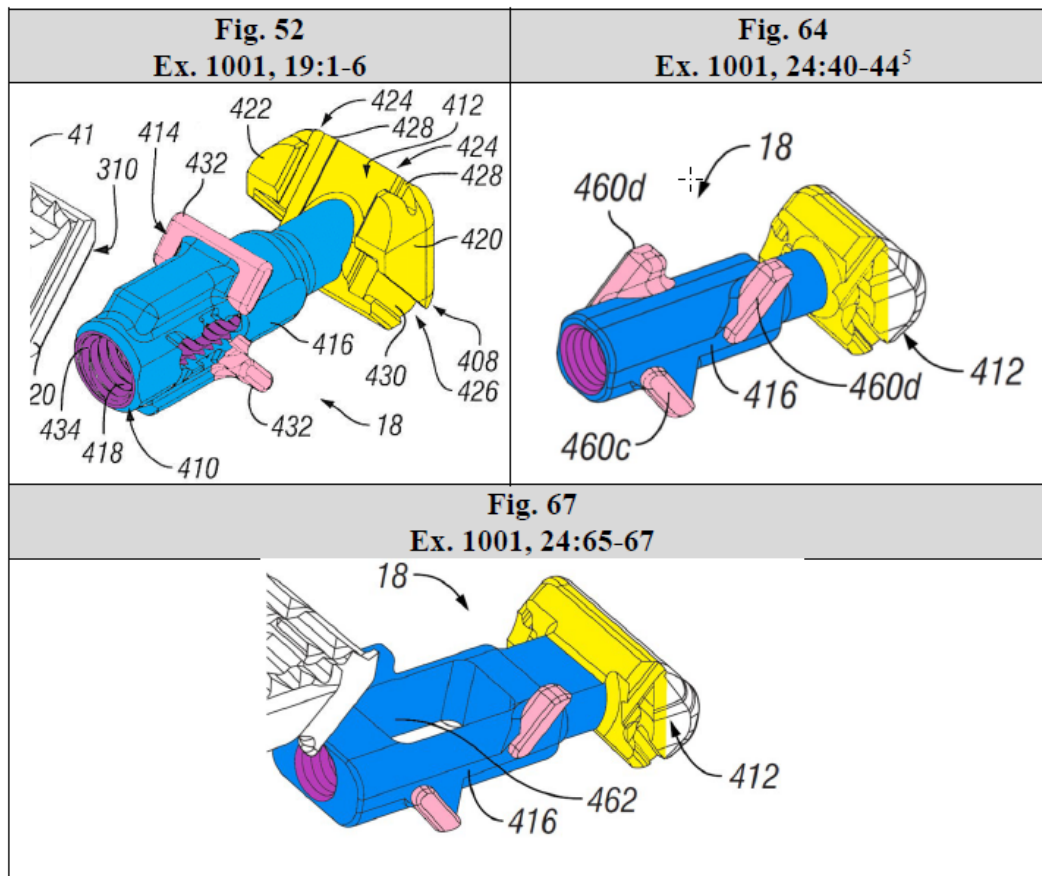
Petitioner argues that the Board’s construction of “central ramp extension” is correct. Reply 1. According to Petitioner, the Specification “uses ‘extension’ to refer to a myriad of structures,” and “during prosecution of a related patent, the Examiner applied ‘extension’ broadly to a variety of structures.” *Id.* (citing Ex. 1037¹², 42–44, 66–67, 126–27). According to Petitioner, Patent Owner “fails to justify why ‘extension’ should have a special meaning when used with the central ramp, but some different meaning when referring to an ‘*endplate* extension’ or ‘*actuator* extension.’” *Id.* at 1–2. Petitioner argues that Patent Owner’s “narrowing construction based on specific embodiments should not be read into the claims.” *Id.* at 2 (citing, e.g., *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014)).

We begin our analysis with the language of the claims. *See Phillips*, 415 F.3d at 1314 (“[T]he claims themselves provide substantial guidance as

¹² Exhibit 1037 is excerpts of the prosecution history of the ’732 patent’s parent application, U.S. Application No. 12/875,637, which issued as U.S. Patent 8,845,731 (the “’731 patent”). *See* Ex. 1037, 1; Ex. 1001, code (63).

to the meaning of particular claim terms.”). The claim language does not support Patent Owner’s proposed construction of “central ramp extension” as meaning “a structure that extends the length of the central ramp.” Patent Owner’s construction includes a directional or dimensional component—i.e., extending the “length” of the central ramp. Patent Owner, however, fails to explain—and we otherwise fail to discern—what in the claim language indicates that the term “extension” carries a meaning of extending the “length” of the central ramp. For example, limitations 12[a] and 16[h] recite that “a central ramp extension extending from the expansion portion,” but there is no directionality requirement indicating in which direction it must extend or in what dimension it must extend (e.g., length, width, height). *See* Pet. 125, 127.

We next turn to the Specification. *See Phillips*, 415 F.3d at 1315 (“[C]laims must be read in view of the specification, of which they are a part.”) (citations omitted). Patent Owner seeks to support its proposed construction by arguing (among other things) that all central ramp extensions depicted in the figures of the ’732 patent “increase the (axial) length of the central ramp.” PO Resp. 22–24 (citing Ex. 2013 (Culbert Decl.) ¶¶ 65–70, 93). To illustrate, Patent Owner provides annotated versions of excerpts of Figures 25, 46, 52, 58, 64, and 67 of the ’732 patent. Patent Owner’s annotated excerpts of Figures 52, 64, and 67 are exemplary, and we reproduce them below.



PO Resp. 24. Figures 52, 64, and 67 depict central ramps with extensions (blue). Mr. Culbert opines that in view of these figures, “[a] POSITA would understand that the purpose of a central ramp extension in all of these embodiments is to lengthen the central ramp (i.e., ‘extend’ it), which allows the actuator to threadingly engage the actuator [sic] at a shorter distance,” which “helps ensure that the actuator does not protrude from the distal end of the central ramp.” Ex. 2013 (Culbert Decl.) ¶ 93; *see also* PO Resp. 24–25.

Petitioner correctly points out that the Specification uses the term “extension” to refer to a multitude of structures. Reply 1. Not all of these “extensions” extend the length of some other structure. *See, e.g.*, Ex. 1001, 6:47–7:13 and Fig. 10 (element 46); *id.* at 12:5–18, 12:37–56, and Fig. 23

(elements 250, 254); *id.* at 10:40–45, 11:1–19, and Fig. 24 (elements 202, 204, and 224). As one example, we reproduce below Figure 24 of the '732 patent, with reference numerals 202, 204, and 224 highlighted in yellow.

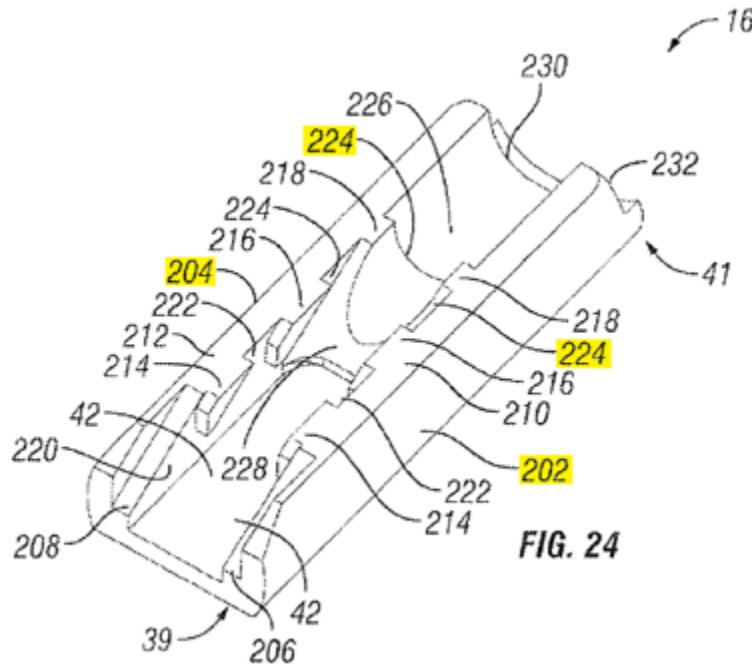


Figure 24 depicts endplate 16, wherein the lower surface 42 “includes a central extension 224,” and wherein “[t]he first and second side portions 202, 204 are extensions from the lower surface 42.” Ex. 1001, 11:1–3, 10:44–45, Fig. 24. Extensions 202, 204, and 224 are additions to the main structure (the endplate), but they do not extend the length of the endplate.

Thus, based on the Specification, we agree with Petitioner that Patent Owner’s construction improperly reads in limitations from specific embodiments depicted in the figures of the '732 patent. *See* Reply 1–2; *see also Hill-Rom*, 755 F.3d at 1371 (“[T]his court has expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment.”) (quoting *Liebel–Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004)).

As discussed above, the Specification uses the term “extension” broadly to refer to a variety of structures, not merely to structures that “increase the length” of the central ramp (or some other structure).

Turning to the prosecution history, Patent Owner argues that “[d]uring examination of the priority application, the Examiner . . . repeatedly mapped the central ramp extension to structures in Olmos that increased length.”

PO Resp. 25 (citing Ex. 1037 (prosecution history of ’731 patent), 42, 48, 51, 56, 59–61, 64–66, 110, 120, 124–25, 137, 166, 171–72, 183, 208, 220, 236–37); *see also id.* (citing Ex. 1004 (prosecution history of ’732 patent), 116, 122–23). The Examiner, however, also identified extensions of endplates that did not increase the length of the endplates. *See, e.g.*, Ex. 1037 (prosecution history of ’731 patent), 42–44, 66–67, 126–27; Ex. 1004 (prosecution history of ’732 patent), 42–44, 66–67. Patent Owner seeks to ignore these portions of the prosecution history because they relate to endplate extensions, not central ramp extensions. *See* PO Resp. 25. But like the claims and Specification, nothing in the prosecution history indicates that the applicant intended one definition for the term “extension” in the context of the central ramp and another in the context of other structures such as the endplate or actuator.

Patent Owner argues that our construction “lead[s] to unreasonable results,” because “almost every part of the expansion portion could be an ‘extension.’” PO Resp. 26. We disagree. As Petitioner correctly notes, “the claims place further requirements on the central ramp extension (e.g., Claim 1’s ‘opening’ in the central ramp extension), negating [Patent Owner’s] complaint (POR, 26) that anything could be an ‘extension’ as construed.” Reply 2.

For the reasons above, in view of the Specification and prosecution history, we construe the term “extension” in accordance with its plain and ordinary meaning, i.e., “an addition to a main structure.” *See* Ex. 3001 (Am. Heritage Dictionary), 4. Thus, we construe the term “central ramp extension” to mean “an addition to the central ramp.”

2. “fixed” (*Independent Claims 1, 13*)

The term “fixed” is recited in independent claims 1 and 13. *See* Ex. 1001, 27:38–41, 29:13–15; *see also* Pet. 123 (limitation 1[l]), 126 (limitation 13[n]). This term appears within a larger clause that reads: “wherein when the actuation member is rotated, the driving ramp is ***fixed*** with respect to the actuation member.” Ex. 1001, 27:38–41, 29:13–15 (emphasis added).

Patent Owner argues that “[a] POSITA understood, in the context of spinal fusion implants, that a component is ‘fixed’ with respect to another, when the spacing between the two components cannot change.” PO Resp. 73 (citing Ex. 2013 (Culbert Decl.) ¶ 200). Patent Owner argues that its construction “follows the specification, which only uses the term in reference to the fusion device being fixed in the intervertebral space.” *Id.* (citing Ex. 1001, 5:37–38; Ex. 2013 (Culbert Decl.) ¶ 200).

Patent Owner also points to the Specification’s discussion of Figure 52, which describes use of a set screw to secure the driving ramp to the actuator assembly. PO Resp. 73–74 (citing Ex. 1001, 19:57–61). Although the Specification does not use the term “fixed” when describing this embodiment, Patent Owner appears to suggest that its proposed construction is consistent with this embodiment because “the set screw prevents the actuator and driving ramp from separating, so the spacing

between them cannot change no matter the direction of rotation.” *Id.* at 74 (citing, *e.g.*, Ex. 2013 (Culbert Decl.) ¶¶ 201–02). Patent Owner also asserts that other references use the term “fixed” in a manner consistent with its proposed construction. *See id.* at 75 (citing Ex. 2013 (Culbert Decl.) ¶¶ 206–08).

Petitioner responds that construction of “fixed” is unnecessary because Chung expressly discloses that the driving ramp is “fastened” to the actuator, and “fastened” and “fixed” are synonyms. Reply 3, 19 (citing Ex. 1076 (Oxford Dictionary), 4, 5). Petitioner also argues that Patent Owner’s proposed construction is not supported by the intrinsic evidence, inasmuch as the Specification does not use the term “fixed” in describing the set screw embodiment disclosed in Figure 52. *Id.* at 3. Petitioner asserts that “if construed at all, the phrase ‘wherein when the actuation member is rotated the driving ramp is fixed with respect to the actuation member’ should be interpreted to mean that when the actuator is rotated, the driving ramp remains in the same axial position relative to the actuator.” *Id.* at 4.

After considering the arguments and cited evidence of record, we determine that neither party’s claim construction proposal is adequately supported, and that we need not construe the term “fixed” in order to resolve the parties’ disputes. Our analysis follows.

We first consider Patent Owner’s proposed construction of “fixed” as meaning that “the spacing between the two components cannot change.” The Specification uses the term “fixed” once, in the following sentence: “Upon successful fusion, a fusion device becomes permanently *fixed* within the intervertebral disc space.” Ex. 1001, 5:37–39 (emphasis added). We find that this sentence does not support Patent Owner’s proposed

construction because it does not specifically address the spacing between the device and the adjacent vertebrae. Moreover, we find that Patent Owner's reliance on the set screw embodiment in Figure 52 is unavailing, because the Specification does not use the term "fixed" to describe this embodiment. *See Reply 3.*

On Sur-reply, Patent Owner asserts that the set screw embodiment of Figure 52 is relevant because the Specification describes the driving ramp as "secured" to the actuator, and Petitioner's proffered dictionary shows that "secured" and "fixed" are synonyms. Sur-reply 11–12 (citing Ex. 1076 (Oxford Dictionary), 5). But even if we accept Patent Owner's argument that "fixed" and "secured" are synonyms, Patent Owner does not explain why we should more narrowly construe "fixed" to mean that "the spacing between the two components cannot change."

Patent Owner's reliance on other extrinsic evidence suffers from a similar flaw. PO Resp. 75 (citing Ex. 2013 (Culbert Decl.) ¶¶ 206–08). Mr. Culbert cites Petitioner's own patent application (US 2017/0224505, "Butler") and other exhibits that purportedly used "fixed" to refer to the inability of two components (e.g., the actuator and driving ramp) to separate. *See* Ex. 2013 (Culbert Decl.) ¶¶ 206–08 (citing Ex. 2024 (Butler) ¶¶ 40, 54, 78, Figs. 14, 61; Ex. 1016 (US 8,906,095), 1:33–41; Ex. 1006 (Olmos) ¶ 76; Ex. 1008 (US 4,743,256), 5:40–44). Patent Owner, however, does not propose that "fixed" means "inability of two components to separate," and does not adequately explain how these references support its narrower proposed construction, which requires that "the spacing between the two components cannot change."

In sum, Patent Owner does not persuade us that “fixed” means that “the spacing between the two components cannot change.”

Turning to Petitioner’s proposed construction, we find that Petitioner also does not adequately support its proposed construction that the phrase “wherein when the actuation member is rotated the driving ramp is fixed with respect to the actuation member” should be interpreted to mean that when the actuator is rotated, the driving ramp remains in the same axial position relative to the actuator.” Reply 4. Petitioner’s only support for this construction is a citation to Olmos’s use of the term “‘fixed’ to refer to holding a tool in a ‘fixed’ position.” *Id.* (citing Ex. 1006 (Olmos) ¶ 91). Petitioner argues that “[t]his means that the tool **does not** move during this part of the procedure, not that the tool **cannot** move (as [Patent Owner’s] construction requires).” *Id.* Petitioner fails to adequately explain how this rationale supports a construction of “fixed” as meaning the driving ramp remains in the same axial position relative to the actuator.

After considering all of the arguments and cited evidence of record, we agree with Petitioner that the claim term “fixed” does not need construction. Reply 3. This is because, as we further discuss below (*see supra* Section II.E.2), “Chung expressly discloses an actuator fastened to the driving ramp,” and on this record, there is no dispute that “fastened” and “fixed” are synonyms. *See* Reply 3 (citing Ex. 1005 (Chung), 1, 4–6), 19 (citing Ex. 1076 (Oxford Dictionary), 4, 5), 20 (citing Ex. 1061 (translator decl.) ¶¶ 6–10; Ex. 1063 (translator decl.) ¶¶ 3–5); *see generally* Sur-reply. Thus, because Chung expressly discloses the “fixed” limitation, construction of this term is unnecessary. *See Realtime Data, LLC*, 912 F.3d at 1375

(holding that the Board is required to construe terms “only to the extent necessary to resolve the controversy”) (citation omitted).

3. “*overlap*” (Claims 8, 10, 11, 13)

The term “overlap” is recited in claims 8, 10, 11, and 13. *See* Ex. 1001, 27:66–28:4, 28:15–27, 28:52–57; *see also* Pet. 125 (limitation 13[g]). This term appears within a larger clause that differs somewhat between the claims, but for purposes of claim construction, the clause in claim 8 is representative. It reads:

wherein, when the intervertebral implant is in an unexpanded configuration, the first ramped surfaces of the first endplate and the first ramped surfaces of the second endplate ***overlap***, and the second ramped surfaces of the first endplate and the second ramped surfaces of the second endplate ***overlap***.

Ex. 1001, 27:66–28:4 (emphasis added).

Patent Owner argues that “overlap” in the context of these claims means “fit over.” *See* PO Resp. 89–90; Ex. 2013 (Culbert Decl.) ¶¶ 236–42. According to Patent Owner, “[t]his means that the ramped surfaces are offset, enabling them to sit side-by-side when the implant is collapsed and to come closer together than they would without the claimed overlap.” Sur-reply 13; Ex. 2013 (Culbert Decl.) ¶ 242.

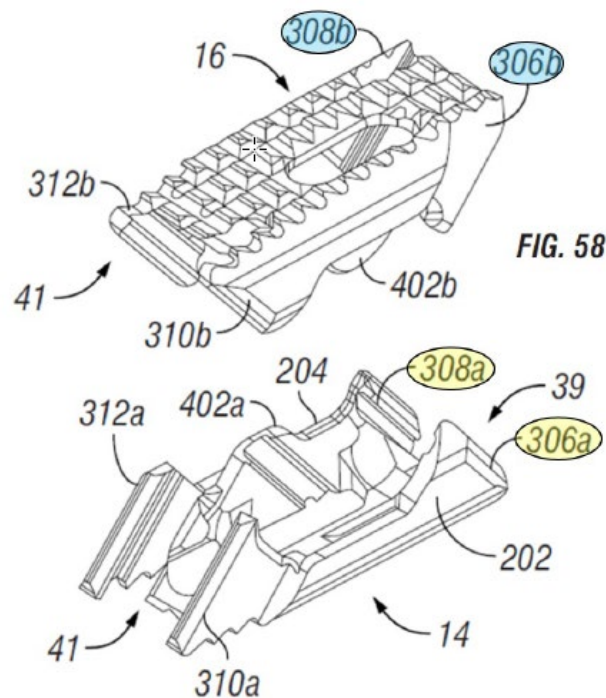
Petitioner argues that Patent Owner’s proposed construction is too limiting, because Patent Owner requires that “the surfaces must be ‘overlapping’ when the device is viewed from the side.” Reply 4; *see also* Ex. 1072 (Drewry Reply Decl.) ¶ 20. Petitioner contends that “‘overlapping’ should be construed to mean ‘covering or having at least part of an area in common with when viewed from the side, top/bottom, or along

the longitudinal axis of the device.”¹³ *Id.* at 5; Ex. 1072 (Drewry Reply Decl.) ¶ 24.

We begin with the language of the claims. Claims 8, 10, 11, and 13 each recite that the ramped surfaces of the first and second endplates overlap when the implant is in an unexpanded configuration, but the claims do not provide further insight into what “overlap” means. *See* Ex. 1001, 27:66–28:4, 28:15–27, 28:52–57.

