

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LIFE SPINE, INC.,
Petitioner,

v.

GLOBUS MEDICAL, INC.,
Patent Owner.

IPR2022-01435
Patent 10,137,001 B2

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

NEWMAN, *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 1–11 of U.S. Patent No. 10,137,001 B2 (“the ’001 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 1–11 are unpatentable.

A. Procedural History

Petitioner Life Spine, Inc., filed a Petition requesting *inter partes* review of claims 1–11 of the '001 patent. Paper 2 (“Pet.”). Patent Owner Globus Medical, Inc., filed a Preliminary Response. Paper 9 (“Prelim. Resp.”). With our authorization, Petitioner filed a Preliminary Reply and Patent Owner filed a Preliminary Sur-reply. Paper 10 (“Prelim. Reply”); Paper 11 (“Prelim. Sur-reply”). In view of the then-available record, we instituted an *inter partes* review. Paper 14 (“Inst. Dec.”).

After institution, Patent Owner filed a Response to the Petition. Paper 16 (“PO Resp.”). Petitioner filed a Reply. Paper 23 (“Pet. Reply”). Patent Owner filed a Sur-reply. Paper 29 (“PO Sur-reply”).

On December 14, 2023, we held an oral hearing, the transcript of which is of record. Paper 35 (“Tr.”).

B. Real Parties in Interest

Petitioner and Patent Owner each identify themselves as the real party in interest. Paper 26 (Petitioner’s Owner Updated Mandatory Notices), 1; Paper 7 (Patent Owner’s Updated Mandatory Notices), 1.

C. Related Matters

The parties identify *Globus Medical, Inc. v. Life Spine, Inc.*, 1:21-cv-01445 (D. Del.), filed October 13, 2021, as involving the '001 patent. Paper 26, 1; Paper 7, 1. The parties also identify as related matters patent applications related to the '001 patent, i.e., 17/192,231, 17/409,079, 17/410,335, 17/589,029, and 17/931,913. Paper 26, 1; Paper 7, 1. Patent Owner also identifies related *inter partes* review proceedings, i.e.,

IPR2022-01434, IPR2022-01599, IPR2022-01600, and IPR2023-00041.
Paper 7, 1. We additionally identify IPR2022-01602 as a related matter.

D. The '001 Patent (Ex. 1001)

The '001 patent, titled “Expandable Fusion Device and Method of Installation Thereof,” relates to an expandable device for insertion between adjacent vertebrae to facilitate fusion and a method for promoting intervertebral fusion using the expandable device. Ex. 1001, code (54), 1:19–22. 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 . . . can maintain a normal distance between adjacent vertebral bodies when implanted.” *Id.* at 1:57–61. The '001 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 unexpanded configuration. *Id.* at 2:2–6. The fusion device can be placed into a disc space via an endoscopic tube and then expanded into an expanded configuration. *Id.* at 2:6–9.

The Specification describes exemplary expandable fusion devices for installing in an intervertebral disc space to facilitate intervertebral fusion. *Id.* at 1:65–2:2. One exemplary device is depicted in Figure 50, reproduced below.

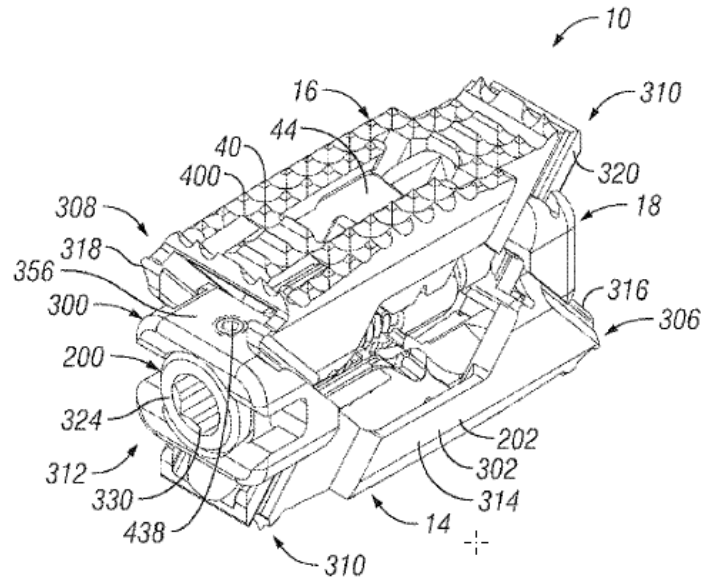


FIG. 50

Figure 50 of the '001 patent, reproduced above, is a perspective view of expandable fusion device 10 in an expanded position. *Id.* at 4:46–59, 17:20–21. Expandable fusion device 10 includes first endplate 14, second endplate 16, central ramp 18, actuator assembly 200, and driving ramp 300. *Id.* at 17:21–24. Actuator assembly 200 functions to pull central ramp 18 and driving ramp 300 together, which forces apart endplates 14 and 16. *Id.* at 17:24–28.