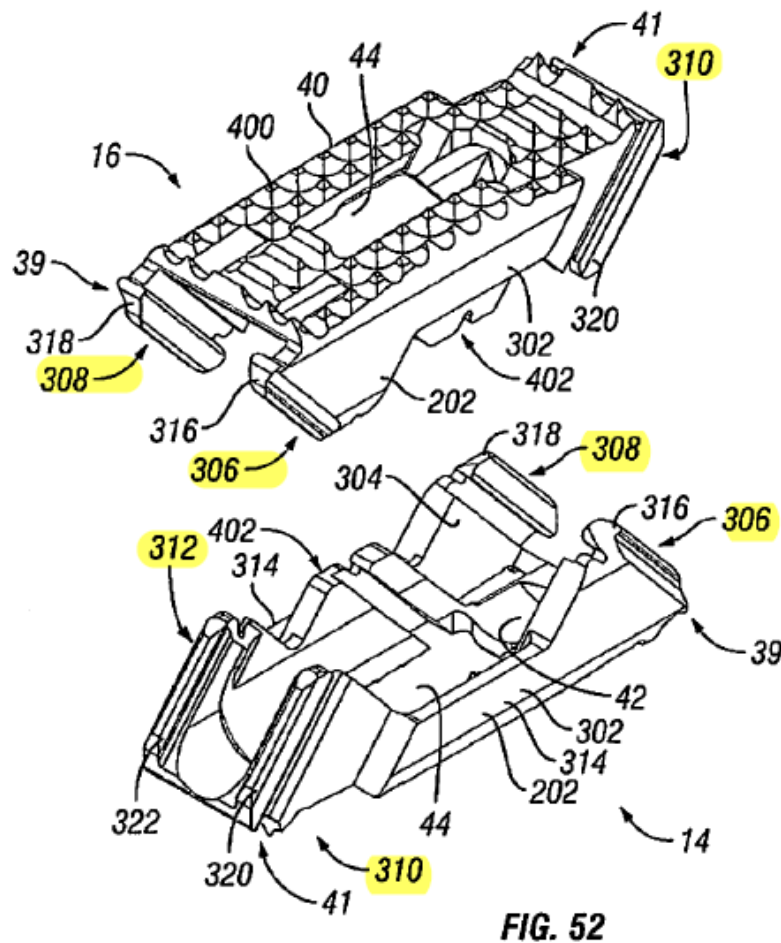
Turning to the Specification, Patent Owner cites various portions of the Specification that discuss overlap of the endplates. *See, e.g.*, PO Resp. 87–92; Ex. 2013 (Culbert Decl.) ¶¶ 236–39. For example, with reference to Figure 58, the Specification explains that ramped portions 306a and 308a of endplate 14 respectively “overlap” ramped portion 306b and 308b of endplate 16. *See* Ex. 1001, 22:7–30. This is depicted in Patent Owner’s annotated excerpt of Figure 58 of the ’732 patent, reproduced below:

¹³ Patent Owner argues that Petitioner offers a construction of the term “overlap” in the Petition, but raises a different construction (and improper new arguments) in Reply. *See* Sur-reply 12–13. Petitioner, however, did not offer a construction of “overlap” in the Petition. Instead, Patent Owner’s argument seems to be that Petitioner’s mapping of the prior art to the “overlap” claim limitation constituted an implicit claim construction of “overlap” that differs from Petitioner’s explicit construction in the Reply. *See id.*; Pet. 36–39. We find that Petitioner’s arguments in Reply are permissible. Patent Owner first identified the term “overlap” as one needing construction in its Patent Owner Response. Under the circumstances here, we find it appropriate to afford Petitioner an opportunity to respond to Patent Owner’s proposed construction.



PO Resp. 88; Ex. 2013 (Culbert Decl.) ¶ 236. This excerpt of Figure 58 shows endplates 16 and 14, with highlighting calling out ramped surfaces 306b and 308b on endplate 16 and ramped surfaces 306a and 308a on endplate 14.

Patent Owner contends that “[t]his same overlap is disclosed in the Fig. 52 embodiment, although the description does not use the term ‘overlap.’” PO Resp. 89–90; Ex. 2013 (Culbert Decl.) ¶ 237. Instead, the Specification describes ramped portions 306, 308 on endplate 14 as “generally designed and configured to *fit over* the second ramped portions 310, 312 of the second endplate 16 when the device 10 is in a closed position.” Ex. 1001, 18:18–30 (emphasis added). This is depicted in our annotated excerpt of Figure 52 of the ’732 patent, reproduced below:



This excerpt of Figure 52 shows endplates 16 and 14, with highlighting calling out ramped surfaces 306, 308, and 310 on endplate 16, and ramped surfaces 306, 308, 310, and 315 on endplate 14. We agree with Patent Owner that this portion of the Specification, which describes the ramps as “fit[ting] over” each other, describes the same relationship the Specification referred to as “overlap[ping]” when discussing the ramps in Figure 58. PO Resp. 89–90.

Based on the above, we agree with Patent Owner that the Specification supports equating “overlap” with “fit over.” *See id.* We also find that construing “overlap” to mean “fit over” is consistent with the

dictionaries of record, which indicate that “overlap” means “[t]o lie or extend over and cover part of.” Ex. 1036 (dictionaries), 3, 6.

Nevertheless, we find that construing “overlap” to mean “fit over” does not sufficiently resolve the parties’ disputes. This is because, as Petitioner argues, Patent Owner’s arguments appear to be based on an unstated assumption that “the surfaces must be ‘overlapping’ when the device is viewed from the side.” Reply 4; *see also* Ex. 1072 (Drewry Reply Decl.) ¶ 20 (“While he does not expressly say so, I believe the real crux of Mr. Culbert’s argument here is to narrow the interpretation of this claim term, where he wants the Board to assess whether two surfaces or portions are overlapping by looking at the device solely from a side-view.”); *see also* Sur-reply 13 (arguing that “fit over” “means that the ramped surfaces are offset, enabling them to sit side-by-side when the implant is collapsed and to come closer together than they would without the claimed overlap”). However, we agree with Petitioner and Mr. Drewry that nothing in the claims or Specification requires this to be “the only axis from which the device can be viewed to assess whether two surfaces are overlapping.” Ex. 1072 (Drewry Reply Decl.) ¶ 20; Reply 4.

Regarding the extrinsic evidence, we additionally agree with Petitioner that “common dictionary definitions . . . fail to place any directionality requirement on the determination.” Reply 5. For example, the dictionary definition “to lie or extend over and cover part of” suggests a top-down viewing of two objects to see if they overlap. Ex. 1072 (Drewry Reply Decl.) ¶ 9; Reply 5; Ex. 1036 (dictionaries), 3, 6. For these reasons, determining whether one structure overlaps another can be ascertained when

viewing the unexpanded device from the side, top/bottom, or along the longitudinal axis of the device.

In sum, we construe “overlap” to mean “fit over,” with the clarification that determining whether one structure overlaps another can be ascertained when viewing the unexpanded device from the side, top/bottom, or along the longitudinal axis of the device.

E. Ground 1 – Alleged Obviousness Based on Chung with Boehm and/or Song

Petitioner asserts that claims 1, 7–13, and 16 are unpatentable as obvious over Chung in combination with Boehm and/or Song. *See* Pet. 10–63 (Ground 1). In brief, Petitioner relies on Chung as disclosing an intervertebral implant meeting most limitations of the claims, and relies on Boehm and Song as disclosing a dilator, cannula, and intervertebral implant sized for insertion through the cannula, as claimed, for example, in claim limitations 1[b]–[d]. *See generally id.* at 10–60. Petitioner argues that a person of ordinary skill in the art “would have been motivated to combine Chung with the teachings of Boehm and/or Song—specifically those related to the use of certain tools such as dilators and cannulas—to create an access path to an intervertebral space and insert the intervertebral implant.” *Id.* at 61.

Patent Owner disputes four aspects of Petitioner’s showing, i.e., whether Petitioner has demonstrated that Chung teaches (1) the claimed central ramp extension (recited in limitations 1[j], 12[a], 13[l], and 16[h]); (2) the “fixed” limitation (recited in limitations 1[l] and 13[n]); (3) the “overlap” limitation (recited in dependent claims 8, 10, and 11, and in limitation 13[g]); and (4) the “central ramped surface” limitation (recited in

dependent claim 9 and claim limitation 16[e]). *See, e.g.*, PO Resp. 19–20, 29–38, 73–79, 83–93, 97–102.

After considering all of the arguments and cited evidence of record, we find that Petitioner demonstrates by a preponderance of the evidence that Chung with Boehm and Song renders claims 1, 7–13, and 16 unpatentable as obvious.¹⁴

We adopt as our own Petitioner’s analysis of how Chung with Boehm and Song teaches or suggests each of the undisputed claim limitations. *See generally* Pet. 10–60; Ex. 1002 (Drewry Decl.) ¶¶ 99–265.¹⁵ We also adopt as our own Petitioner’s undisputed analysis of why a person of ordinary skill in the art would have been motivated to combine Chung’s implant with Boehm and Song’s teachings regarding dilators, cannulas, and the insertion of intervertebral implant devices through cannulas, with a reasonable expectation of success. *See* Pet. 61–63; Ex. 1002 (Drewry Decl.) ¶¶ 266–74.

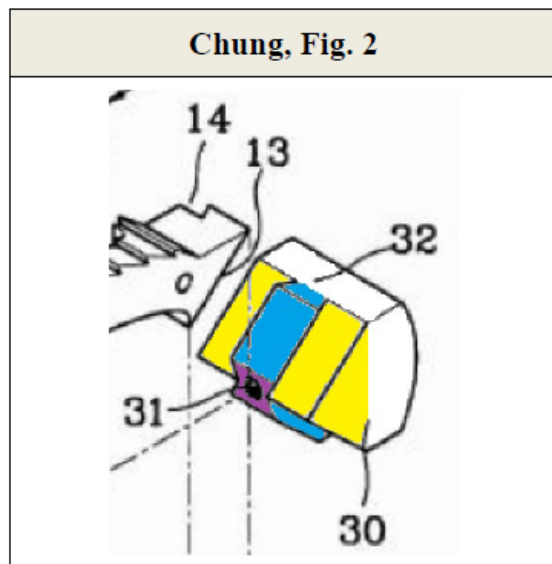
Below, we analyze the disputed limitations.

¹⁴ Petitioner’s unpatentability grounds refer to “Boehm and/or Song.” *See, e.g.*, Pet. 4–5. Because Petitioner demonstrates that both Boehm and Song teach the cited subject matter, and that a person of ordinary skill in the art would have been motivated to combine both references with Chung and with Olmos, we base our findings on Boehm *and* Song. That said, the outcomes herein would be the same if we had based our findings on Boehm (without Song) or Song (without Boehm).

¹⁵ For clarity, we are adopting all undisputed aspects of Petitioner’s showing in Ground 1. The disputed aspects relate to limitation 1[j] (“central ramp extension”), 1[l] (“fixed”), claims 8, 10, and 11 (“overlap”), claim 9 (“central ramped surface”), 12[a] (“central ramp extension”), 13[g] (“overlap”), 13[l] (“central ramp extension”), 13[n] (“fixed”), 16[e] (“central ramped surface”), and 16[h] (“central ramp extension”).

*1. Whether Chung Teaches the “central ramp extension”
Limitation*

Independent claims 1, 13, and 16, and dependent claim 12, recite a “central ramp extension.” Ex. 1001, 27:35, 28:30, 29:7–8, 30:7; *see also* Pet. 123 (limitation 1[j]), 125 (limitation 12[a]), 126 (limitation 13[l]), 127 (limitation 16[h]). Petitioner maps Chung’s “lead wedge (30)” to the claimed “central ramp,” and “dovetail (32)” to the claimed “central ramp extension.” *See, e.g.*, Pet. 19, 26¹⁶, 46. To illustrate, we reproduce below Petitioner’s annotated excerpt of Chung’s Figure 2:



Id. at 45. Petitioner’s annotated excerpt of Chung’s Figure 2 shows Chung’s lead wedge 30. Petitioner highlights in blue dovetail 32 (which Petitioner maps to the claimed “central ramp extension”), and highlights in yellow the

¹⁶ In discussing the “the central ramp extension” portion of limitation 1[j], Petitioner cross-references its arguments in Section “§IX(A)(4)(a)” of the Petition. *See* Pet. 26. Based on the Petition as a whole, we understand Petitioner’s cross-reference to Section IX(A)(4)(a) to be a typographical error, with Section IX(A)(6)(a) being the intended cross-reference. *See* Inst. Dec. 35 n.13.

ramped surfaces that flank dovetail 32 (which Petitioner maps to the claimed “expansion portion” of the central ramp¹⁷). *See id.* at 45–46.

Patent Owner argues that because Chung’s dovetail facilitates expansion, it is part of the claimed “expansion portion,” and thus cannot be the claimed “central ramp extension.” PO Resp. 16–17, 19–20; Ex. 2013 (Culbert Decl.) ¶¶ 77–78, 84–87. To arrive at this conclusion, Patent Owner compares Chung’s lead wedge with an embodiment depicted in Figure 52 of the ’732 patent. *See, e.g.*, PO Resp. 19–20. The proper comparison, however, is to compare Chung to the claims as properly construed. Under our construction of “central ramp extension” as meaning “an addition to the central ramp,” we find that Chung’s dovetail 32 is “an addition to the central ramp.” That is, Petitioner sufficiently shows that Chung’s dovetail 32 is an addition to central ramp/lead wedge 30. This can be seen, for example, in Petitioner’s annotated excerpt of Chung’s Figure 2 (reproduced above), where dovetail 32 is an addition to lead wedge 30 (the main structure) because it protrudes above and below the surfaces of the lead wedge.

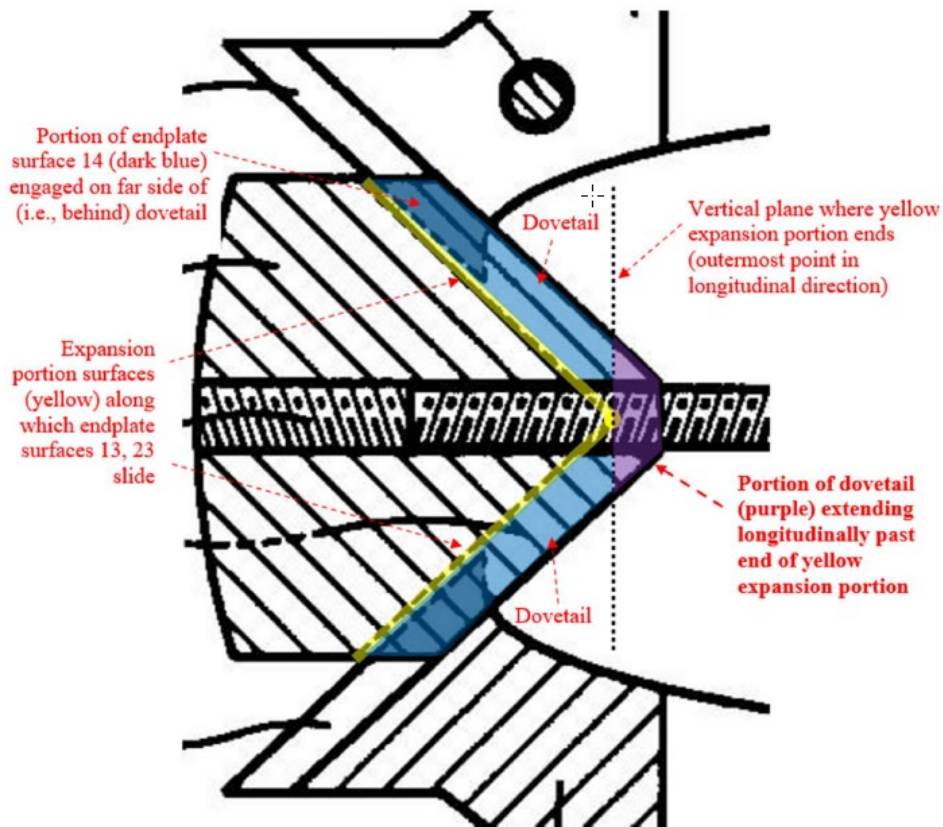
Moreover, Patent Owner’s attempt to exclude a structure from being a “central ramp extension” because it facilitates expansion is contrary to the Specification, which teaches that (i) “an extension can have ramped surfaces that facilitate expansion (*e.g.*, Ex. 1001, 19:31–41),” and (ii) “two expansion portions can have a dovetail between them with its own ramped surfaces interacting with the endplates (*id.*, 11:37–48, Fig. 25).” Reply 17. Thus, we disagree with Patent Owner’s argument that Chung’s dovetail cannot map to

¹⁷ Claim limitations 12[a], 13[j], and 16[h] recite an “expansion portion” of the central ramp. *See* Pet. 125, 126, 127.

the claimed extension because it is part of the claimed expansion portion. Rather, Petitioner has sufficiently demonstrated that Chung teaches a “central ramp extension” (i.e., dovetail 32) located between two ramped surfaces that engage with the end plates to facilitate expansion.

Patent Owner next argues that Chung’s dovetail 32 is not a “central ramp extension” because, under Patent Owner’s proposed construction of “central ramp extension,” dovetail 32 does not extend the length of the central ramp (distal wedge 30). *See, e.g.*, PO Resp. 8, 36; *see also id.* at 29–38; Ex. 2013 (Culbert Decl.) ¶¶ 104–19. This argument is unavailing, because as discussed above, we do not agree with Patent Owner that a “central ramp extension” must extend the length of the central ramp. *See supra* Section II.D.1.

However, even if the term “central ramp extension” did require the extension to lengthen the central ramp as Patent Owner argues, we find that Petitioner demonstrates by a preponderance of the evidence that Chung’s central ramp extension (dovetail 32) in fact extends the length of the central ramp (lead wedge 30). Petitioner provides the following annotated excerpt of Chung’s Figure 4:



Reply 15. The above excerpt of Chung’s Figure 4 shows lead wedge 30 interacting with the endplates of Chung’s implant. Petitioner’s annotations highlight the information signified by the dashed lines that appear in Chung’s Figure 4.¹⁸ Specifically, Petitioner’s annotations indicate that (1) the dashed line on the top endplate indicates the “portion of endplate surface 14 (dark blue) engaged on the far side of (i.e., behind) [the] dovetail;” and (2) the yellow dashed line indicates the “[e]xpansion portion surfaces (yellow) along which endplate surfaces 13, 23 slide.” *Id.*; *see also*

¹⁸ Petitioner demonstrates, and Patent Owner does not dispute, that dashed lines are commonly used in the art to show hidden features in technical drawings. *See* Ex. 1072 (Drewry Reply Decl.) ¶ 34 (citing examples in the ’731 patent and in Olmos); Ex. 1064 (Hatch Decl.) ¶¶ 28–35 (explaining use of dashed lines in technical drawings to indicate hidden features).

Ex. 1072 (Drewry Reply Decl.) ¶¶ 38, 40, 41. We agree with Petitioner that as shown in the purple-shaded region in Petitioner’s annotated excerpt of Chung’s Figure 4 reproduced above, “Chung’s dovetails (blue) can definitively be seen to extend longitudinally past” the plane where the expansion portion (yellow) terminates. Reply 14; Ex. 1072 (Drewry Reply Decl.) ¶¶ 41, 43.

Patent Owner disputes this conclusion, arguing that Chung’s Figure 4, which is a cross-sectional drawing, was “not intended to show the extent of the yellow side ramps relative to the dovetail, and a POSITA would not rely on [it] to determine that extent.” Sur-reply 15–16; *see also id.* (citing Ex. 2013 (Culbert Decl.) ¶ 114 (“[A] POSITA would not rely on figures that are clearly not intended to depict the yellow ramped sides to determine where those sides reside relative to the dovetail 32.”); Ex. 1041 (Culbert Depo. Tr.), 210:9–211:13 (opining that “a person of ordinary skill in the art wouldn’t rely on this [Chung’s Figure 4] to understand what’s happening,” but would instead “rely on something that you can actually see them, not through hidden lines”), 227:2–17 (opining that a person of ordinary skill in the art would look to Chung’s Figure 2 to determine where the dovetails terminate relative to the side ramps)). Patent Owner’s argument is unavailing.

Petitioner persuasively demonstrates that there are many instances where side-views (like Chung’s Figure 4) are used instead of perspective views (like Chung’s Figure 2) “to determine whether one object is positioned further forward/ahead of another.” Ex. 1064 (Hatch Decl.) ¶¶ 53–55; Ex. 1072 (Drewry Reply Decl.) ¶ 43. Thus, we disagree with Patent Owner that a person of ordinary skill in the art would look only to

Chung's Figure 2 and would ignore Figure 4 (and in particular, the information provided by the dashed lines) in determining where the dovetail terminates relative to the side ramps.

We find that Chung's Figure 4, in the context of Chung's broader disclosure, sufficiently demonstrates that Chung's central ramp extension (dovetail 32) in fact extends the length of the central ramp (lead wedge 30). It is true, as Patent Owner notes, that the dashed lines in Chung's Figure 4 do not depict the point where the expansion surfaces meet. *See* PO Sur-reply 14. This is because the meeting point is behind the actuator, and as Mr. Drewry explains, "based on drafting standards and the purpose of this cross-sectional view, . . . [it] would not be appropriate" for Chung's Figure 4 to show the meeting point. Ex. 2033 (Drewry Reply Depo. Tr.), 33:20–34:3. Nevertheless, based on the information in Chung, we agree with Petitioner that a person of ordinary skill in the art would know that the expansion surfaces meet behind the actuator at the position Petitioner indicates with the dashed yellow line. *See* Reply 9–12; Ex. 1072 (Drewry Reply Decl.) ¶ 38; Ex. 1041 (Culbert Depo. Tr.), 221:7–14 (agreeing that "[i]f you extrapolate the dotted lines on this figure [Chung's Figure 4], that's where they would intersect"). This meeting point is consistent with the location of Chung's endplate surfaces and Chung's description of how the endplates interact with the wedges, as depicted in Chung's Figures 1–6 and as discussed in the Petition. *See* Reply 9–12; Ex. 1072 (Drewry Reply Decl.) ¶¶ 36–38. Once this meeting point is known, "Chung's dovetails (blue) can definitively be seen to extend longitudinally past this point," as illustrated by the purple-shaded region in Petitioner's annotated version of Chung's Figure 4 reproduced above. *See* Reply 13–15.

Patent Owner’s own side-view illustration of Chung’s lead wedge 30, which shows the extension (blue) and expansion portion (yellow) terminating in the same plane, is unavailing. *See, e.g.*, PO Resp. 31. Patent Owner and Mr. Culbert generated the illustration based on Chung’s Figure 2. *See* Ex. 1041 (Culbert Depo. Tr.), 78:9–79:9; Reply 15. Patent Owner’s reliance solely on Chung’s Figure 2 improperly ignores the additional information disclosed in Chung’s Figure 4, e.g., the information imparted by the dashed lines that indicate hidden material.

Because we cite Mr. Hatch’s testimony in our analysis above, we turn to Patent Owner’s argument that “much of” this testimony is improperly incorporated by reference “and cannot plausibly be responded to due to word limits.” Sur-reply 14–15 (citing Ex. 1064 (Hatch Decl.) ¶¶ 28–66). This generic objection to “much of” Mr. Hatch’s declaration is unavailing because it fails to adequately specify which portions of the declaration Patent Owner objects to, and which portions it does not.¹⁹ *See, e.g.*, *Rembrandt Diagnostics*, 76 F.4th at 1383.

Patent Owner also more specifically argues that “Petitioner improperly incorporates 12 pages of expert testimony via a single sentence.” Sur-reply 15 n.2 (citing Reply 16, which in turn cites Ex. 1064 (Hatch Decl.) ¶¶ 49–66). Many of the paragraphs within the cited range (i.e., Hatch Declaration paragraphs 49–66) have at most a tenuous connection to the proposition for which they are cited. *See* Reply 16. However, paragraphs

¹⁹ Patent Owner suggests that it could not more fully respond to Mr. Hatch’s declaration “due to word limits.” Sur-reply 14–15. Our rules permit Patent Owner to request a waiver of word counts. 37 C.F.R. § 42.24(a)(2). Patent Owner did not seek such a waiver.

53–55 directly support Petitioner’s proposition in the Reply, i.e., that a person of ordinary skill in the art “would rely on a cross-sectional view over a perspective view for making the determination in question, because only the cross-sections provide the needed side view, orthogonal to the positions of the yellow expansion portion and the end of the dovetail.” *Id.*

Mr. Hatch’s testimony in paragraphs 53–55 is persuasive to support the argument for which Petitioner cites them and the mere fact that Mr. Hatch provides additional detail to support that argument does not amount to an improper incorporation by reference. Indeed, expert testimony is generally more persuasive when it does not merely parrot the arguments in the briefs, but provides additional detail supporting the argument for which it is cited, as it does here. *Cf. Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 (PTAB Aug. 24, 2022) (holding that declaration is entitled to little weight when it restates conclusory assertions without any additional supporting evidence or reasoning).

For the above reasons, even if the term “central ramp extension” were construed to require that the extension lengthen the central ramp as Patent Owner argues, we find that Petitioner demonstrates by a preponderance of the evidence that Chung’s central ramp extension (dovetail 32) in fact extends the length of the central ramp (lead wedge 30).

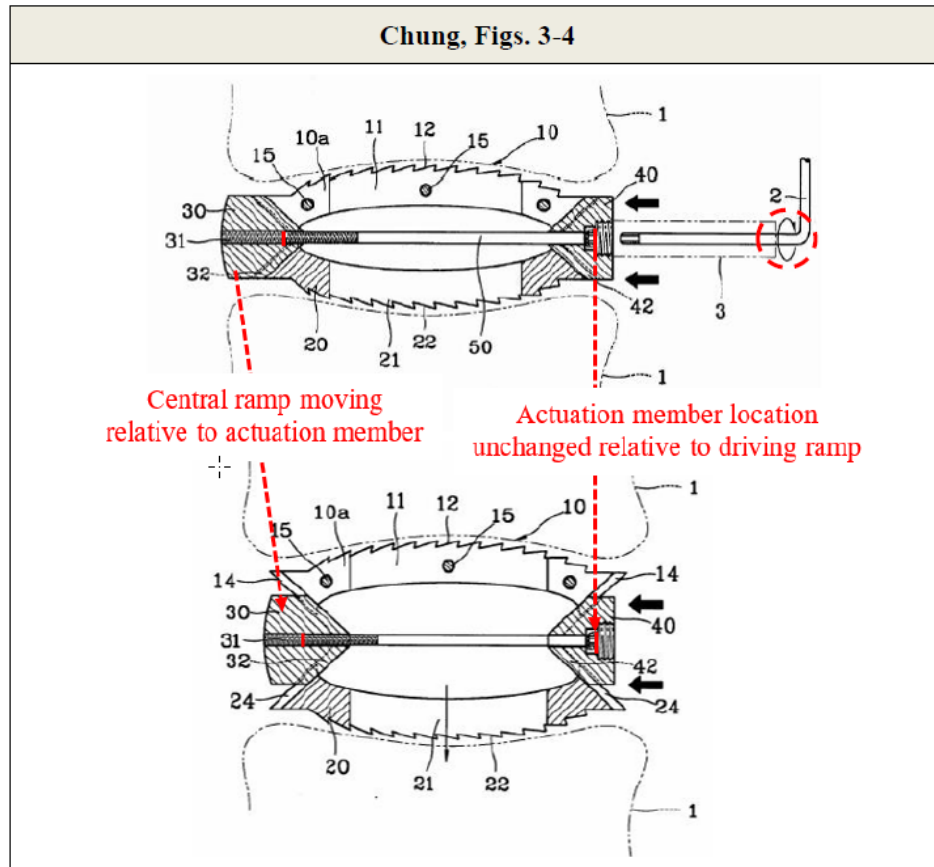
On the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Chung’s dovetail 32 teaches the claimed “central ramp extension.”

2. Whether Chung Teaches the “fixed” Limitation

Claims 1 and 13 recite: “wherein when the actuation member is rotated, the driving ramp is ***fixed*** with respect to the actuation member.”

Ex. 1001, 27:38–41, 29:13–15 (emphasis added); *see also* Pet. 123 (limitation 1[l]), 126 (limitation 13[n]). Patent Owner argues that Chung does not teach or suggest this limitation. PO Resp. 73.

For this limitation, Petitioner provides annotated versions Chung’s Figures 3 and 4, which we reproduce below:



Pet. 22. Petitioner’s annotated Figures 3 and 4 reproduced above show Chung’s intervertebral implant having groove fastening screw 50²⁰ (i.e., the claimed “actuation member”), opposing wedge 40 (i.e., the claimed “driving ramp”), and lead wedge 30 (i.e., the claimed “central ramp”). Mr. Drewry

²⁰ For clarity, we note that Chung’s Figures 3 and 4 do not show a lead line for groove fastening screw 50, which is depicted running horizontally through the middle of implant.

explains that because the screw 50 and central ramp/lead wedge 30 are threadingly engaged, turning screw 50 will cause the central ramp/lead wedge 30 to move, whereas “the actuation member and driving ramp (40) are fixed relative to each other by virtue of the lack of engaging threads in driving ramp opening (41).” Ex. 1002 (Drewry Decl.) ¶ 161. Mr. Drewry also cites Chung’s statement that

groove fastening screw (50) is *fastened* to the penetrating hole (41) of the aforementioned opposing wedge (40) and to the screw hole (31) of the lead wedge (30) in order to adjust the distance between the aforementioned opposing wedge (40) and the aforementioned lead wedge (30).

Id. (quoting Ex. 1005 (Chung), 6) (emphasis added). Mr. Drewry and Petitioner assert that based on these disclosures, a person of ordinary skill in the art would have understood that Chung expressly discloses the “fixed” limitation. *Id.* ¶ 164; Pet. 29–30; Reply 18–20.

Patent Owner responds by arguing that both the ’732 patent and other art of record use a set screw or retaining member to secure or “fix” the driving ramp and actuator to each other. PO Resp. 73–75 (citing, e.g., Ex. 1001, 19:57–61; Ex. 2013 (Culbert Decl.) ¶¶ 200–08). According to Patent Owner, “[i]n Chung, the screw and wedge 40 are not fixed because Chung’s driving ramp does not have any mechanism (e.g., a set screw) that prevents the screw from backing out from the wedge when the implant is transitioning from the expanded to unexpanded state.” PO Resp. 77; *see also id.* at 76–79. Patent Owner also disputes the accuracy of Petitioner’s translation of Chung, and submits its own translation, which uses the term “coupled” instead of “fastened.” *Id.* at 79; Ex. 2025 (Chung translation) ¶ 31; Ex. 2013 (Culbert Decl.) ¶ 219.

After considering all of the arguments and cited evidence of record, we find that Petitioner demonstrates by a preponderance of the evidence that Chung discloses the “fixed” limitation recited in claims 1 and 13. Specifically, Chung expressly states that “groove fastening screw (50) is *fastened* to the penetrating hole (41) of the aforementioned opposing wedge (40).” Ex. 1005 (Chung), 6 (emphasis added). It is undisputed on this record that “fastened” is a synonym of the claim term “fixed.” See Reply 19 (citing Ex. 1076 (Oxford Dictionary), 4, 5); *see generally* Sur-reply. Thus, Chung expressly teaches this claim limitation.

Patent Owner’s complaint that Chung fails to disclose a physical mechanism (e.g., a set screw) that prevents the screw/actuator from backing out from the wedge when the implant is transitioning from the expanded to unexpanded state is unavailing. *See, e.g.*, PO Resp. 73–75. The claim language does not recite a set screw or some other physical mechanism. It merely requires that “the driving ramp is *fixed* with respect to the actuation member.” Ex. 1001, 27:38–41, 29:13–15 (emphasis added). As we discuss above, Chung expressly discloses that the screw is “fastened” (i.e., “fixed”) to the penetrating hole of wedge 40 (i.e., the claimed driving ramp). Ex. 1005 (Chung), 6.

Patent Owner seeks to avoid Chung’s express disclosure by suggesting that Petitioner’s translation of Chung is inaccurate. *See* PO Resp. 79 (citing Ex. 2013 (Culbert Decl.) ¶ 219 (“[T]he inclusion of ‘fastened’ in the translation provided by Petitioner would be understood to be a clear mistake or ambiguity in the translation . . . because there is simply no teaching in Chung that suggests there is a fixation mechanism in the proximal wedge.”)). Patent Owner submits a different certified translation

of Chung, which it characterizes as “refer[ring] to the head screw 50 being ‘coupled’ not ‘fastened.’” *Id.*; Ex. 2025 (Chung translation) ¶ 31.

We do not credit Patent Owner’s new Chung translation. First, as Petitioner points out, in a separate *inter partes* review (IPR2020-01306), Patent Owner itself submitted and relied upon the same translation of Chung that Petitioner uses here. *See* Reply 20; Ex. 1043 (copy of Chung translation submitted as Exhibit 1033 in IPR2020-01306); Ex. 1042 (Patent Owner’s petition in IPR2020-01306; page 15 of that petition quotes Chung’s description of screw 50 being “fastened” between the wedges). Patent Owner’s attempt to discredit Petitioner’s Chung translation rings hollow where Patent Owner itself submitted and relied on the exact same translation in IPR2020-01306. *See* Reply 20.

Second, Petitioner submitted a declaration from a translator who reviewed both Petitioner’s original Chung translation (Exhibit 1005) and Patent Owner’s new Chung translation (Exhibit 2025) against the original Korean source text, and concluded that “the term used in Exhibit 1005, ‘fasten’ (and modified versions thereof), is more accurate and accepted than is ‘couple’ (and modified versions thereof), for the Korean term (‘체결’).”

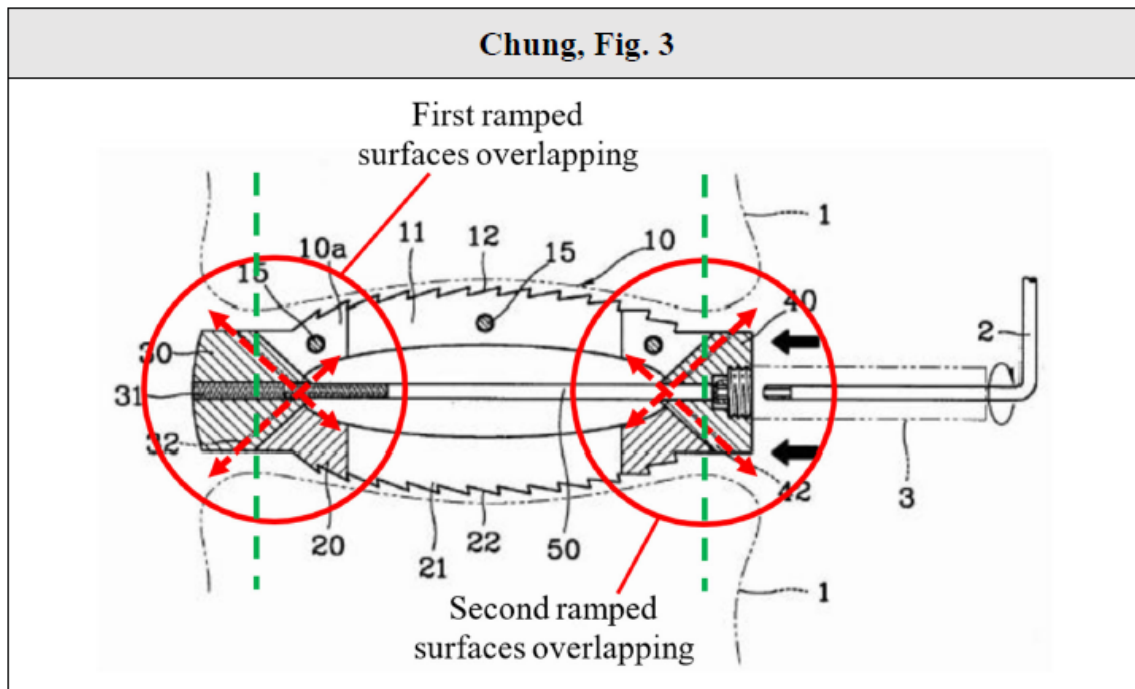
Ex. 1063 (translator decl.) ¶ 3; *see also id.* ¶¶ 4–5. The original translator of Exhibit 1005 affirmed the same. *See* Ex. 1061 (translator decl.) ¶ 6; *see also id.* ¶¶ 7–10. We find these declarations persuasive as to the correctness of the Chung translation submitted as Exhibit 1005. We note that Patent Owner did not dispute any aspect of these declarations. *See generally* Sur-reply.

In sum, on the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Chung expressly teaches the “fixed” limitation recited in claims 1 and 13 (i.e., “wherein when the actuation member is rotated, the driving ramp is fixed with respect to the actuation member”).

3. Whether Chung Teaches the “overlap” Limitation

Patent Owner argues that the structures Petitioner relies on in Chung to meet the “overlap” limitation “never fit over, coincide, or mate such that they overlap in any way.” PO Resp. 92–93.

To provide context, we reiterate that the term “overlap” is recited in claims 8, 10, 11, and 13, and generally requires that when the implant is in an unexpanded configuration, the ramped surfaces at one end of the first and second endplates overlap, and the ramped surfaces at the other end of the first and second endplates overlap. *See* Ex. 1001, 27:66–28:4, 28:15–27, 28:52–57; Ex. 2013 (Culbert Decl.) ¶ 231. Petitioner argues that Chung’s ramped surfaces at the ends of the top and bottom endplates overlap, as depicted in Petitioner’s annotated version of Chung’s Figure 3, reproduced below:



Pet. 38. Chung’s Figure 3 shows Chung’s implant in an unexpanded configuration, with red circles highlighting a first set of ramped surfaces at the left side of the figure, and a second set of ramped surfaces at the right side of the figure. Petitioner argues that these ramped surfaces overlap in two ways, i.e., because: (1) “the angles of the ramped surfaces intersect,” as demonstrated by the red dashed lines that trace the ramp surfaces, and (2) “the ramped surfaces reside vertically opposite each other (i.e., one over the other),” as demonstrated by the vertical green dashed line that runs through the ramps. *Id.* at 36–37; Ex. 1002 (Drewry Decl.) ¶¶ 175–77.

Patent Owner criticizes Petitioner’s mapping as “greatly broaden[ing] the plain and ordinary meaning” of “overlap” “to include any two objects or surfaces that can be connected by a line.” PO Resp. 86–87.

We agree with Patent Owner and Mr. Culbert that “[m]erely because lines extending beyond two objects or surfaces ultimately intersect at some far point in space says nothing about whether the objects or surfaces

themselves overlap.” PO Resp. 87; Ex. 2013 (Culbert Decl.) ¶ 235. Thus, we disagree with Petitioner’s first argument that Chung’s ramped surfaces overlap because their angles overlap (as demonstrated by the red dashed lines in Petitioner’s annotated version of Chung’s Figure 3 above that trace the ramp surfaces). *See* Pet. 36–38.

However, we agree with Petitioner’s second argument that the identified ramps overlap because they reside vertically opposite each other and extend over or cover one another, as demonstrated by the green dashed line. *See id.*; *see also* Reply 26. That is, the ramps fit over one another when viewing the unexpanded device from the top or bottom. *See* Reply 26; Ex. 1072 (Drewry Decl.) ¶¶ 75–76.

For completeness, we note that Patent Owner’s argument that “the mapped portions of Chung . . . do not ‘overlap’ in any way that allows their implants to be more compact than it otherwise would be” is unavailing. PO Resp. 93; Ex. 2013 (Culbert Decl.) ¶ 244. Although configuring certain structures to overlap may in some cases result in a more compact design, the term “overlap” does not require that the overlapping surfaces result in a device that is “more compact than it otherwise would be.” In other words, enhanced compactness is not required by the term “overlap,” nor is it inherent in all structures that “overlap.” *See, e.g.*, Ex. 1036 (dictionaries), 3, 6 (dictionary definitions of “overlap” do not require enhanced compactness).

Additionally, Patent Owner asserts that the ramps Petitioner relies on in Chung do not “mate such that they overlap in any way.” PO Resp. 92–93; Ex. 2013 (Culbert Decl.) ¶ 243. To the extent Patent Owner is asserting that the ramps must “mate” in order to “overlap,” we disagree. Nothing in our

construction of “overlap” (or even in Patent Owner’s proposed construction of “overlap”) requires that the structures must “mate” or physically engage.

In sum, on the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Chung expressly teaches the “overlap” limitation recited in claims 8, 10, 11, and 13.

*4. Whether Chung Teaches the “central ramped surfaces”
Limitation*

Patent Owner argues that Chung does not teach or suggest the “central ramped surfaces” limitation recited in dependent claim 9 and in claim limitations 16[e], [f], [j]. PO Resp. 97–102; *see also* Pet. 126–27 (claim limitations 16[e], [f], [j]).

To provide context, we reproduce below claims 9 and 16:

9. The system of claim 7, wherein ***the first endplate further comprises a central ramped surface disposed between*** the first and second ramped surfaces of the first endplate, wherein ***the second endplate further comprises a central ramped surface disposed between*** the first and second ramped surfaces of the second endplate, and wherein ***the central ramped surface*** of the first endplate and wherein ***the central ramped surface*** of the second endplate are configured to engage the central ramp.