Figure 52 of the '001 patent is reproduced below.

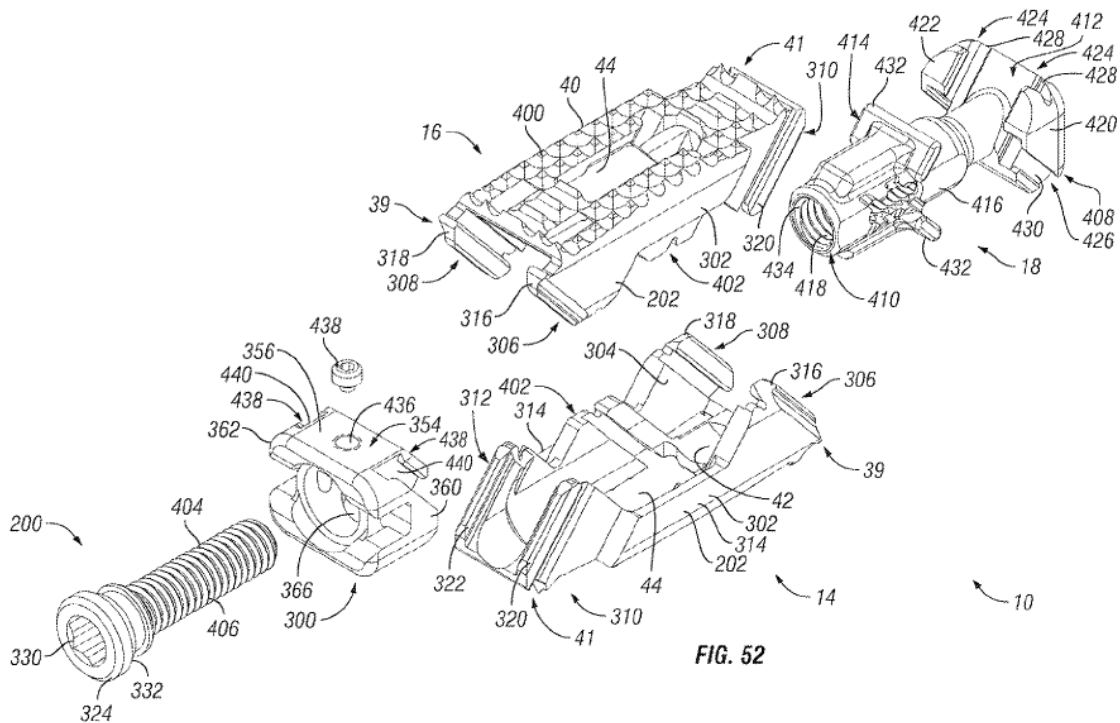


Figure 52, reproduced above, is an exploded view of expandable fusion device 10. *Id.* at 4:53–55. Central ramp 18, which has first end 408 and second end 410, includes first expansion portion 412, second expansion portion 414, rod-receiving extension 416, and longitudinally-extending through bore 418. *Id.* at 19:5–10. Rod-receiving extension 416 is threaded to receive threading of extension 404 of actuator assembly 200. *Id.* at 19:51–54. Driving ramp 300 includes bore 366 sized to receive extension 404. *Id.* at 19:61–63. Actuator assembly 200 includes head portion 324 with rim 332, which engages contact surface 368 of driving ramp 300. *Id.* at 19:67–20:3.

In operation, expandable fusion device 10 is seated into an intervertebral disc space. *Id.* at 20:44–45. An instrument is used to engage head portion 324 of actuator assembly 200. *Id.* at 20:47–48. Rotating

actuator assembly 200 in a first direction pulls central ramp 18 linearly towards driving ramp 300 and pushes driving ramp 300 linearly towards central ramp 18. *Id.* at 20:49–57. Ramped portions of central ramp 18 and driving ramp 300 push against corresponding ramped portions of endplates 14 and 16, which forces the endplates outward into an expanded position. *Id.* at 20:58–60, 21:12–18.

The Specification also describes an exemplary technique for endoscopically inserting the expandable fusion devices into the intervertebral disc space between adjacent vertebrae. *Id.* at 5:26–51, 21:60–22:61. An access path to the intervertebral disc space is created, for example, by using a posterolateral approach. *Id.* at 21:62–65. The expandable fusion device 10 is placed into the intervertebral disc space and expanded to the desired height. *Id.* at 22:28–30. A bone graft or similar bone-growth inducing material is then introduced around or within the expandable fusion device 10. *Id.* at 5:53–55, 22:30–32.

E. Challenged Claims

Petitioner challenges all 11 claims of the '001 patent. Claims 1 and 10 are independent. Claim 1, reproduced below with bracketed and bolded lettering added,¹ is illustrative:

1. **[pre]** A surgical method comprising:
 - [a]** creating an access path to an intervertebral disc space;
inserting an expandable implant into the disc space,
 - [b]** wherein the expandable implant comprises:
a first endplate having a pair of first tongues;

¹ For ease of reference, we use the same bracketed lettering Petitioner uses in the Petition. *See* Pet. 7–48, 122–123.

[c] a second endplate opposed to the first endplate, the second endplate having a pair of second tongues;

[d] a central ramp positioned between the first endplate and the second endplate, **[e]** wherein the central ramp comprises a first end and a second end, **[f]** wherein the second end includes a first ramped portion configured to engage a portion of the first endplate and a second ramped portion configured to engage a portion of the second endplate, and **[g]** a third ramped portion configured to engage a portion of the first endplate and a fourth ramped portion configured to engage a portion of the second endplate positioned between the first and second ends, **[h]** wherein the central ramp has a longitudinal bore, and **[i]** wherein the first ramped portion has a pair of first grooves, each of the first grooves sized to receive one of the first tongues, and **[j]** wherein the second ramped portion has a pair of second grooves, each of the second grooves sized to receive one of the second tongues;

[k] a driving ramp positioned between the first endplate and the second endplate, **[l]** wherein the driving ramp comprises a first end and a second end, **[m]** wherein the second end includes a first angled portion configured to engage a portion of the first endplate and a second angled portion configured to engage a portion of the second endplate, **[n]** wherein the driving ramp has a non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp, **[o]** the longitudinal bore of the of the [sic] central ramp and the nonthreaded longitudinal through bore of the driving ramp are coaxially aligned;

[p] an actuator insertable through the driving ramp, **[q]** wherein a portion of the actuator extends through the non-threaded longitudinal through bore of the driving ramp and the longitudinal bore of the central ramp, **[r]** the actuator is disposed and remains within the non-threaded longitudinal bore, and the actuator is movable with respect to the central ramp and the driving ramp, and **[s]** wherein the actuator is configured to translate the driving ramp such that the second end of the driving ramp is moved closer to the second end of

the central ramp to thereby cause expansion of the first endplate and the second endplate;

[t] wherein the first tongues and the second tongues are configured to move within corresponding first grooves and second grooves to expand and compress the expandable implant;

[u] wherein the third ramped portion and the fourth ramped portions extend outwardly from a rod receiving extension of the central ramp; and

[v] introducing bone graft material adjacent the expandable implant.

Ex. 1001, 23:4–60.

Independent claim 10 is similar to claim 1, but broader in scope. Specifically, claim 10 does not recite a “non-threaded longitudinal through bore” for the driving ramp found in limitations [n] through [r] of claim 1. *Compare id.* at 23:34–45 (claim 1), *with id.* at 24:45–50 (claim 10). Additionally, claim 10 does not recite the step of “introducing bone graft material” found in limitation [v] of claim 1. *Compare id.* at 23:59–60 (claim 1), *with id.* at 24:63 (claim 10).

Claims 2–9 and 11 depend directly or indirectly from independent claim 1 and recite additional features, including with respect to the access path (claim 2), the actuator (claims 3 and 4), the number of expandable implants (claims 6–9), and a pair of third grooves added to the central ramp (claim 11). *Id.* at 23:61–24:14, 24:64–25:2.