16. A system for intervertebral fusion comprising:

a dilator having a proximal end and a tapered distal end for penetrating soft tissue;

a cannula having a proximal end and a distal end; and

an intervertebral implant sized for insertion into an intervertebral space through the cannula, wherein the intervertebral implant comprises:

a first endplate comprising a first end, a second end, an upper surface connecting the first end and the second end, first

ramped surfaces on either side of the first endplate proximate the first end, second ramped surfaces on either side of the first endplate proximate the second end, and ***a central ramped surface disposed between*** the first and second ramped surfaces;

a second endplate comprising a first end, a second end, an upper surface connecting the first end and the second end, first ramped surfaces on either side of the second endplate proximate the first end, second ramped surfaces on either side of the second endplate proximate the second end, and ***a central ramped surface disposed between*** the first and second ramped surfaces;

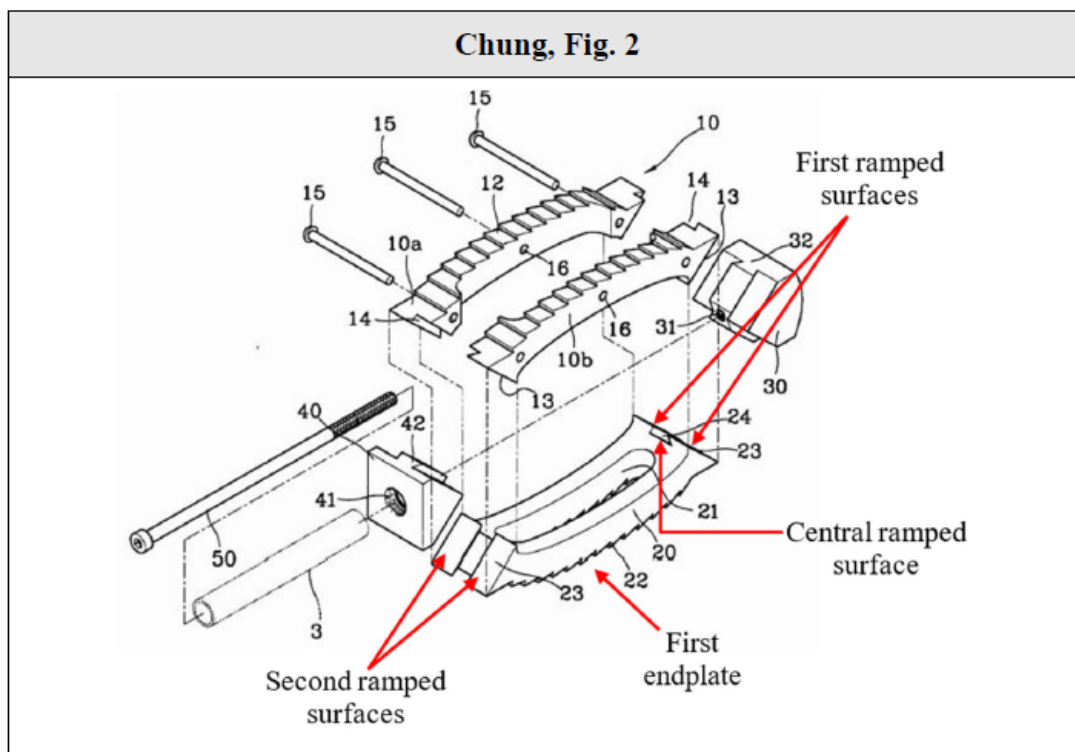
a central ramp disposed between the first endplate and the second endplate, wherein the central ramp comprises a ramped expansion portion at one end of the intervertebral implant and a central ramp extension extending from the expansion portion, wherein the ramped expansion portion is configured to engage the first ramped surfaces of the first endplate and the first ramped surfaces of the second endplate, and wherein the central ramp extension comprises ramped surfaces projecting from the central ramp extension and configured to engage ***the central ramped surface*** of the first endplate and ***the central ramped surface*** of the second endplate;

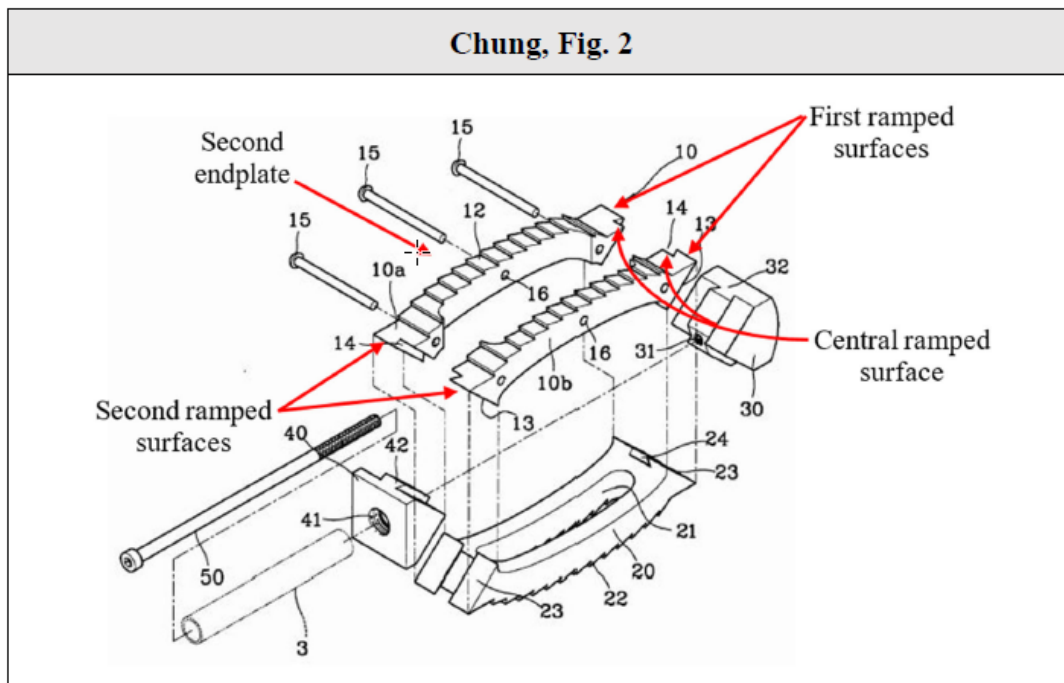
a driving ramp disposed between the first endplate and the second endplate at an opposite end of the intervertebral implant from the expansion portion of the central ramp, wherein the driving ramp has a longitudinal through bore, wherein the driving ramp is configured to engage the second ramped surfaces of the first endplate and the second ramped surfaces of the second endplate; and

an actuation member comprising a head portion and an actuation member extension that extends through the longitudinal through bore of the driving ramp to be received within an opening in the central ramp extension, wherein rotational movement of the actuation member in the first direction pulls the central ramp and the driving ramp towards one another.

Ex. 1001, 28:5–14, 29:26–30:32 (emphasis added).

Petitioner argues that “Chung discloses a central ramped surface (‘dovetail groove (24)’) disposed between the first end plate’s first and second ramped surfaces, and a central ramped surface (‘dovetail groove (14)’) disposed between the second endplate’s first and second ramped surfaces,” as depicted in Petitioner’s two different annotated versions of Chung’s Figure 2, both of which we reproduce below:





Pet. 39–41; *see also id.* at 42 (providing additional annotated figure), 54, 56–59; Ex. 1005 (Chung), 4, Figs. 2, 4; Ex. 1002 (Drewry Decl.) ¶¶ 180–85 (claim 9), 242–45, 252–54 (limitations 16[e], [f], [j]). Both of these annotated figures show Chung’s implant, with labels pointing to the alleged central ramp surfaces, i.e., dovetail groove 24 (top figure) and dovetail groove 14 (bottom figure). According to Petitioner, these grooves are disposed between the first end plate’s first and second ramped surfaces of the bottom and top endplates, as respectively shown in the top and bottom figures reproduced above.

Patent Owner argues that dovetail grooves 24 and 14 do not properly map to the “central ramped surfaces” limitation. PO Resp. 101–02. According to Patent Owner, the claimed “central ramped surfaces are located between each end of their respective endplate—between the first ramped surfaces proximate one end and second ramped surfaces proximate the other, as described in the claims.” *Id.* at 99; Ex. 2013 (Culbert Decl.)

¶ 274. Patent Owner contends that dovetail grooves 24 and 14 are “not between the endplates’ first and second ramped surfaces as required by the claims, but between the first ramped surfaces on the first end, and then between the second ramped surfaces on the second end at the other.” PO Resp. 101–02; Ex. 2013 (Culbert Decl.) ¶¶ 275–76.

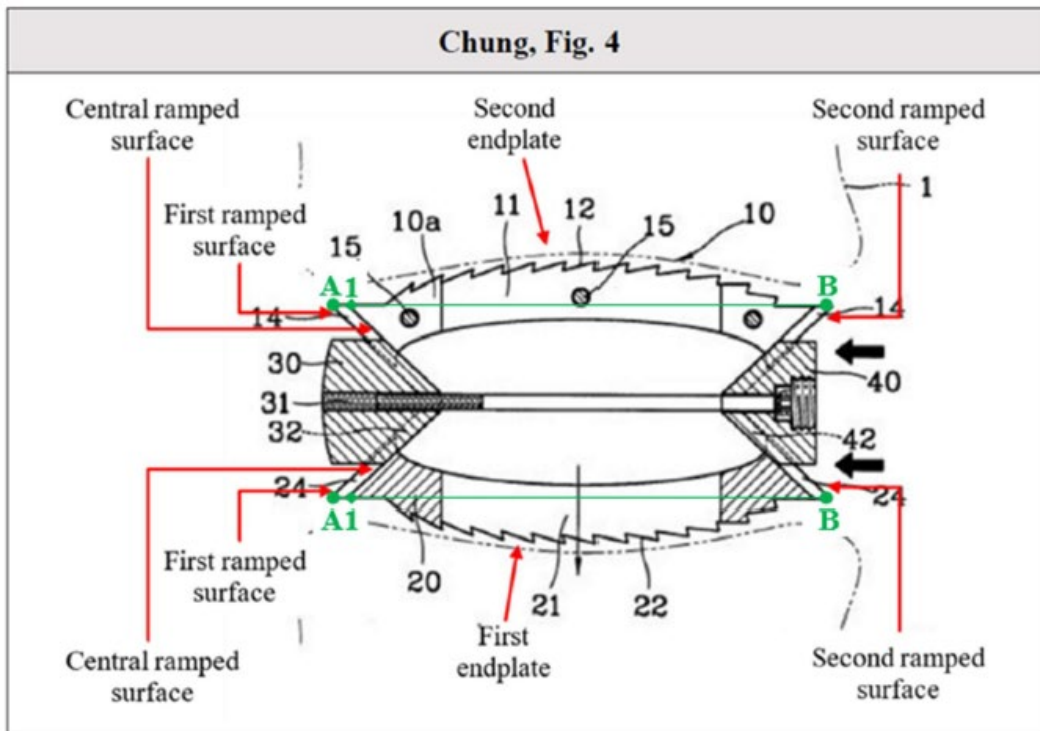
Petitioner responds that Patent Owner is arguing that surfaces can only meet the claim limitation “if they are a certain distance from both the first and second ramped surfaces.” Reply 24. According to Petitioner, “[t]he claims do not specify that central ramped surfaces must be any particular distance from the first and second ramps surfaces. Rather, they only require that the central ramped surfaces be ‘disposed between the first and second ramped surfaces.’” *Id.* (citing Ex. 1072 (Drewry Reply Decl.) ¶ 70). With reference to the graphic reproduced below, Petitioner asserts that a person of ordinary skill in the art “would readily understand that any of the following points would be ‘disposed between’ End A and End B:”



Reply 24. Petitioner’s graphic reproduced above depicts a horizontal line between ends A and B, with points 1 and 2 shown closer to end A, and point 3 shown roughly equidistant between ends A and B. *See id.* Petitioner asserts that “[w]hile Point 1 is clearly closer to End A, a POSITA (or, indeed, anyone) would readily understand that Point 1 is still ‘disposed between’ Ends A and B, just like Points 2 and 3.” *Id.*; Ex. 1072 (Drewry Reply Decl.) ¶ 71.

We agree with Petitioner that Chung discloses the “central ramped surfaces” limitation of claims 9 and 16. Petitioner is correct that “[t]he claims do not specify that central ramped surfaces must be any particular distance from the first and second ramps surfaces”—a limitation Patent Owner seeks to improperly import from the Specification. Reply 24; *see also* Ex. 1079 (Culbert Depo. Tr.), 18:14–19:13 (Mr. Culbert agreeing that claim 9 does not describe a specific distance the central ramped surfaces must be between the first and second ramped surfaces of each endplate). The claims “only require that the central ramped surfaces be ‘**disposed between** the first and second ramped surfaces.’” Reply 24 (emphasis added); *see also* Ex. 1001, 28:5–14, 29:26–30:32.

We agree with Petitioner that although dovetail groove 24 is closer to the first set of ramped surfaces at one end of the implant (and dovetail groove 14 is closer to the second set of ramped surfaces at the other end of the implant), a person of ordinary skill in the art would still recognize these grooves as “disposed between the first and second ramped surfaces” as claimed. *Id.* at 25; Ex. 1072 (Drewry Reply Decl.) ¶¶ 69–72. This is demonstrated in Petitioner’s annotated version of Chung’s Figure 4, reproduced below:



Reply 25. Chung's Figure 4 shows Chung's implant, with labels for, among other things, the first and second ramped surfaces (at either end of the implant) and the central ramped surface. Petitioner marks the location of the first set of ramped surfaces (at the left end of the implant) with an A, and the location of the second set of ramped surfaces (at the right end of the implant) with a B, with a horizontal line connecting points A and B. Petitioner also marks the location of the central ramped surface; it is closer to point A than point B, but is still "disposed between the first and second ramped surfaces" (points A and B), as claimed. *See* Ex. 1072 (Drewry Reply Decl.) ¶ 72.

Patent Owner's argument that "[t]he ramped surfaces identified by Petitioner . . . are located between the same end of each endplate" fails to account for Petitioner's arguments, which rely on the ramped surfaces at either end of the implant (e.g., labelled in Petitioner's annotated version of

Chung's Figure 4 as points A and B), not one the same end of each endplate. Sur-reply 36.

In sum, on the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Chung expressly teaches the “central ramped surfaces” limitation recited in claims 9 and 16.

5. Conclusion—Obviousness Based on Chung with Boehm and/or Song

On this record, we determine that Petitioner has shown by a preponderance of the evidence that Chung with Boehm and Song renders claims 1, 7–13, and 16 unpatentable as obvious.

F. Ground 3 – Alleged Obviousness Based on Chung, Boehm and/or Song, and Varela, or Based on Chung, Boehm and/or Song, Baynham, and Varela

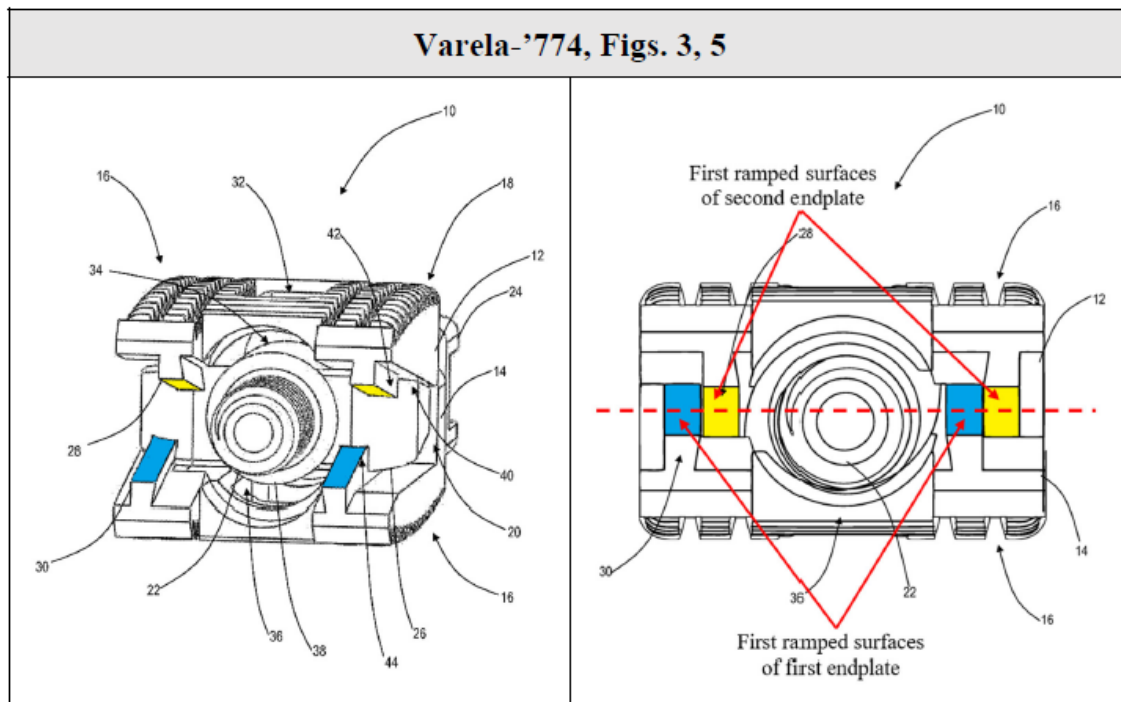
For Ground 3, Petitioner asserts that claims 8, 10, 11, and 13 are unpatentable as obvious over Chung in view of Boehm and/or Song (as detailed in Ground 1), or Chung in view of Boehm and/or Song and Baynham (as detailed in Ground 2), further in view of Varela.²¹ Pet. 70–74 (Ground 3).

In brief, claims 8, 10, 11, and 13 each recite that the ramped surfaces of the implant's first and second endplates “overlap.” *See, e.g.*, Pet. 124

²¹ Although this Ground proposes various combinations of prior art, we address this ground based on the combination of Chung, Boehm, Song, and Varela. First, although this Ground references “Boehm and/or Song,” for the same reasons discussed above for Ground 1, we treat this as Boehm and Song. *See supra* n.14. Additionally, we understand that Petitioner optionally includes Baynham in this Ground because this Ground builds on Ground 2 (which includes Banyham). Because we do not reach Ground 2 (*see infra* Section II.I), we also do not reach the permutation in this Ground based on “Chung, Boehm and/or Song, Baynham, and Varela.”

(dependent claims 8, 10, 11), 125 (limitation 13[g]). As discussed above for Ground 1, Petitioner argues that Chung teaches first and second endplates that overlap. *See supra* Section II.E.3; *see also* Pet. 36–38 (citing Ex. 1005, Figs. 1, 3; Ex. 1002 (Drewry Decl.) ¶¶ 173–79). Petitioner presents this ground as an alternative to arguing that the “overlap” feature is present in Chung. *See* Pet. 70.

More specifically, Petitioner argues that Varela discloses an expandable intervertebral implant with ramped structures that “are offset from one another relative to the central axis of the expandable intervertebral implant 10 such that they sit side-by-side when the expandable intervertebral implant 10 is undepolyed [sic], thereby making the assembly as compact as possible.” *Id.* at 70–71 (quoting Ex. 1030 (Varela) ¶ 39, alteration Petitioner’s). Petitioner provides the below annotated versions of Varela’s Figures 3 and 5:



Id. at 71. Petitioner’s annotated versions of Varela’s Figures 3 and 5

show the device in an expanded state (Fig. 3) and in a collapsed state (Fig. 5), with the ramped surfaces of the first endplate in blue and the ramped surfaces of the second endplate in yellow and (in Fig. 5) the plane of overlap denoted with a red dashed line.

Id. Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Chung with Varela’s offset track structures that “nest” with one another, given Varela’s express teaching that such track structures achieve “the smallest possible form factor,” which is advantageous in minimally invasive surgery. *Id.* at 72–74 (quoting Ex. 1030 ¶¶ 2, 34, 39).

Patent Owner disputes Petitioner’s arguments, urging that Petitioner has “failed to show a reasonable expectation of success in making the proposed modifications.” PO Resp. 97; *see also, e.g., id.* at 93–97; Ex. 2013 (Culbert Decl.) ¶¶ 245–63. First, Patent Owner argues that Petitioner fails “to adequately explain how a POSITA would modify Chung or Olmos to incorporate Varela’s track structures.” PO Resp. 93. Second, Patent Owner argues that “Varela’s single-wedge design significantly differed from the double-wedged designs of Chung and Olmos,” yet the Petition fails to consider whether the designs could be combined. *Id.* at 95. Third, Patent Owner argues that an exhibit that Petitioner cites to support a reasonable expectation of success (namely, “Varela-’049), is not of record and has not been shown to be prior art. *See id.* at 94–95.

We adopt as our own Petitioner’s undisputed analysis of how the combination of Chung, Boehm, Song, and Varela teaches or suggests each limitation of claims 8, 10, 11, and 13. *See generally* Pet. 70–72; Ex. 1002

(Drewry Decl.) ¶¶ 291–330. We also adopt as our own Petitioner’s undisputed analysis of why a person of ordinary skill in the art would have been motivated to combine Chung’s implant with Boehm and Song’s teachings regarding dilators, cannulas, and the insertion of intervertebral implant devices through cannulas, with a reasonable expectation of success. *See* Pet. 70 (cross-referencing Ground 1); *see also supra* Section II.E; Ex. 1002 (Drewry Decl.) ¶¶ 266–74. Finally, we also adopt as our own Petitioner’s undisputed analysis of why a person of ordinary skill in the art would have been motivated to combine Chung’s implant with Varela’s offset track structures, e.g., to achieve the smallest possible form factor for insertion, as expressly taught in Varela. *See* Pet. 72–73; Ex. 1030 (Varela) ¶¶ 2, 34, 39; Ex. 1002 (Drewry Decl.) ¶¶ 332–33; *see also* Ex. 1079 (Culbert Depo. Tr.), 64:7–14, 65:9–66:7 (agreeing that Varela’s teachings regarding the benefits of configuring the endplates to nest or overlap are the same as those described in the ’732 patent itself).

Below, we analyze the disputed issue of whether Petitioner has demonstrated a reasonable expectation of success in using Varela’s offset track structures with Chung’s implant. *See, e.g.*, PO Resp. 97; Sur-reply 32 (“[T]he issue is that the Petition and its supporting evidence are insufficient to prove a reasonable expectation of success.”).

Petitioner argues that a person of ordinary skill in the art would have had a reasonable expectation of success in modifying Chung according to Varela, “such that, in an unexpanded configuration, Chung’s first ramped surfaces of the first and second endplates overlap, and the second ramped surfaces of the first and second endplates overlap.” Pet. 72. This is because, Petitioner argues, the proposed modifications to Chung “are straight-forward

mechanical features/designs that, as the prior art shows, a POSITA was well capable of incorporating.” *Id.* at 73. Petitioner further argues that “the devices of Chung and Varela-’774 are structurally and functionally comparable, with both Varela-’774 and Chung disclosing an expandable implant for surgical insertion between two vertebra to provide structural support and expansion by moving at least one wedge through the rotation of an actuator.” *Id.* at 73–74; Ex. 1002 (Drewry Decl.) ¶ 334. Petitioner argues that this structural and functional comparability would have provided a person of ordinary skill in the art a reasonable expectation of success in applying Varela’s overlapping track structures to the device of Chung. *Id.*

We agree with Petitioner. As Mr. Drewry demonstrates, “both Varela-’774 and Chung disclose an expandable implant for surgical insertion between two vertebra to provide structural support and expansion by rotating a screw to move a threadingly-engaged wedge in a first direction, which causes a first endplate and a second endplate to move outwardly and away from each other.” Ex. 1002 (Drewry Decl.) ¶ 334. We credit Mr. Drewry’s testimony that

A POSITA would have been able to easily achieve [Varela’s] objective simply by shrinking and offsetting at least the lower parts of the ramped surfaces on Chung’s endplates, such that one endplate could nest inside/beside the other in the collapsed position, with Varela-’774 showing the POSITA how to implement this feature for any given pair of endplates such as those disclosed in Chung.

*Id.*²² That a person of ordinary skill in the art would have been able to implement the proposed combination is consistent with “the numerous designs and embodiments depicted in Olmos alone (let alone Chung, Baynham, etc.)[, which] show the relatively high level of skill a POSITA possessed in terms of adapting various structure designs to carry out the known mechanical functions desired of them.” Ex. 1072 (Drewry Reply Decl.) ¶ 165; *see also* Ex. 1002 (Drewry Decl.) ¶ 334 (“The devices of Chung and of Varela-’774 are straight-forward mechanical features/designs that, as the prior art shows, a POSITA was well capable of incorporating.”).

We find unavailing Patent Owner’s arguments that Petitioner fails to adequately explain the proposed combination because Petitioner has not detailed all of the alleged structural changes necessary to accommodate Varela’s track structures in Chung’s implant. *See, e.g.*, PO Resp. 93, 97; Sur-reply 32–33 (arguing that “given the complexities involved,” a more detailed “explanation of the proposed modifications” was necessary). Based on the facts of this case, we credit Mr. Drewry’s explanation that

A POSITA would have been able to easily achieve [Varela’s] objective simply by shrinking and offsetting at least the lower parts of the ramped surfaces on Chung’s endplates, such that one endplate could nest inside/beside the other in the collapsed

²² Patent Owner argues that this statement from Mr. Drewry “is never stated or explained in the Petition, and should not be considered or improperly incorporated by reference.” PO Resp. 94. We disagree. The paragraph in which this sentence appears is cited in the Petition. *See* Pet. 73–74 (citing ¶ 334). We find that this single sentence is appropriate elaboration on how a person of ordinary skill in the art would have carried out the combination proposed in the Petition, and is not so extensive as to amount to improper incorporation by reference.

position, with Varela-'774 showing the POSITA how to implement this feature for any given pair of endplates such as those disclosed in Chung.

Ex. 1002 (Drewry Decl.) ¶ 334. Additionally, against the backdrop of the level of skill in the art (as exemplified by, e.g., Olmos, Chung, and Baynham's "numerous designs and embodiments"), the record supports Mr. Drewry's testimony that an ordinarily skilled artisan would have understood how to shrink and offset parts of Chung's ramped surfaces to implement Varela's track structures. *See* Ex. 1072 (Drewry Reply Decl.) ¶ 165; Ex. 1002 (Drewry Decl.) ¶ 334; Pet. 73–74; Reply 44; *see also KSR Int'l Co.*, 550 U.S. at 421 ("A person of ordinary skill is also a person of ordinary creativity, not an automaton."). On this record, Patent Owner's demand for more detail about alleged structural changes necessary to accommodate Varela's track structures in Chung's implant is inconsistent with the "well-established" proposition "that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements." *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012).

Patent Owner argues that "a POSITA would have recognized that Varela's single-wedge design significantly differed from the double-wedged designs of Chung and Olmos," and "[b]efore determining whether any modification of Chung or Olmos to incorporate Varela's 'nested' arrangement, a POSITA would have necessarily considered whether these differences could be successfully incorporated." PO Resp. 95 (citing Ex. 2013 (Culbert Decl.) ¶¶ 254–59). Mr. Drewry, however, expressly considered this difference. *See* Ex. 1002 (Drewry Decl.) ¶ 335. We credit

his testimony that the “implementation would merely have involved taking Varela’s teaching as to the end of its endplates that interact with its wedge, and applying that same design principle to both ends of Chung’s endplates in essentially equal fashion.” *Id.*

Patent Owner argues that implementing Varela’s track structures in Chung’s double-wedge device could require structural changes such as removing material and lengthening or changing the angle of the ramps, which may weaken the implant’s stability and/or adversely affect its expansion height. *See* PO Resp. 95–96, 97; Ex. 2013 (Culbert Decl.) ¶¶ 254–58, 260–63, 269–71. As explained below, we find that Mr. Culbert’s concerns regarding the articulated combination are largely speculative and unavailing to undermine Petitioner’s showing of a reasonable expectation of success.

First, we agree with Petitioner that although Patent Owner raises “alleged uncertainties regarding the combination of Varela-’774 with Chung or Olmos, . . . its expert never says that the combination cannot be made by a POSITA.” Reply 43. For example, Mr. Culbert indicates that “the angle of the wedges would have to be decreased to allow room for the track structures,” which would make it “difficult to size the implant length correctly.” Ex. 2013 (Culbert Decl.) ¶¶ 256–57. He does not conclude that this alleged difficulty would have undermined a reasonable expectation of success, but rather merely concludes that this issue “require[s] evaluation” by the person of ordinary skill in the art. *Id.* Mr. Drewry considered Mr. Culbert’s opinion, but concluded that “Varela’s track structure could be incorporated into Chung’s design without any such modifications,” and reaffirmed that “[t]he only changes needed would be those described in my

first declaration (Ex. 1002, ¶ 334), which simply adapts Varela’s track structure into Chung’s endplates.” Ex. 1072 (Drewry Reply Decl.) ¶ 168.²³

As another example, Mr. Culbert argues that the proposed modifications may “reduc[e] the maximum implant height,” thus “making the implant less desirable for a surgeon to select before use, because it will not fit as many patients as an implant that has a higher maximum height.” Ex. 2013 (Culbert Decl.) ¶ 263. This statement signals that Mr. Culbert identified no impediment to achieving the proposed modified device; instead, he merely opines that the modified device may not be as desirable as the unmodified Chung device for some surgeries.

Additionally, we credit Mr. Drewry’s testimony that “even if the modifications identified by Mr. Culbert were necessary, . . . a POSTA [sic] in this field knew and understood the mechanical principles in play, and possessed the ability to modify designs to achieve a certain amount of expansion for a given device.” Ex. 1072 (Drewry Reply Decl.) ¶¶ 165, 169. This testimony is consistent with the prior art of record. That is, prior art

²³ Patent Owner suggests that paragraphs 156–174 of Mr. Drewry’s Reply Declaration (Ex. 1072) come too late because they are cited to “fill . . . holes in [Petitioner’s] original analysis,” and are improperly incorporated by reference. *See* Sur-reply 32, 33. We rely herein on three paragraphs from the cited range (¶¶ 165, 168, and 169). The cited paragraphs address the level of skill in the art to carry out the proposed modifications of Chung and Olmos to accommodate Varela’s ramps, and provide Mr. Drewry’s opinion that the modifications could be made with no other changes to the implants. *See* Ex. 1072 (Drewry Reply Decl.) ¶¶ 165, 168, 169. We find that this subject matter is proper elaboration on arguments made in the Petition and reply to Patent Owner’s arguments, and is not so extensive as to amount to improper incorporation by reference.

references including Olmos, Chung, and Baynham all include “numerous designs and embodiments,” and “[a]s Mr. Culbert’s own exhibit shows (Ex. 2021, 2), it is typical to manufacture and offer these devices in a variety of different sizes to accommodate different patients and different expansion needs.” *Id.* This supports Mr. Drewry’s view that a person of ordinary skill in the art would have “possessed the ability to modify designs to achieve a certain amount of expansion for a given device.” *Id.* ¶ 169.

For the above reasons, we find that Petitioner demonstrates a reasonable expectation of success by a preponderance of the evidence.

For completeness, we address the parties’ disputes regarding Petitioner’s attempted reliance on “Varela-’049” to support its reasonable expectation of success argument. *See* Pet. 119. Patent Owner argues that this reference should not be considered because Petitioner (1) failed to make it of record, and (2) has not sufficiently shown that it is prior art. PO Resp. 94, 95 n.13. We need not reach Patent Owner’s first argument, because we find that Petitioner has not demonstrated Varela-’049’s relevance to the obviousness determination in this case.

Petitioner does not assert that Varela-’049 is prior art, but instead argues that the Board may rely on “‘non-prior art evidence of what was known’ for ‘indicating the level of ordinary skill in the art.’” Reply 45 (quoting *Yeda Rsch. & Dev. Co. v. Mylan Pharms., Inc.*, 906 F.3d 1031, 1041 (Fed. Cir. 2018)). Petitioner, however, does not adequately explain how Varela-’049 demonstrates the state of the art or what was known as of the applicable priority date of the ’732 patent. On the current record, we agree with Patent Owner that Varela-’049 at best “shows only that it was known—*after the priority date*—how to use Varela’s nesting concept” with

a double-wedge implant. Sur-reply 33–34 (emphasis added). That timeframe, however, is not relevant to determining obviousness at the time of the alleged invention. *See* 35 U.S.C. § 103(a) (2006).

In sum, after considering the arguments and evidence of record, we determine that Petitioner has shown by a preponderance of the evidence that claims 8, 10, 11, and 13 would have been obvious over Chung, Boehm, Song, and Varela.

G. Ground 4 – Alleged Obviousness Based on Olmos with Boehm and/or Song

Petitioner asserts that claims 1 and 7–13 would have been obvious over Olmos in combination with Boehm and/or Song. *See* Pet. 74–112. In brief, Petitioner relies on Olmos as disclosing an intervertebral implant meeting most limitations of the claims, and relies on Boehm and/or Song as disclosing a dilator, cannula, and intervertebral implant sized for insertion through the cannula, in a manner similar to how it used Boehm and Song in Ground 1.²⁴ *See id.*

²⁴ For clarity, we note that Petitioner presents two alternative obviousness arguments based on Olmos, i.e., based on: (1) Olmos’s Figure 16 embodiment alone; and (2) the combination of Olmos’s Figure 8 and Figure 16 embodiments. *See* Pet. 100–02; *see also* PO Resp. 38 (acknowledging Petitioner’s alternative arguments). As we discuss below, we find Petitioner’s arguments based on the combination of Olmos’s Figure 8 and Figure 16 embodiments persuasive. Thus, we do not address the arguments based on Olmos’s Figure 16 embodiment alone.

We further note that Petitioner sometimes refers to Olmos’s Figure 16 embodiment as the Figure 16-26 embodiment or the Figure 16-24 embodiment. *See, e.g.,* Pet. 109–10 (referring to both “the Fig. 16-26 embodiment” and “Fig. 16-24’s embodiment”). For clarity and consistency, like Patent Owner, we refer to Olmos’s embodiment depicted in its Figures 16 through 24 as the “Figure 16 embodiment.” *See* PO Resp. 14 n.3

Patent Owner disputes three aspects of Petitioner’s showing, i.e., whether Petitioner has demonstrated that (1) Olmos teaches the “overlap” limitation (recited in dependent claims 8, 10, and 11, and in limitation 13[g]); (2) Olmos teaches the “central ramped surfaces” limitation (recited in dependent claim 9 and claim limitation 16[e]); and (3) a person of ordinary skill in the art would have had a reason to use Olmos’s Figure 8 extension with Olmos’s Figure 16 embodiment. *See* PO Resp. 38–63, 83–93, 97–102.

After considering all of the arguments and cited evidence of record, we find that Petitioner demonstrates by a preponderance of the evidence that claims 1 and 7–13 would have been obvious over Olmos in combination with Boehm and Song.²⁵

We adopt as our own Petitioner’s analysis of how Olmos (specifically, the Figure 8/Figure 16 combination), with Boehm and Song, teaches or suggests each of the undisputed claim limitations. *See generally* Pet. 74–112; Ex. 1002 (Drewry Decl.) ¶¶ 337–455.²⁶ We also adopt as our own Petitioner’s undisputed analysis of why a person of ordinary skill in the art

(equating the term “Figure 16 Embodiment” with the embodiments in Olmos’s Figures 16A–24B).

²⁵ As noted above (*supra* n.14), we base our Decision on Petitioner’s proposed combination using both Boehm and Song, but the outcome would be the same if we used only Boehm or only Song.

²⁶ For clarity, we are adopting all undisputed aspects of Petitioner’s showing in Ground 4. The disputed aspects relate to claims 8, 10, and 11 (“overlap”), claim 9 (“central ramped surface”), 13[g] (“overlap”), and 16[e] (“central ramped surface”), and whether Petitioner has demonstrated an adequate reason to use Olmos’s Figure 8 extension with Olmos’s Figure 16 embodiment.

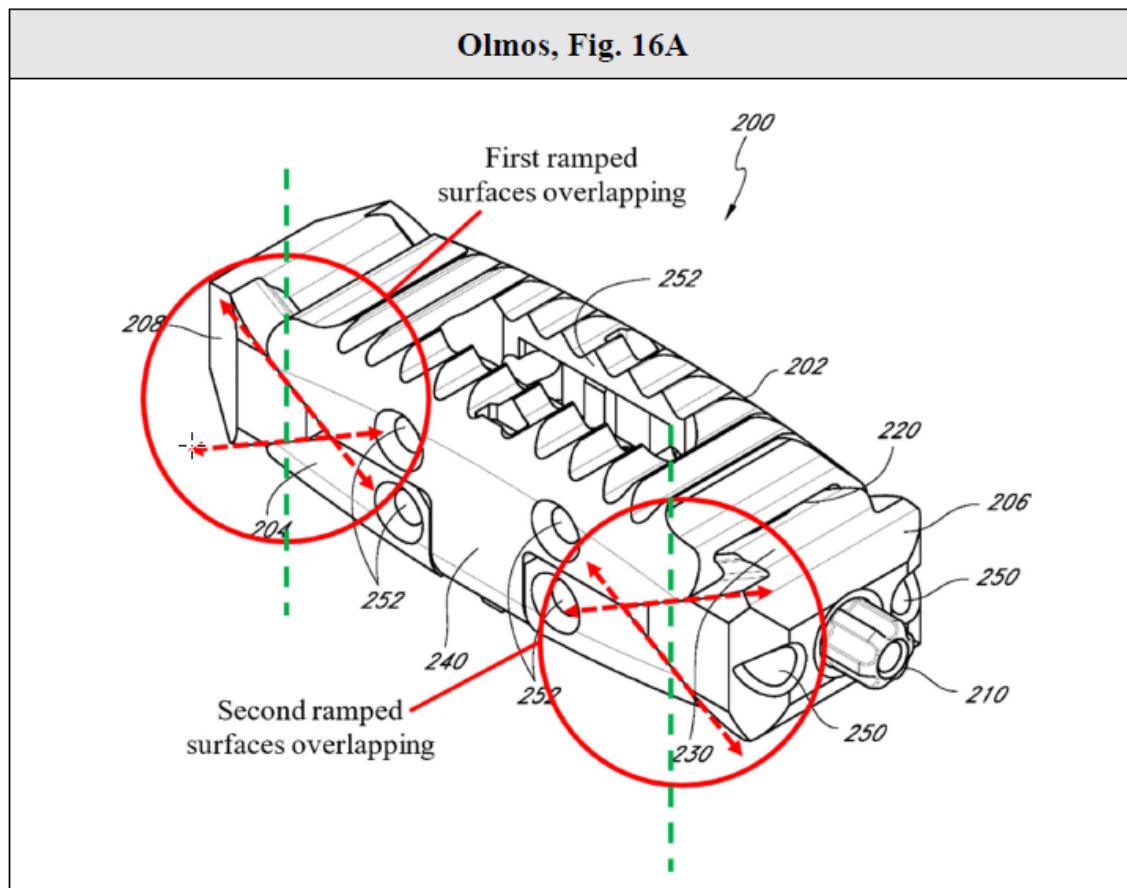
would have been motivated to combine Olmos's implant with Boehm and Song's teachings regarding dilators, cannulas, and the insertion of intervertebral implant devices through cannulas, with a reasonable expectation of success. *See* Pet. 107–09; Ex. 1002 (Drewry Decl.) ¶¶ 456–60.

Below, we analyze the disputed issues.

1. Whether Olmos Teaches the “overlap” Limitation

Patent Owner argues that the structures Petitioner relies on in Olmos to meet the “overlap” limitation “never fit over, coincide, or mate such that they overlap in any way.” PO Resp. 92–93.

Petitioner argues that Olmos's ramped surfaces at the ends of the top and bottom endplates overlap, as depicted in Petitioner's annotated version of Olmos's Figure 16A, reproduced below:



Pet. 95. Olmos's Figure 16A shows Olmos's implant in an unexpanded configuration, with red circles highlighting a first set of ramped surfaces at the left side of the figure, and a second set of ramped surfaces at the right side of the figure. Petitioner argues that these ramped surfaces overlap in two ways, i.e., because: (1) "the angles of the ramped surfaces intersect," as demonstrated by the red dashed lines that trace the ramp surfaces, and (2) "the ramped surfaces reside opposite each other (i.e., one over the other)," as demonstrated by the vertical green dashed line that runs through the ramps. *Id.* at 94; Ex. 1002 (Drewry Decl.) ¶ 398.

Patent Owner criticizes Petitioner's mapping as "greatly broaden[ing] the plain and ordinary meaning" of "overlap" "to include any two objects or surfaces that can be connected by a line." PO Resp. 86–87.

We agree with Patent Owner and Mr. Culbert that “[m]erely because lines extending beyond two objects or surfaces ultimately intersect at some far point in space says nothing about whether the objects or surfaces themselves overlap.” PO Resp. 87; Ex. 2013 (Culbert Decl.) ¶ 235. Thus, we disagree with Petitioner’s first argument that Olmos’s ramped surfaces overlap because their angles overlap (as demonstrated by the red dashed lines in Petitioner’s annotated version of Olmos’s Figure 16A that trace the ramp surfaces). *See* Pet. 94–95.

However, we agree with Petitioner’s second argument that the identified ramps overlap because they reside vertically opposite each other and extend over or cover one another, as demonstrated by the green dashed line. *See id.*; *see also* Reply 43. That is, the ramps fit over one another when viewing the unexpanded device from the top or bottom. *See* Reply 43, 26; Ex. 1072 (Drewry Decl.) ¶ 155.

For completeness, we note that Patent Owner’s argument that “the mapped portions of . . . Olmos do not ‘overlap’ in any way that allows their implants to be more compact than it otherwise would be” is unavailing. PO Resp. 93; Ex. 2013 (Culbert Decl.) ¶ 244. Although configuring certain structures to overlap may in some cases result in a more compact design, the term “overlap” does not require that the overlapping surfaces result in a device that is “more compact than it otherwise would be.” As noted above (Section II.E.3), enhanced compactness is not required by the term “overlap,” nor is it inherent in all structures that “overlap.”

Additionally, Patent Owner asserts that the ramps Petitioner relies on in Olmos do not “mate such that they overlap in any way.” PO Resp. 92–93; Ex. 2013 (Culbert Decl.) ¶ 243. To the extent Patent Owner is asserting that

the ramps must “mate” in order to “overlap,” we disagree. Nothing in our construction of “overlap” (or even in Patent Owner’s proposed construction of “overlap”) requires that the structures must “mate” or physically engage.

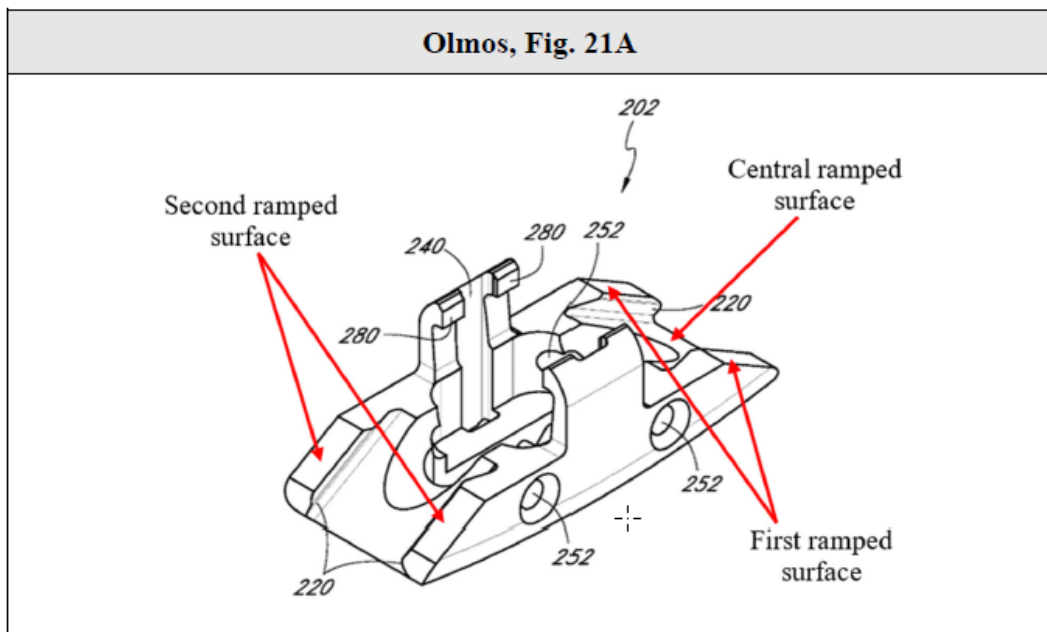
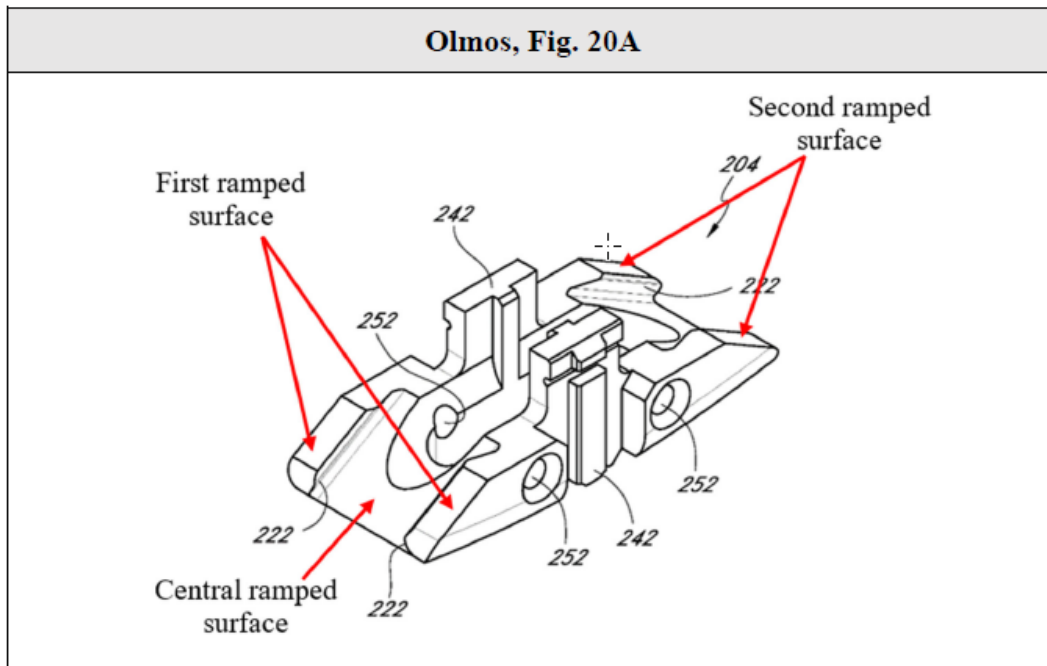
In sum, on the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Olmos expressly teaches the “overlap” limitation recited in claims 8, 10, 11, and 13.