F. Asserted Grounds of Unpatentability

We instituted trial based on the following grounds of unpatentability:

Ground	Claim(s) Challenged	35 U.S.C. § ²	Reference(s)/Basis
1	1, 3, 4, 10	102(b)/103(a)	Chung ³
2	2, 5–9, 11	103(a)	Chung with knowledge of the person of ordinary skill in the art or Olmos ⁴
3	1–11 ⁵	103(a)	Chung with Baynham ⁶ or Baynham and Olmos
4	1–11	102(b)/103(a)	Olmos
5	1–9, 11	103(a)	Olmos, Chung

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 §§ 102 and 103. The ’001 patent claims benefit to two applications, both of which were filed before the effective date of the applicable AIA amendments. Ex. 1001, code (63). Thus, we refer to the pre-AIA versions of 35 U.S.C. §§ 102 and 103.

³ Ex. 1005 is a certified translation of a Korean patent application for “A lumbar holder” submitted May 11, 2002, and having a registration date of September 10, 2002. The inventors are Yeon Moon Chung *et al.* (“Chung”). 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 Olmos, Fausto, *et al.*, US 2008/0140207 A1, published June 12, 2008 (Ex. 1006, “Olmos”).

⁵ We note that the Petition at page 3 alleges claims 1–10 are unpatentable under Ground 3, but the Petition additionally argues the unpatentability of claim 11 under this combination. Pet. 66, 71. Accordingly, we also address claim 11 under this ground.

⁶ Baynham, Bret O. *et al.*, US 2007/0270968, published Nov. 22, 2007 (Ex. 1007, “Baynam”).

Inst. Dec. 9–10, 49; Pet. 3. Petitioner supports its contentions with the Declaration and Reply Declaration of Troy D. Drewry (Exs. 1002, 1036), and the Declarations of Paul Hatch (Exs. 1064, 1083), among other evidence. Patent Owner supports its contentions with the Declaration of Brad Culbert (Ex. 2031), among other evidence. The record also contains a transcript of the depositions of Mr. Culbert (Exs. 1041, 1078).

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 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).

Anticipation under 35 U.S.C. § 102(b) requires that a prior art reference set forth each and every element of a claim, as set forth in the claim. *Verdegaal Bros. v. Union Oil Co.*, 814 F.2d 628, 631 (Fed. Cir. 1987); *see also Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008) (anticipation not only requires that each element of a claim be present in a prior art reference, but also the “arrangement or combination” of those elements).

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.⁷ *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.

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; Ex. 1001, code (63). 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

⁷ Patent Owner does not assert objective indicia supporting nonobviousness of the challenged claims. *See generally* PO Resp.

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 and basic surgical techniques in this field, as explained by Prof. Drewry.

Pet. 5 (citing Ex. 1002 (Drewry Decl.) ¶¶ 31, 43–64). Patent Owner does not dispute Petitioner’s proposal. *See* PO Resp. 9–10.

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 that Petitioner’s declarant Mr. Drewry, and Patent Owner’s declarant Mr. Culbert, are each 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.) ¶¶ 7–12 (Mr. Drewry’s statement of qualifications); Ex. 1003 (Mr. Drewry’s curriculum vitae); Ex. 2031 (Culbert Decl.) ¶¶ 3–9, 13–18 (Mr. Culbert’s statement of qualifications); Ex. 2032 (Mr. Culbert’s curriculum vitae).

Petitioner also relies on a Declaration from Mr. Hatch (Exhibit 1086), whose primary experience is in product and industrial design. *See* Ex. 1064 (Hatch Decl.) ¶¶ 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* PO 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,” which relevant to this case is “the creation and interpretation of technical drawings used to illustrate and describe mechanical structures.”

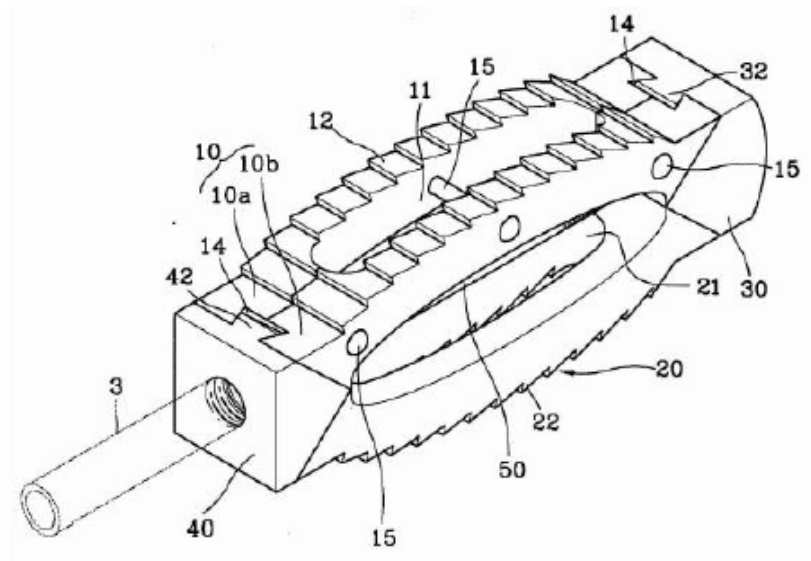
Ex. 1064 (Hatch Decl.) ¶ 13.