2. Whether Olmos Teaches the “central ramped surfaces” Limitation

Patent Owner argues that Olmos does not teach or suggest the “central ramped surfaces” limitation recited in dependent claim 9.²⁷ PO Resp. 97–102.

Petitioner maps the “central ramped surfaces” to the dovetail-shaped grooves formed between slots 222 and 220, as depicted in Petitioner’s annotated versions of Olmos’s Figures 20A and 21A, reproduced below:

²⁷ Although the “central ramped surfaces” limitation is also recited in claim 16, Petitioner does not challenge claim 16 in Ground 4.



Pet. 96–97; Ex. 1005 (Chung), 4, Figs. 2, 4; Ex. 1006 (Olmos) ¶¶ 167–68, 170, Figs. 16B, 18, 20A–B, 21A–B; Ex. 1002 (Drewry Decl.) ¶¶ 400–05. Olmos's Figure 20A shows one endplate of Olmos's implant, with annotations showing a first ramped surface at the left side of the endplate and a second ramped surface at the right side of the endplate, with dovetail-

shaped groove 222 towards the left side of the endplate. Similarly, Olmos's Figure 21A shows the other endplate of Olmos's implant, with annotations showing a first ramped surface at the right side of the endplate and a second ramped surface at the left side of the endplate, with dovetail-shaped groove 220 towards the left side of the endplate.

Patent Owner argues that Olmos's grooves 222 and 220 do not properly map to the "central ramped surfaces" limitation. PO Resp. 97–102. According to Patent Owner, the claimed "central ramped surfaces are located between each end of their respective endplate—between the first ramped surfaces proximate one end and second ramped surfaces proximate the other, as described in the claims." PO Resp. 99; Ex. 2013 (Culbert Decl.) ¶ 274. Patent Owner contends that grooves 222 and 220 are "are "not between the endplates' first and second ramped surfaces as required by the claims, but between the first ramped surfaces on the first end, and then between the second ramped surfaces on the second end at the other." PO Resp. 101–02; Ex. 2013 (Culbert Decl.) ¶¶ 275–76.

Petitioner responds that Patent Owner is arguing that surfaces can only meet the claim limitation "if they are a certain distance from both the first and second ramped surfaces." Reply 24 (cross-referenced at Reply 41). According to Petitioner, "[t]he claims do not specify that central ramped surfaces must be any particular distance from the first and second ramps surfaces. Rather, they only require that the central ramped surfaces be 'disposed between the first and second ramped surfaces.'" *Id.*; *see also* Ex. 1072 (Drewry Reply Decl.) ¶¶ 150–54. With reference to the graphic reproduced below, Petitioner asserts that a person of ordinary skill in the art

“would readily understand that any of the following points would be ‘disposed between’ End A and End B:”



Reply 24. Petitioner’s graphic reproduced above depicts a horizontal line between ends A and B, with points 1 and 2 shown closer to end A, and point 3 shown roughly equidistant between ends A and B. *See id.* Petitioner asserts that “[w]hile Point 1 is clearly closer to End A, a POSITA (or, indeed, anyone) would readily understand that Point 1 is still ‘disposed between’ Ends A and B, just like Points 2 and 3.” *Id.*; Ex. 1072 (Drewry Reply Decl.) ¶ 71.

We agree with Petitioner that Olmos discloses the “central ramped surfaces” limitation of claim 9. Petitioner is correct that “[t]he claims do not specify that central ramped surfaces must be any particular distance from the first and second ramps surfaces”—a limitation Patent Owner seeks to improperly import from the Specification. Reply 24; *see also* Ex. 1079 (Culbert Depo. Tr.), 18:14–19:13 (Mr. Culbert agreeing that claim 9 does not describe a specific distance between the central ramped surfaces the first and second ramped surfaces of each endplate). Claim 9 “only require[s] that the central ramped surfaces be ‘*disposed between*’ the first and second ramped surfaces.” Reply 24 (emphasis added); *see also* Ex. 1001, 28:5–14.

We agree with Petitioner that although grooves 222 and 220 each reside close to a set of ramped surfaces at one end of the implant, a person of ordinary skill in the art would still recognize these grooves as “disposed

between the first and second ramped surfaces” as claimed. *Id.* at 25, 41–42; Ex. 1072 (Drewry Reply Decl.) ¶¶ 150–54.

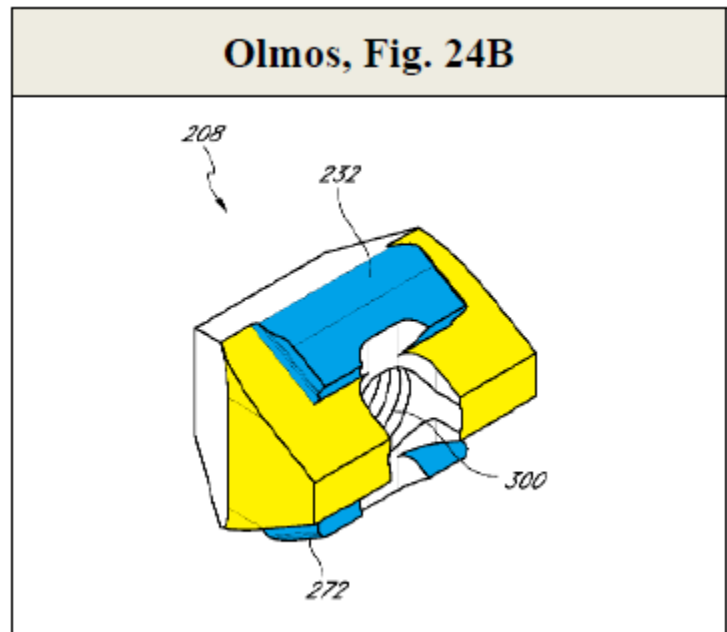
Patent Owner’s argument that “[t]he ramped surfaces identified by Petitioner . . . are located between the same end of each endplate” fails to account for Petitioner’s arguments, which rely on the ramped surfaces at either end of the implant, not on the same end of each endplate. Sur-reply 36.

In sum, on the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Olmos expressly teaches the “central ramped surfaces” limitation recited in claim 9.

3. Whether Petitioner Has Adequately Demonstrated that a Person of Ordinary Skill in the Art Would Have Had a Reason to Use Olmos’s Figure 8 Extension With Olmos’s Figure 16 Embodiment

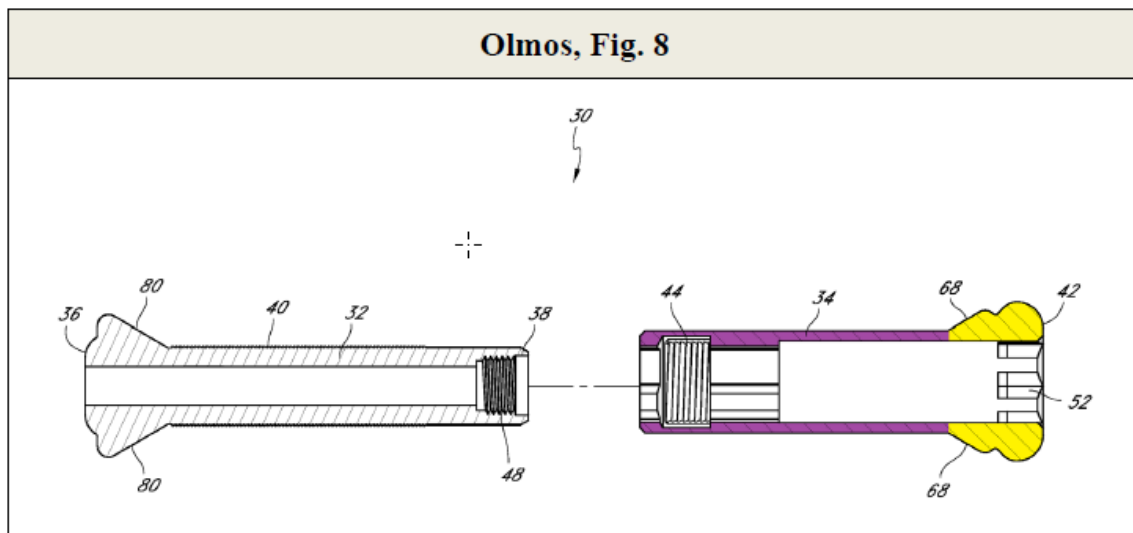
Patent Owner disputes whether Petitioner has demonstrated that a person of ordinary skill in the art would have had a reason to use Olmos’s Figure 8 extension with Olmos’s Figure 16 embodiment. *See* PO Resp. 38–63.

To provide context for this discussion, we first provide an overview of Petitioner’s relevant arguments. For the claimed “central ramp extension” recited in independent claims 1 and 13, Petitioner points to “guide member 232” on Olmos’s distal wedge member 208. *See* Pet. 100 (analysis for limitation 12[a]); *see also id.* at 84, 107, (for claim limitations 1[j] and 13[l], cross-referencing arguments for limitation 12[a]). Petitioner highlights guide member 232 in blue in Petitioner’s annotated version of Olmos’s Figure 24B, reproduced below:



Pet. 100. Petitioner’s annotated version of Olmos’s Figure 24B shows Olmos’s distal wedge member 208. Petitioner highlights “guide member 232” in blue and the structures flanking the guide member in yellow. *See id.* Petitioner maps distal wedge member 208 to the claimed “central ramp,” “guide member 232” (blue) to the claimed “central ramp extension,” and the structures (yellow) flanking guide member 232 to the claimed “expansion portion.” *See id.* at 99–101.

Petitioner then argues that “it would have been obvious to add a further extension to the central ramp,” namely, Olmos’s outer sleeve member 34 as depicted in Olmos’s Figure 8. *Id.* at 101. We reproduce below Petitioner’s annotated version of Olmos’s Figure 8:



Pet. 102. Olmos’s Figure 8 is a side cross-sectional view of actuator shaft 30. *See* Ex. 1006 (Olmos) ¶ 35. Actuator shaft 30 comprises two parts, i.e., “an outer sleeve member and an inner sleeve member.” *Id.* Petitioner annotates Figure 8 to show outer sleeve member 34 in purple and the expansion portion in yellow. Pet. 102. Outer sleeve member 34 “extends longitudinally from an expansion portion of the driving ramp/proximal wedge,” and has threading that engages threading on the inner sleeve member to permit expansion and contraction of the implant, similar to how the actuation member is used in the Figure 16 embodiment. *Id.* at 101; Ex. 1006 (Olmos) ¶¶ 35, 81–82, 90, 106–107.

Petitioner articulates several reasons why a person of ordinary skill in the art would have used Figure 8’s extension with the Figure 16 embodiment. Pet. 109–12. First, Petitioner explains that the extension “allows the actuator to engage with the distal wedge member/central ramp more quickly and over a greater distance, while allowing use of a shorter actuator/screw,” which “would make the connection between the wedges stronger” and prevent the actuator from “stick[ing] out the far end of the

central ramp when the device is expanded.” *Id.* at 109 (citing Ex. 1002 (Drewry Decl.) ¶¶ 462–63). Second, Petitioner explains that “adding Fig. 8’s extension to Fig. 16-24’s embodiment would preserve the structurally advantageous, interconnecting components of the primary embodiments.” *Id.* at 109–10 (citing Ex. 1006 (Olmos) ¶ 156). Third, Petitioner argues that “an integrally-formed extension advantageously requires fewer parts, which facilitates both manufacturing and use.” *Id.* at 110 (citing Ex. 1006 (Olmos) ¶ 107; Ex. 1002 (Drewry Decl.) ¶ 464).

Petitioner also asserts that the proposed combination “merely involves the combination of known mechanical elements that do not interact in any surprising or unexpected way, rendering []the modification a simple, obvious substitution.” Pet. 111 (citing *KSR*, 550 U.S. at 417). Petitioner further asserts that “Olmos expressly teaches that ‘all features discussed in connection with any one embodiment herein can be readily adapted for use in other embodiments herein to form various combinations and sub-combinations,’ and that integrally formed extensions like that in Fig. 8 are common and relatively simple to manufacture.” *Id.* (citing Ex. 1006 (Olmos) ¶¶ 107, 188; Ex. 1002 (Drewry Decl.) ¶ 466). Petitioner notes that during prosecution of the ’731 patent, “the Examiner combined the embodiment of Figs. 16-26 with similar Olmos embodiments (e.g., Fig. 5).” *Id.* at 111–12 (citing Ex. 1037 (prosecution history of the ’731 patent), 63–64, 72–73, 132–33, 137–38).

After consideration of all the arguments and cited evidence of record, we find that Petitioner has demonstrated by a preponderance of the evidence that a person of ordinary skill in the art would have had reasons to use Olmos’s Figure 8 extension with Olmos’s Figure 16 embodiment. First, we

agree with Petitioner that Olmos expressly suggests combining its various embodiments, including by using Figure 8's extension with the Figure 16 embodiment. Pet. 111; Reply 34; Ex. 1006 (Olmos) ¶¶ 174, 188; Ex. 1002 (Drewry Decl.) ¶ 466; Ex. 1072 (Drewry Reply Decl.) ¶¶ 143–44, 146–47. We find that Olmos's express teaching is itself a sufficient basis on which to credit Petitioner's motivation to combine argument.

Second, we additionally agree with Petitioner that the proposed combination “merely involves the combination of known mechanical elements that do not interact in any surprising or unexpected way, rendering []the modification a simple, obvious substitution.” Pet. 111; Ex. 1002 (Drewry Decl.) ¶ 466. The record shows that it was common in the art to use an extension like that in Olmos's Figure 8 to threadingly engage the actuation member and cause expansion and contraction of the implant. *See, e.g.*, Pet. 111; Ex. 1006 (Olmos) ¶ 107; Ex. 1007 (Baynham) ¶ 29 (threaded tube 27, visible in Fig. 3); *see also* Pet. 64–66; Ex. 1002 (Drewry Decl.) ¶¶ 85–86, 278 (discussing Baynham's extension/threaded tube). Olmos teaches that such an extension could be substituted in place of a threaded actuator that lacks such an extension. *See* Ex. 1006 (Olmos) ¶ 174.

Because Petitioner's proposed combination is no more than “the predictable use of prior art elements according to their established functions,” we find that this is an additional reason why Petitioner has adequately demonstrated a sufficient motivation to combine with a reasonable expectation of success. *See KSR*, 550 U.S. at 417; *see also Bos. Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009) (“Combining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness.”).

Finally, we also agree with Petitioner that a person of ordinary skill in the art would have been motivated to use the Figure 8 extension because it “allows the actuator to engage with the distal wedge member/central ramp more quickly and over a greater distance, while allowing use of a shorter actuator/screw.” Pet. 109. Petitioner demonstrates that a person of ordinary skill in the art would have understood that this “would make the connection between the wedges stronger” and reduce the risk of the actuator protruding from the far end of the central ramp when the device is expanded. *See id.*; Reply 34–39; Ex. 1002 (Drewry Decl.) ¶¶ 462–63; Ex. 1072 (Drewry Reply Decl.) ¶¶ 121–34.

We discuss our reasoning in more detail below, in connection with addressing Patent Owner’s arguments.

a. Olmos’s Express Teachings

Patent Owner disputes that Olmos expressly teaches combining the Figure 8 extension with the Figure 16 embodiment. PO Resp. 52. First, Patent Owner argues that Olmos “only states that features *could* be combined, without any discussion of the simplicity or complexity of said combinations.” *Id.* at 59. According to Patent Owner, “it is readily apparent that many features in Olmos’ embodiments would simply be impossible or impractical to implement in other embodiments, lending little credibility to Petitioner’s apparent suggestion that every disclosed feature is automatically obvious and easily combinable with every other embodiment.” *Id.* (citing Ex. 2013 (Culbert Decl.) ¶ 167).

Patent Owner’s argument is unavailing. Patent Owner raises certain alleged drawbacks of adding an extension (i.e., problems with sufficient osseointegration and device visibility, discussed below), but does not show

that Petitioner’s proposed combination would be “impossible or impractical to implement.” PO Resp. 59. Nor does the record reflect any such impossibility or impracticality. Instead, as just discussed above, the record shows that it was common in the art to use an extension like that in Olmos’s Figure 8 to threadingly engage the actuation member and cause expansion and contraction of spinal implants. This is also consistent with Olmos itself, which states: “The actuator shaft 30 can be utilized in several embodiments to provide numerous advantages, such as facilitating precise placement, access, and rapid deployment of the intervertebral implant 10.” Ex. 1006 (Olmos) ¶ 81.

Additionally, as discussed above, we agree with Petitioner that Olmos includes an express teaching to combine Figure 8’s extension with the Figure 16 embodiment. In discussing the Figure 16 embodiment, Olmos states:

[A]lthough this embodiment is described and illustrated as having the actuator shaft 210 with threads 294, it is also contemplated that relative movement of the wedge members can be achieved through the use of the actuator shaft 30 described in reference to FIGS. 5-6, and that such an actuator shaft could likewise be used with the embodiment shown in FIGS. 16A-19.

Id. ¶ 174. As noted above, Olmos teaches that “actuator shaft 30” comprises an outer sleeve member and an inner sleeve member. *Id.* ¶¶ 35, 82. We agree with Petitioner that Olmos’s paragraph 174 is an express teaching to

use the actuator assembly in Figure 8²⁸ with the Figure 16 embodiment.

Reply 34; Ex. 1072 (Drewry Reply Decl.) ¶¶ 143–47.

Patent Owner argues that in paragraph 174, Olmos teaches “that the **actuator** shaft 30 (Fig. 5–6) can replace actuator 210 in the Fig. 16 embodiment,” but “[r]eplacing actuator 210 with actuator 30 does not add an extension on Figure 16’s distal wedge (absent hindsight bias).” Sur-reply 26. This argument is unavailing.

Patent Owner overlooks Petitioner’s argument and supporting evidence that although Olmos’s Figures 5 and 8 illustrate the outer sleeve member stemming from the proximal wedge/driving ramp rather than from the distal wedge/central ramp, “[t]hese configurations are simple mirror images of each other, with no difference in their functionality or purpose.” Pet. 110 (citing Ex. 1002 (Drewry Decl.) ¶ 465). According to Petitioner, “[a]dding a threaded extension to the distal wedge/central ramp would have been most logical for a POSITA considering the advantages of embodiment(s) of Figs. 16-26, simply because the actuator in those figures is inserted through the proximal wedge/driving ramp.” *Id.* We adopt Petitioner’s undisputed analysis as our own. *See id.* at Pet. 110–11; Ex. 1002 (Drewry Decl.) ¶¶ 465–66.

²⁸ Although Olmos’s paragraph 174 refers to Figures 5 and 6 instead of Figure 8, the record reflects that the actuator assembly structure in Figure 8 is “interchangeable with that in Figures 5-6.” Reply 34. The embodiments differ primarily in that in Figures 5 and 6, proximal wedge member 68 is formed separately from outer sleeve member 34, whereas in Figure 8, these members are integrally formed. *See* Ex. 1006 (Olmos) ¶¶ 106–07; Ex. 1072 (Drewry Reply Decl.) ¶ 144 (citing Ex. 1041 (Culbert Depo. Tr.), 164:2–165:15 (agreeing that the two-piece actuator assembly in Figure 8 can replace the four-piece design in Figures 5 and 6)).

For the above reasons, we find that Patent Owner’s arguments do not undermine Petitioner’s showing that Olmos expressly motivates Petitioner’s proposed combination.

b. Simple Substitution

As to Petitioner’s argument that using Figure 8’s extension with the Figure 16 embodiment would have been a “simple, obvious substitution” (Pet. 111), Patent Owner argues that “the simple substitution rationale does not apply,” because “[s]ubstitution’ refers to replacing a first thing for a second thing,” and here “Petitioner does not propose replacing an existing component, but rather **adding** a new extension.” PO Resp. 58 (citing *Apple Inc. v. Samsung Elecs. Co., Ltd.*, 839 F.3d 1034 (Fed. Cir. 2016) (“[T]he simple substitution of one known element **for another** makes the claimed invention obvious.”)).

We find that Patent Owner views Petitioner’s argument too narrowly. Petitioner proposes to change the actuator assembly depicted in Olmos’s Figure 16 embodiment to instead use Figure 8’s extension and a shorter actuator/screw. *See* Pet. 101–02; 109. This is the substitution a first thing (the Figure 16 actuator assembly) for a second thing (Figure 8’s extension and a shorter actuator/screw), just as Petitioner proposes.

Patent Owner also argues that “no proposed structural modification to a spinal implant this substantial can be said [to] involve ‘simple substitution,’” because “[m]aking even minor modifications to a spinal fusion implant can adversely affect many other aspects of the design.” PO Resp. 58–59 (citing Ex. 2013 (Culbert Decl.) ¶ 164). But as we discuss above, Petitioner’s proposed combination is no more than the predictable use of prior art elements according to their established functions. Patent Owner

mentions two potential adverse effects on the implant design that could arise from the combination, i.e., having to “remov[e] material from the plates so the extension fits within the implant when collapsed,” and “reduc[ing] the effectiveness of osseointegration [sic].” PO Resp. 59 (citing Ex. 2013 (Culbert Decl.) ¶¶ 165–66).

Patent Owner appears to be arguing that a person of ordinary skill in the art would not have had a reasonable expectation of success in making the proposed modification, given these potential adverse effects. As to Patent Owner’s concern regarding removing material from the plates, Patent Owner has not demonstrated that this speculative concern would have undermined Petitioner’s showing that a person of ordinary skill in the art would have had a reasonable expectation of combining the references to achieve a spinal implant as claimed. *See* PO Resp. 59. In fact, Patent Owner’s expert Mr. Culbert expressly acknowledges that even if a person of ordinary skill in the art had to remove material from the implant to accommodate the extension, the implant’s structural integrity could be maintained by “bolstering other aspects of the implant.” Ex. 2013 (Culbert Decl.) ¶ 165.

As to potentially reducing the effectiveness of osseointegration, the reasonable expectation of success requirement relates to “achieving what is claimed in the patent-at-issue.” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016). The challenged claims do not recite any limitations directed to osseointegration or long-term stability of the implant within the patient. Accordingly, this potential adverse effect flowing from Petitioner’s proposed combination is also unavailing.

For the above reasons, we find that Patent Owner's arguments do not undermine Petitioner's showing that adding Olmos's Figure 8 extension to the Figure 16 embodiment would have been a simple, obvious substitution.

c. Risk of Protrusion

Patent Owner disputes that a person of ordinary skill in the art would have been motivated to make Petitioner's asserted combination based on an alleged risk of the actuator protruding from the far end of the central ramp. *See* PO Resp. 53–56. On the full trial record, we find Patent Owner's argument unavailing, because Patent Owner misconstrues the Figure 16 embodiment on which Petitioner relies. Once Petitioner's proposed combination is properly understood, we agree with Petitioner that its proposed combination provides benefits over the Figure 16 embodiment, namely allowing the use of a shorter actuator/screw and thus reducing the risk of actuator protrusion, which would have motivated a person of ordinary skill in the art to make the proposed combination. *See* Pet. 109–10.

More specifically, Patent Owner argues that in Olmos's Figure 16 embodiment, protrusion is not a problem because the distal wedge has an “elongated body . . . to provide the necessary additional threading to allow full engagement without actuator 210 protruding from distal wedge 208.” PO Resp. 54. Patent Owner argues that Olmos's Figures 16B and 18 “depict the implant in the ‘expanded state’” and show that “actuator 210 does *not* protrude,” nor can it, “because the implant includes motion limiting structures . . . to prevent further expansion.” *Id.* at 54–55 (citing, e.g., Ex. 2013 (Culbert Decl.) ¶¶ 146–47; Ex. 1006 (Olmos) ¶¶ 52, 54, 158, 171). As such, Patent Owner asserts that “Petitioner's motivation addresses a

phantom ‘protrusion’ that simply does not exist.” *Id.* at 56; *see also* Ex. 2013 (Culbert Decl.) ¶¶ 146–48.

The problem with Patent Owner’s argument is that it is based on Olmos’s Figure 16 embodiment having “a dual-threaded actuator for movement of the **two wedges**.” PO Resp. 40 (emphasis added); *see also id.* at 40–44 (describing Patent Owner’s understanding of Olmos’s Figure 16 embodiment as having threaded engagement of each wedge to move both ramps/wedges). The Petition, however, relies on an embodiment of Figure 16 where the actuator is “axially-fixed relative to one wedge,” and thus moves only **one wedge**.²⁹ *See* Pet. 89–90, 85–86 (describing unthreaded opening in the driving ramp/proximal wedge and a threaded opening in the central ramp/distal wedge, and quoting, e.g., Olmos’s teaching (¶ 159), which teaches that “at least a portion of the actuator shaft can be axially

²⁹ Patent Owner argues that Petitioner “alters its asserted combination” because Petitioner “exclusively combined the Fig. 8 embodiment with the Fig. 16 embodiment—and no other.” Sur-reply 25–26. We disagree. First, Petitioner relied on the single-threaded actuator embodiment in connection with the portion of claim limitation 1[j] directed to “an actuation member . . . that extends through an unthreaded opening in a longitudinal through bore of the driving ramp.” *See* Pet. 85–87. We see no indication that Petitioner abandoned or altered these arguments when discussing the “central ramp extension” portion of limitation 1[j]. *See, e.g.,* Pet. 84, 101–02, 110–11 (discussing adding Figure 8’s threaded extension to the distal wedge/central ramp, with the actuator inserted through proximal wedge/driving ramp); *see also id.* at 89–90. Second, Patent Owner appears to suggest that Olmos’s paragraph 159, which describes the single-threaded actuator embodiment that moves only one ramp, is different than the Figure 16 embodiment. Olmos’s paragraph 159, however, is applicable to the Figure 16 embodiment. *See, e.g.,* Ex. 1006 (Olmos) ¶ 152 (discussing actuator shaft 210 in the context of Figures 16A–19).

fixed relative to one of the proximal and distal wedge members 206, 208 with the actuator shaft being operative to move the other one of the proximal and distal wedge members 206, 208”) (emphasis Petitioner’s)); *see also* Reply 33–34 (arguing that Patent Owner “ignore[s] the Petition’s reliance on an . . . an embodiment[] . . . where the actuator is ‘axially-fixed’ relative to one ramp”); Ex. 1072 (Drewry Reply Decl.) ¶¶ 123–24 (reiterating reliance on Olmos’s disclosure of a single-threaded actuator that moves one wedge).

This difference in embodiments is important to the parties’ arguments, because as Petitioner persuasively establishes, a person of ordinary skill in the art would have recognized a greater risk of actuator protrusion when using an axially-fixed actuator that moves one wedge (a single-threaded actuator) as compared to an actuator that moves both wedges (a double-threaded actuator). *See* Reply 34–36.³⁰ This is because a single-threaded

³⁰ Patent Owner asserts that Petitioner’s Reply “exceeds the proper scope of reply by explaining its protrusion theory for the first time via lengthy new testimony (Ex. 1072 ¶¶ 122–131), despite Mr. Drewry’s original declaration never referencing the issue.” Sur-reply 27 (citing Ex. 1002 (Drewry Decl.) ¶¶ 461–66). We disagree. We find that Petitioner’s discussion of the protrusion problem is both a permissible expansion on its arguments made in the Petition, and response to Patent Owner. *See Corephotonics, Ltd. v. Apple Inc.*, 84 F.4th 990, 1008 (Fed. Cir. 2023) (“there is no blanket prohibition against the introduction of new evidence during an IPR, provided it is an ‘expan[sion] on and . . . fair extension of . . . [a] previously raised . . . argument’ and has a ‘nexus’ (and is therefore responsive) to an argument made by the patent owner or the Board”) (quoting *Rembrandt Diagnostics*, 76 F.4th at 1384–85) (alterations in original). The Petition identifies a concern with the actuator “stick[ing] out the far end of the central ramp,” and Mr. Drewry’s original declaration stated that the combination would “allow a surgeon to use a shorter actuator.” Pet. 109; Ex. 1002 (Drewry Decl.) ¶ 462. As we discuss above, in attempting to rebut Petitioner’s argument, Patent Owner misdescribed Petitioner’s proposed

actuator “will result in the distance between the ramps decreasing (or increasing) only half as much relative to when a dual-threaded actuator is rotated the same amount.” Ex. 1072 (Drewry Reply Decl.) ¶ 124. This creates a risk that the actuator will protrude beyond the end of the central ramp, even if the central ramp has an elongated body portion with extended threading. *See* Reply 34–37; Ex. 1072 (Drewry Reply Decl.) ¶¶ 124–26.

As Petitioner persuasively establishes, a person of ordinary skill in the art would have recognized that adding Figure 8’s extension to the central ramp would allow use of a shorter actuator, thereby mitigating the protrusion risk. Pet. 109; Ex. 1002 (Drewry Decl.) ¶ 462; *see also id.* ¶ 286; Reply 37–38; Ex. 1072 (Drewry Reply Decl.) ¶¶ 127–131. Notably, both parties’ experts agree that protruding actuators are problematic because they can encroach on adjacent tissues, blood vessels, and nerves. *See* Ex. 1002 (Drewry Decl.) ¶ 286 (explaining, in the context of Ground 2, that “the use of a shorter screw avoids the problem of having the actuator be too long such that it encroaches to or protrudes from the outside of either of the ramps and into adjacent tissue/nerves”); Ex. 1041 (Culbert Depo. Tr.), 17:8–18:4, 22:5–23:10.

Patent Owner argues that even if a person of ordinary skill in the art “believed that additional threaded engagement was desirable,” he or she “would have simply added more threading in the unthreaded proximal end of the distal wedge 208.” PO Resp. 56; Ex. 2013 (Culbert Decl.) ¶ 149. Mr. Culbert asserts that an ordinarily skilled artisan would have elected this

combination. Under the circumstances here, we find that Petitioner’s Reply and Mr. Drewry’s Reply declaration appropriately elaborate on the Petition and respond to Patent Owner’s counterarguments related thereto.

approach over adding an extension, because an extension “would unnecessarily occupy critical space for bone graft.”³¹ Ex. 2013 (Culbert Decl.) ¶ 150.

This argument is unavailing. First, Patent Owner does not adequately explain how this approach would have reduced the risk of protrusion. For example, as Mr. Drewry points out, adding threading in the wedge would not allow for the use of a shorter actuator. Ex. 1072 (Drewry Reply Decl.) ¶ 136. Second, even if this approach were viable and/or better, it would not negate Petitioner’s approach of adding an extension. “[J]ust because better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.” *In re Mouttet*, 686 F.3d at 1334.

On Sur-reply, Patent Owner argues that Petitioner’s proposed combination of Olmos embodiments “admittedly achieves Chung’s design,” and “Chung’s single-threaded actuator is far from protruding,” without using an extension. Sur-reply 28. This argument is unavailing. Even assuming there is no protrusion problem with Chung, Patent Owner does not establish that what is true of Chung’s implant would necessarily be true of Petitioner’s proposed combination based on Olmos. Patent Owner does not point us to any admission by Petitioner that Petitioner’s proposed combination of

³¹ Notably, during his deposition, Mr. Culbert agreed that one way to “modify Olmos to ensure that the actuator doesn’t protrude out of the back of the central ramp” is to “make the central ramp bigger . . . in the axial direction.” Ex. 1041 (Culbert Depo. Tr.) 230:3–231:1 (cited at Sur-reply 28). This testimony further supports Petitioner’s argument that a person of ordinary skill in the art would have added Olmos’s Figure 8 extension to the distal wedge member/central ramp in the Figure 16 embodiment to reduce the risk of protrusion. Pet. 109.

Olmos embodiments “admittedly achieves Chung’s design.” Patent Owner appears to arrive at this alleged admission because, according to Patent Owner, “Mr. Drewry admits that Olmos’ single threaded actuator would closely resemble Chung’s actuator.” *See* Sur-reply 27–28 (citing Ex. 1072 (Drewry Reply Decl.) ¶ 123). But in paragraph 123 of his Reply Declaration (Ex. 1072), Mr. Drewry does not say that Petitioner’s proposed combination of Olmos embodiments “admittedly achieves” or “closely resembl[es]” Chung’s overall *design*. *See* Sur-reply 28. Rather, Mr. Drewry states that Olmos’s single-threaded *actuator* “functionally would more closely resemble” Chung’s single actuator than Olmos’s dual-threaded actuator. *See* Ex. 1072 (Drewry Reply Decl.) ¶ 123. Accordingly, the record does not support Patent Owner’s argument regarding an alleged admission that the proposed combination of Olmos embodiments “achieves Chung’s design.”

For the above reasons, we find that Patent Owner’s arguments do not undermine Petitioner’s showing that a person of ordinary skill in the art would have been motivated to add Olmos’s Figure 8 extension to the Figure 16 embodiment to reduce the risk of actuator protrusion.

d. Stronger Connection Between the Wedges/Ramps

Patent Owner disputes the sufficiency of Petitioner’s argument that a person of ordinary skill in the art would have been motivated to make Petitioner’s asserted combination to “make the connection between the wedges stronger.” PO Resp. 44–53; Pet. 109. Patent Owner argues that beyond a certain point, adding threaded engagement between the wedge and actuator “has no notic[e]able or appreciable [e]ffect on the strength of the threaded connection, because the bolt or screw [actuator] will fail for reasons unrelated to the threaded engagement (e.g., the bolt will simply

break in half).” PO Resp. 46; Ex. 2013 (Culbert Decl.) ¶¶ 132–43. Patent Owner asserts that Olmos’s “Figure 16 embodiment already provided sufficient threaded engagement between the actuator and distal wedge such that the connection strength could not be increased by simply adding more.” PO Resp. 50–52; Ex. 2013 (Culbert Decl.) ¶ 142.

We find that Petitioner has shown by a preponderance of the evidence that a person of ordinary skill in the art would have been motivated to use Olmos’s Figure 8 extension in Olmos’s Figure 16 device in order to allow the actuator to engage with the distal wedge member/central ramp more quickly and over a greater distance, which would make the connection between the wedges stronger. *See, e.g.*, Pet. 109; Ex. 1002 (Drewry Decl.) ¶ 462. Petitioner persuasively explains that the threads are stressed when a surgeon first starts to rotate the actuator to expand the device, and thus a person of ordinary skill in the art would have understood that a quicker (earlier) engagement between the actuator and wedge member would disperse the forces across a greater area and mitigate the risk of failure. *See* Reply 38; Ex. 1072 (Drewry Reply Decl.) ¶¶ 104, 132, 134.

Patent Owner’s argument that additional threaded engagement would have no appreciable effect on the strength of the connection is unavailing. *See, e.g.*, PO Resp. 53. As Petitioner and Mr. Drewry demonstrate, Patent Owner’s analysis “only focuses on the Olmos and Chung devices in their expanded states,” while “ignoring the reduced threaded engagement seen in the collapsed state.” Ex. 1072 (Drewry Reply Decl.) ¶ 106 (explaining that Mr. Culbert’s calculations are based on Olmos’s Fig. 18, which shows the device in its expanded state); Reply 38.

Patent Owner argues that Petitioner’s emphasis on “connection strength **early in expansion**” is a “new theory not in the Petition.” Sur-reply 28. We disagree. The Petition states that “Fig. 8’s extension allows the actuator to engage with the distal wedge member/central ramp *more quickly*,” i.e., in the early stages of expansion. Pet. 109 (emphasis added).

Patent Owner also argues that maximum stress occurs not at the early stages of expansion, but after surgery, when the implant is at its most expanded and the patient is upright. Sur-reply 28. Patent Owner does not support this assertion with citation to evidence of record. But even if it were true, the actuator threads will also experience significant stress when the surgeon first starts to rotate the actuator. Reply 38; *see also* Ex. 1072 (Drewry Reply Decl.) ¶ 105 (“even if the highest stresses are not always seen at this point in the process, a designer has to plan for this possibility which will occur in real-life operations at least some of the time”).

Patent Owner also disputes that the actuator threads experience significant stress at the start of actuator rotation, because the implant will have “significant clearance upon insertion,” as allegedly depicted in Olmos’s Figure 1, reproduced below:

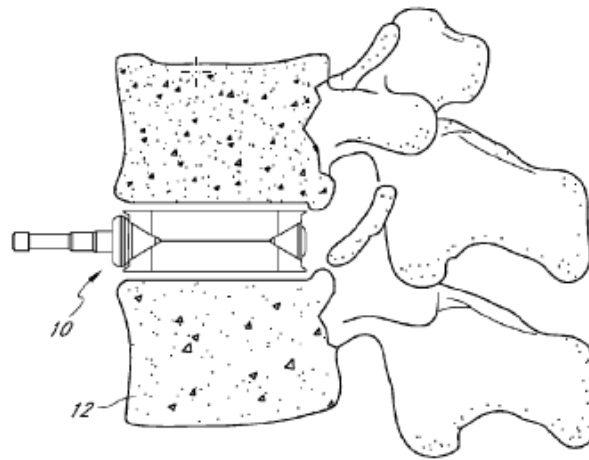
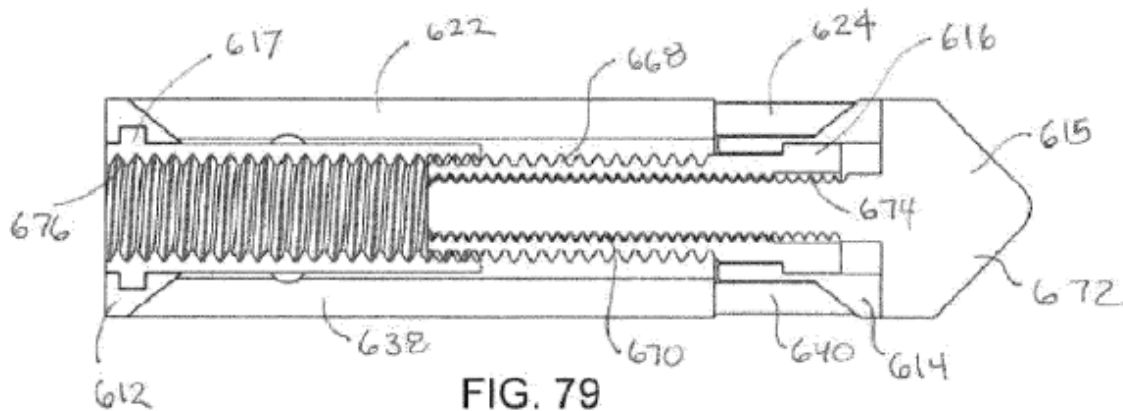


FIG. 1

Sur-reply 28–29. According to Olmos, Figure 1 above depicts “a side view of an intervertebral implant in an unexpanded state while positioned intermediate adjacent vertebrae.” Ex. 1006 (Olmos) ¶ 28. Patent Owner’s argument is unavailing, because we are not directed to any persuasive evidence that Olmos’s Figure 1 accurately shows the actual anatomical “clearance” surgeons would have typically experienced upon insertion of Olmos’s implant.

Patent Owner also argues that Petitioner’s arguments are “contradicted by Petitioner’s own published patent application (filed years after the ’731 [sic] Patent) showing minimal threaded engagement in the collapsed state.” Sur-reply 29. Patent Owner cites Figure 79 of Petitioner’s patent application (Butler, Ex. 2024), reproduced below:



Sur-reply 29 (citing Ex. 2024 (Butler) ¶ 98, Fig. 79). Figure 79 of Petitioner’s patent application above shows a side view of a vertebral implant. Patent Owner’s brief reference to this figure lacks the detail necessary for us to determine whether the depicted implant has “minimal” threaded engagement in the collapsed state, or whether it has sufficient similarity to the proposed Olmos combination to enable an appropriate comparison. Accordingly, we find Patent Owner’s argument based on Petitioner’s patent application unavailing.

In sum, for the reasons we discuss above, we find that Patent Owner's arguments do not undermine Petitioner's showing that a person of ordinary skill in the art would have been motivated to add Olmos's Figure 8 extension to the Figure 16 embodiment to make the connection between the wedges stronger.

e. Comparing Benefits and Drawbacks

Patent Owner argues that “Petitioner’s failure to address the balancing of benefits and drawbacks that a POSITA would undertake, and which is required by the case law, fatally undermines its obviousness theory.” PO Resp. 63; *see also id.* at 40 (arguing that Petitioner “fails to weigh the benefits and drawbacks of the proposed modification against one another,”

citing *Arctic Cat Inc. v. Polaris Indus.*, 795 F. App'x 827, 833 (Fed. Cir. 2019)). This argument is unavailing, because Patent Owner mischaracterizes the *Arctic Cat* case. That case indicates that it is the “**Board** [who] must weigh the benefits and drawbacks of the modification against each other.” *Arctic Cat Inc.*, 795 F. App'x at 833. Patent Owner points us to no case law indicating that Petitioner must anticipate and preemptively address (in the Petition) alleged drawbacks Patent Owner might later raise during the *inter partes* review.³²

Nor has Patent Owner established that the two alleged drawbacks it raises would have outweighed the benefit of employing the extension. First, Patent Owner argues that “an extension would have occupied valuable space within the implant” for bone graft material, which is used to improve fusion and healing. PO Resp. 60–61 (citing Ex. 2013 (Culbert Decl.) ¶¶ 169–73; Ex. 2023 (Kandziora), 14; Ex. 2022 (Wiggins), 14–15; Exs. 2027–2030 (Life Spine press releases and marketing materials); Ex. 2021 (Opticage brochure)). Second, Patent Owner argues that there will be “a loss in fluoroscopy imaging quality” when physicians attempt to observe the progress of healing, because “x-rays cannot penetrate through metal.” PO Resp. 62–63 (citing Ex. 2013 (Culbert Decl.) ¶ 172; Exs. 2027–2030

³² This is not to suggest that a petition may leave out information necessary to make a prima facie case of unpatentability, but our procedures also allow a petitioner to reply, including with new evidence, to arguments developed at trial. See Consolidated Trial Practice Guide 73–75, *available at* <https://www.uspto.gov/TrialPracticeGuideConsolidated>. On the facts here, the alleged drawbacks of the asserted combination of references identified in Patent Owner’s Response are in the latter category and are appropriate for development through additional argument and evidence on reply.

(Life Spine press releases and marketing materials)³³). Patent Owner concludes:

In view of these known disadvantages, a POSITA would not have added an extension to Olmos' Figure 16 embodiment ***unless*** it was determined that the potential improvement provided by the extension would at least equal the benefits of having additional open volume, particularly the significant benefit of having additional bone graft volume to facilitate long-term structural stability of the vertebrae.

PO Resp. 63.

Patent Owner is correct that the art recognized a tradeoff between implant volume (i.e., the amount of space occupied by the physical material of the implant) and the availability of space for bone graft material. *See, e.g.,* PO Resp. 60–63; Ex. 2023 (Kandziora), 14 (“one important biological factor for a fusion cage is to have the smallest possible cage volume and as a result to allow the maximum graft filling of the intervertebral space”); Ex. 2022 (Wiggins), 14–15 (“the optimal environment for fusion using cages would include . . . [u]se of the smallest cage volume (as cage volume increases, graft volume decreases) that will provide mechanical stability”); Ex. 2013 (Culbert Decl.) ¶¶ 169–70. The art also recognized that “more bone graft is expected to provide improved fusion.” Ex. 2013 (Culbert Decl.) ¶ 170.

Nevertheless, Patent Owner does not demonstrate that “adding even a small extension would ***necessarily*** reduce the effectiveness of osseointegration and affect the long-term stability of the implant in a

³³ Patent Owner also cites Exhibit 2031, but in this proceeding Patent Owner did not file an Exhibit 2031.

patient.” PO Resp. 59 (emphasis added). Instead, we agree with Petitioner that a person of ordinary skill in the art “would not understand the minimal volume preserved by omitting an elongated extension to be meaningfully beneficial.” Reply 39. Petitioner’s argument is consistent with the evidence of record. For example, despite post-dating Patent Owner’s references discussing the tradeoff between implant volume and space for bone graft material, the art still taught use of elongated extensions.³⁴ See Reply 39, 40; *see also id.* at 29 (quoting Ex. 1007 (Baynham) ¶ 28; citing *id.* ¶¶ 25–26); Ex. 1072 (Drewry Reply Decl.) ¶ 98).

In our Institution Decision, we explained that Patent Owner’s drawback argument could be strengthened if it “specifically address[ed] the volume of bone graft material needed to facilitate natural integration of the expandable implant, as compared to the space occupied by the proposed elongated extension.” Inst. Dec. 40. The full trial record does not include such a comparison. In short, the record does not demonstrate that Olmos’s Figure 8 extension would take up so much space that it would negatively impact osseointegration, thereby causing a person of ordinary skill in the art to eschew the extension.

We also find Patent Owner’s argument that an elongated extension would interfere with fluoroscopy unavailing. PO Resp. 62. We agree with

³⁴ Patent Owner’s references discussing the tradeoff between implant volume and space for bone graft material predate the ’732 patent and Olmos, and were published in the same year as Baynham’s earliest possible priority date. Compare Ex. 2023 (Kandziora), 3 (2004 copyright) and Ex. 2022 (Wiggins), 2 (2003 copyright), with Ex. 1001, code 63 (2010 priority date), Ex. 1006 (Olmos), code 60 (earliest possible filing date of 2006), and Ex. 1007 (Baynham), code 63 (earliest possible filing date of 2004).

Petitioner that “[a]dding an elongated extension would not impede visibility any more than Olmos’s already-existing features, including the significant material in and around the central cavity in every Olmos embodiment and, in the relied-on Figure 16 embodiment, the endplates’ upper and lower side portions 240/242.” Reply 41; Ex. 2036 (Drewry Reply Decl.) ¶ 142; Ex. 1006 (Olmos) ¶ 157, Figs. 16A–B, 18. Moreover, to the extent an extension would have presented a visualization problem, the art taught means of improving visualization, such as by incorporating non-metal, radiolucent materials. *See, e.g.*, Ex. 1006 (Olmos) ¶ 154 (“[T]he implant 200 can be at least partially radiolucent, which radiolucency can allow a doctor to perceive the degree of bone growth around and through the implant.”); Ex. 2028 (Petitioner’s product marketing material touting “[r]adiopaque tantalum rod markers [that] improve intraoperative visualization”).

In sum, Patent Owner has not established that the alleged drawbacks of reduced space for bone graft material and potential interference with fluoroscopy would have negated a person of ordinary skill in the art’s reason to use Olmos’s Figure 8 extension with Olmos’s Figure 16 embodiment as demonstrated by Petitioner. Nor has Patent Owner established with persuasive evidence of record that these alleged drawbacks would have overridden the anticipated benefits of the proposed combination (e.g., permitting use of a shorter screw to reduce the risk of protrusion, and strengthening the connection). *See, e.g., Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (“[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.”).

f. Petitioner's Additional Arguments

For completeness, we address three arguments Petitioner made that we do not agree with, and thus do not rely on as a basis for our decision. First, as to Petitioner's argument that adding an extension to the Figure 16 embodiment would "preserve the structurally advantageous, interconnecting components of the primary embodiments" (Pet. 109–10), we agree with Patent Owner that the fact "[t]hat a newly-added feature would not adversely affect existing features does not provide a reason to add the new feature in the first place." PO Resp. 56. Accordingly, we do not rely on this argument offered by Petitioner.

Second, Petitioner argues that a person of ordinary skill in the art would have been motivated to add an extension to the Figure 16 embodiment because "an integrally-formed extension advantageously requires fewer parts, which facilitates both manufacturing and use." Pet. 110. We agree with Patent Owner that this argument is unavailing. PO Resp. 57–58. Petitioner's combination entails adding an extension (from Figure 8) to an embodiment lacking one (Figure 16). We agree with Patent Owner that adding a new component (whether separately or integrally) can in some instances complicate manufacturing/assembly and increase costs. *See id.* at 58 (citing Ex. 2013 (Culbert Decl.) ¶ 162). Petitioner has not sufficiently demonstrated that the proposed combination in this instance would reduce complexity or facilitate the manufacturing process. Accordingly, we do not rely on this argument offered by Petitioner.

Third, regarding Petitioner's argument that the Examiner combined different embodiments of Olmos (Pet. 111–12), we agree with Patent Owner that the Examiner's statements were directed to a feature unrelated to the

extension. PO Resp. 59–60; Ex. 1037 (prosecution history of the '731 patent), 63–64, 72–73, 132–33, 137–38. On this record, Petitioner fails to adequately explain how the Examiner's unrelated rationales support a reason to combine the Olmos embodiments as Petitioner proposes. Accordingly, we do not rely on this argument offered by Petitioner.

g. Conclusion

In sum, because Petitioner's proposed combination of Olmos's Figure 8 extension with Olmos's Figure 16 embodiment (1) is expressly taught or suggested by Olmos; (2) is no more than the predictable use of prior art elements according to their established functions; and (3) permits use of a shorter screw to reduce the risk of protrusion while strengthening the connection between the wedges, we find that Petitioner has demonstrated by a preponderance of the evidence that a person of ordinary skill in the art would have had a reason to combine Olmos's Figure 8 extension with Olmos's Figure 16 embodiment with a reasonable expectation of success.

4. Conclusion – Obviousness Over Olmos with Boehm and/or Song

On this record, we determine that Petitioner has shown by a preponderance of the evidence that Olmos with Boehm and Song renders claims 1 and 7–13 unpatentable as obvious.

H. Ground 6 – Alleged Obviousness Based on Olmos, Boehm and/or Song, and Varela, or Based on Olmos, Boehm and/or Song, Chung, and Varela

For Ground 6, Petitioner asserts that claims 8, 10, 11, and 13 would have been obvious over Olmos in combination with Boehm and/or Song (as detailed in Ground 4), or over Olmos in combination with Boehm and/or

Song, and Chung (as detailed in Ground 5), further in view of Varela.³⁵ Pet. 116–19 (Ground 6).

In brief, claims 8, 10, 11, and 13 each recite that the ramped surfaces of the implant’s first and second endplates “overlap.” *See, e.g., id.* at 124 (dependent claims 8, 10, 11), 125 (limitation 13[g]). As discussed above for Ground 4, Petitioner argues that Olmos teaches first and second endplates that overlap. *See supra* Section II.G.1; *see also* Pet. 94–95 (citing Ex. 1006, Fig. 16A; Ex. 1002 (Drewry Decl.) ¶¶ 396–99). Petitioner presents this ground as an alternative to arguing that the “overlap” feature is present in Olmos. *See* Pet. 116.

Petitioner asserts that Varela discloses an expandable intervertebral implant with ramped structures that “are offset from one another relative to the central axis of the expandable intervertebral implant 10 such that they sit side-by-side when the expandable intervertebral implant 10 is undepolyed [sic], thereby making the assembly as compact as possible.” Pet. 70–71 (quoting Ex. 1030 (Varela) ¶ 39, alteration Petitioner’s), 116–17 (incorporating by reference arguments from Ground 3). Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Olmos with Varela given Varela’s express teaching of achieving

³⁵ Although this Ground proposes various combinations of prior art, we address this ground based on the combination of Olmos, Boehm, Song, and Varela. First, although this Ground references “Boehm and/or Song,” for the same reasons discussed above for Ground 1, we treat this as Boehm and Song. *See supra* n.14. Additionally, we understand that Petitioner optionally includes Chung in this Ground because this Ground builds on Ground 5 (which includes Chung). Because we do not reach Ground 5 (*see infra* Section II.I), we also do not reach the permutation in this Ground based on “Olmos, Boehm and/or Song, Chung, and Varela.”

“the smallest possible form factor,” which is advantageous in minimally invasive surgery. *Id.* at 118–19 (quoting Ex. 1030 (Varela) ¶¶ 2, 34, 39).

Patent Owner disputes Petitioner’s arguments, urging that Petitioner has “failed to show a reasonable expectation of success in making the proposed modifications.” PO Resp. 97; *see also, e.g., id.* at 93–97; Ex. 2013 (Culbert Decl.) ¶¶ 245–59, 264–68. First, Patent Owner argues that Petitioner fails “to adequately explain how a POSITA would modify Chung or Olmos to incorporate Varela’s track structures.” PO Resp. 93. Second, Patent Owner argues that “Varela’s single-wedge design significantly differed from the double-wedged designs of Chung and Olmos,” yet the Petition fails to consider whether the designs could be combined. *Id.* at 95.

We adopt as our own Petitioner’s undisputed analysis of how the combination of Olmos, Boehm, Song, and Varela teaches or suggests each limitation of claims 8, 10, 11, and 13. *See generally* Pet. 116–17; Ex. 1002 (Drewry Decl.) ¶¶ 485–90. We also adopt as our own Petitioner’s undisputed analysis of why a person of ordinary skill in the art would have been motivated to combine Olmos’s implant with Boehm and Song’s teachings regarding dilators, cannulas, and the insertion of intervertebral implant devices through cannulas, with a reasonable expectation of success. *See* Pet. 118 (cross-referencing Ground 4); *see supra* Section II.G; Ex. 1002 (Drewry Decl.) ¶¶ 456–60. Finally, we also adopt as our own Petitioner’s undisputed analysis of why a person of ordinary skill in the art would have been motivated to combine Olmos’s implant with Varela’s track structures, e.g., to achieve the smallest possible form factor for insertion, as expressly taught in Varela. *See* Pet. 118–19; Ex. 1030 (Varela) ¶¶ 2, 34, 39; Ex. 1002 (Drewry Decl.) ¶¶ 491–96; *see also* Ex. 1079 (Culbert Depo. Tr.), 64:7–14,

65:9–66:7 (agreeing that Varela’s teachings regarding the benefits of configuring the endplates to nest or overlap are the same as those described in the ’732 patent itself).

Below, we analyze the disputed issue of whether Petitioner has demonstrated a reasonable expectation of success in using Varela’s offset track structures with Olmos’s implant. *See, e.g.*, PO Resp. 97; Sur-reply 32 (“[T]he issue is that the Petition and its supporting evidence are insufficient to prove a reasonable expectation of success.”).

We agree with Petitioner that a person of ordinary skill in the art would have had a reasonable expectation of success in modifying Olmos’s implant to accommodate Varela’s overlapping track structures because “the devices of Olmos and Varela-’774 are structurally and functionally comparable,” in that they both “disclose an expandable implant that is surgically inserted between two vertebra to provide structural support and is expanded by moving at least one wedge through the rotation of an actuator.”³⁶ Pet. 118; Ex. 1002 (Drewry Decl.) ¶ 494. We credit Mr. Drewry’s testimony that “[a] POSITA would have been able to easily achieve [Varela’s] objective simply by shrinking and offsetting at least the lower parts of the ramped surfaces on Olmos’s endplates, such that one endplate could nest inside/beside the other in the collapsed position, with Varela-’774 showing the POSITA how to implement this feature for any

³⁶ Petitioner also cites Varela-’049 in connection with its arguments on motivation to combine Olmos and Varela. *See* Pet. 119. For the reasons discussed above (*see supra* Section II.F), we do not rely on Varela-’049 in finding a motivation to combine with a reasonable expectation of success.

given pair of endplates such as those disclosed in Olmos.”³⁷ Ex. 1002 (Drewry Decl.) ¶ 494. That a person of ordinary skill in the art would have been able to implement the proposed combination is consistent with “the numerous designs and embodiments depicted in Olmos alone (let alone Chung, Baynham, etc.)[, which] show the relatively high level of skill a POSITA possessed in terms of adapting various structure designs to carry out the known mechanical functions desired of them.” Ex. 1072 (Drewry Reply Decl.) ¶ 165.

We find unavailing Patent Owner’s arguments that Petitioner fails to adequately explain the proposed combination because Petitioner must detail all of the alleged structural changes necessary to accommodate Varela’s track structures in Olmos’s implant. *See, e.g.*, PO Resp. 93, 97; Sur-reply 32–33 (arguing that “given the complexities involved,” a more detailed “explanation of the proposed modifications” was necessary). Based on the facts of this case, we find Mr. Drewry’s explanation that “[a] POSITA would have been able to easily achieve [Varela’s] objective simply by shrinking and offsetting at least the lower parts of the ramped surfaces on Olmos’s endplates, such that one endplate could nest inside/beside the other in the collapsed position, with Varela-’774 showing the POSITA how to

³⁷ Patent Owner argues that this statement from Mr. Drewry “is never stated or explained in the Petition, and should not be considered or improperly incorporated by reference.” PO Resp. 94. We disagree. The paragraph in which this sentence appears is cited in the Petition. *See* Pet. 118–19 (citing ¶ 494). We find that this single sentence is appropriate elaboration on how a person of ordinary skill in the art would have carried out the combination proposed in the Petition, and is not so extensive as to amount to improper incorporation by reference.

implement this feature for any given pair of endplates such as those disclosed in Olmos,” sufficiently explains the proposed modification. Ex. 1002 (Drewry Decl.) ¶ 494. Additionally, against the backdrop of the level of skill in the art (as exemplified by, e.g., Olmos, Chung, and Baynham’s “numerous designs and embodiments”), the record supports Mr. Drewry’s testimony that an ordinarily skilled artisan would have understood how to shrink and offset parts of Chung’s ramped surfaces to implement Varela’s track structures. *See* Ex. 1072 (Drewry Reply Decl.) ¶ 165; Pet. 118–19; Reply 44; *see also KSR Int’l Co.*, 550 U.S. at 421 (“A person of ordinary skill is also a person of ordinary creativity, not an automaton.”). On this record, Patent Owner’s demand for more detail about the proposed modification is inconsistent with the “well-established” proposition “that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements.” *In re Mouttet*, 686 F.3d at 1332.

Patent Owner argues that “a POSITA would have recognized that Varela’s single-wedge design significantly differed from the double-wedged designs of Chung and Olmos,” and “[b]efore determining whether any modification of Chung or Olmos to incorporate Varela’s ‘nested’ arrangement, a POSITA would have necessarily considered whether these differences could be successfully incorporated.” PO Resp. 95 (citing Ex. 2013 (Culbert Decl.) ¶¶ 254–59). Mr. Drewry, however, acknowledged this difference. *See* Ex. 1002 (Drewry Decl.) ¶ 495. We credit his testimony that the “implementation would merely have involved taking Varela’s teaching as to the end of its endplates that interact with its wedge, and

applying that same design principle to both ends of Chung’s [*sic*, Olmos] endplates in essentially equal fashion.” *Id.*

Patent Owner argues that implementing Varela’s track structures in Olmos’s double-wedge device could require structural changes, which may weaken the implant’s stability and/or adversely affect its expansion height, and “would not actually result in a lower profile.” *See* PO Resp. 96–97; Ex. 2013 (Culbert Decl.) ¶¶ 254–58, 264–71. As explained below, we find that Mr. Culbert’s concerns regarding the articulated combination are largely speculative and unavailing to undermine Petitioner’s showing of a reasonable expectation of success.

First, we agree with Petitioner that although Patent Owner raises “alleged uncertainties regarding the combination of Varela-’774 with Chung or Olmos, . . . its expert never says that the combination cannot be made by a POSITA.” Reply 43. Mr. Culbert indicates, for example, that “the angle of the wedges would have to be decreased to allow room for the track structures,” which would make it “difficult to size the implant length correctly.” Ex. 2013 (Culbert Decl.) ¶¶ 256–57. He does not conclude that this alleged difficulty would have undermined a reasonable expectation of success, but rather merely concludes that this issue “require[s] evaluation” by the person of ordinary skill in the art. *Id.*

As another example, Mr. Culbert states that the proposed modifications may result in an “implant [that] will not provide the same expansion range and maximum height as the unmodified implant,” which “would be undesirable.” Ex. 2013 (Culbert Decl.) ¶ 265; *see also id.* ¶ 263. This statement does not cast doubt on a reasonable expectation of success of achieving the proposed modified device; instead, Mr. Culbert merely opines

that the modified device may not be as desirable as the unmodified Olmos device.

Additionally, we agree with Mr. Drewry that “even if the modifications identified by Mr. Culbert were necessary, . . . a POSTA [sic] in this field knew and understood the mechanical principles in play, and possessed the ability to modify designs to achieve a certain amount of expansion for a given device.” Ex. 1072 (Drewry Reply Decl.) ¶¶ 165, 169. This testimony is consistent with the prior art of record. That is, prior art references including Olmos, Chung, and Baynham all include “numerous designs and embodiments,” and “[a]s Mr. Culbert’s own exhibit shows (Ex. 2021, 2), it is typical to manufacture and offer these devices in a variety of different sizes to accommodate different patients and different expansion needs.” *Id.* This supports Mr. Drewry’s view that a person of ordinary skill in the art would have “possessed the ability to modify designs to achieve a certain amount of expansion for a given device.” *Id.* ¶ 169.

In sum, after considering the arguments and evidence of record, we determine that Petitioner has shown by a preponderance of the evidence that claims 8, 10, 11, and 13 would have been obvious over Olmos, Boehm, Song, and Varela.

*I. Petitioner’s Additional Grounds of Alleged Unpatentability
(Grounds 2 and 5)*

Petitioner additionally asserts that (1) claims 1, 7–13, and 16 are unpatentable as obvious over Chung with Boehm and/or Song, and further with Baynham (Ground 2); and (2) claims 1 and 7–13 are unpatentable as obvious over Olmos with Boehm and/or Song, and further with Chung (Ground 5). *See* Pet. 3–4, 63–69, 112–15.

Because we determine that claims 1, 7–13, and 16 (all challenged claims) are unpatentable based on the grounds of unpatentability discussed above, we need not address Petitioner’s additional grounds of unpatentability. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App’x 984, 990 (Fed. Cir. 2020) (nonprecedential) (agreeing that the Board has “discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims”).

III. CONCLUSION³⁸

Based on the information presented, we conclude that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 7–13, and 16 of U.S. Patent No. 8,845,732 B2 are unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 7–13, 16	103(a)	Chung, Boehm, Song	1, 7–13, 16	

³⁸ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this Decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 7–13, 16	103(a)	Chung, Boehm, Song, Baynham ³⁹		
8, 10, 11, 13	103(a)	Chung, Boehm, Song, Varela ⁴⁰	8, 10, 11, 13	
1, 7–13	103(a)	Olmos, Boehm, Song	1, 7–13	
1, 7–13	103(a)	Olmos, Boehm, Song, Chung ⁴¹		
8, 10, 11, 13	103(a)	Olmos, Boehm, Song, Varela ⁴²	8, 10, 11, 13	
Overall Outcome			1, 7–13, 16	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has demonstrated by a preponderance of the evidence that claims 1, 7–13, and 16 of U.S. Patent No. 8,845,732 B2 are unpatentable; and

³⁹ As explained above (*see supra* Section II.I), we need not reach this ground.

⁴⁰ As explained above (*see supra* Section II.F), we need not reach Petitioner’s optional inclusion of Baynham in this Ground.

⁴¹ As explained above (*see supra* Section II.I), we need not reach this ground.

⁴² As explained above (*see supra* Section II.H), we need not reach Petitioner’s optional inclusion of Chung in this Ground.

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

IPR2022-01599
Patent 8,845,732 B2

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