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), 2–4.⁸ 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 3.

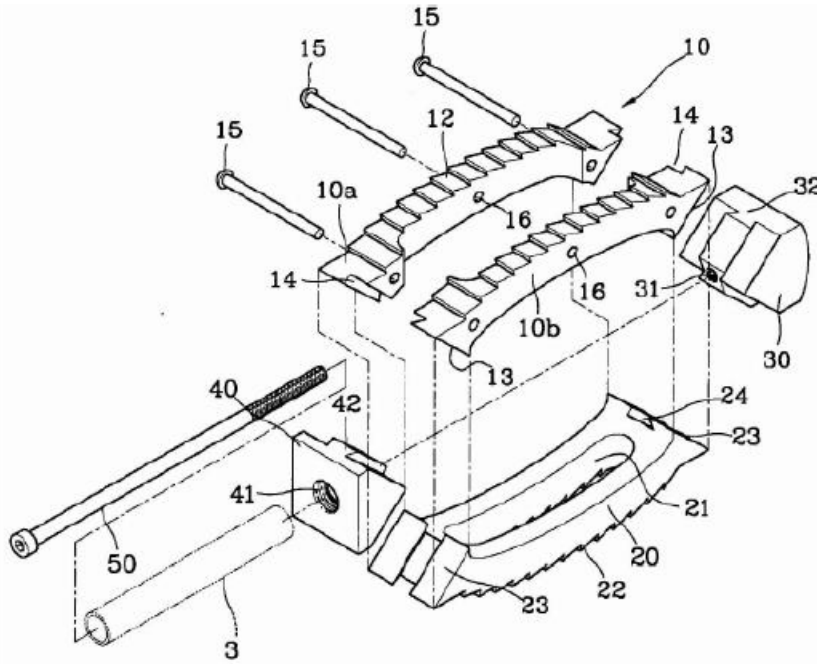
Figure 1 of Chung, reproduced below, is a perspective view of a lumbar holder.



Id. at 3, 9. Figure 1 of Chung depicts main holder bodies 10 and 20, lead wedge 30, and opposing wedge 40. *Id.* at 6.

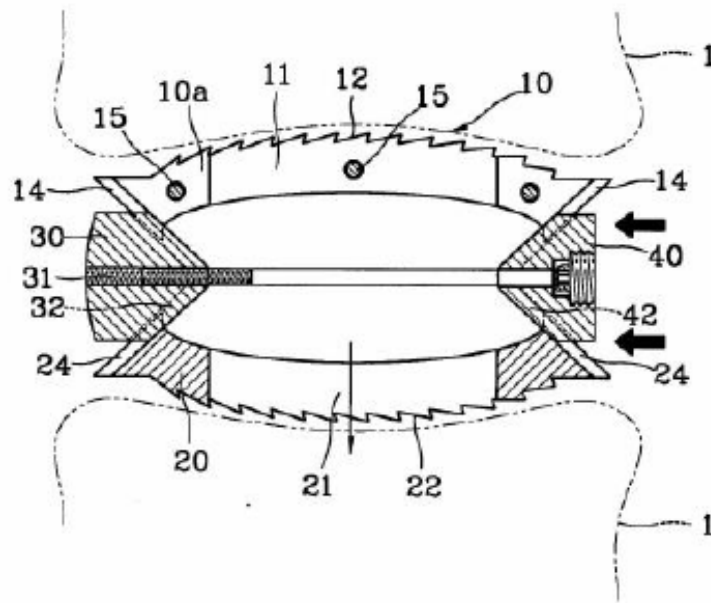
⁸ We refer to the original pagination in Ex. 1005 herein.

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



Id. at 3, 10. Figure 2 of Chung depicts groove fastening screw 50, which fastens to screw hole 31 of lead wedge 30. *Id.* at 6. The groove fastening screw 50 can be inserted using the circular pipe wrapper 3 to hold the screw. *Id.* 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, which 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.

Figure 4 of Chung is reproduced below.



Id. at 10. Figure 4 of Chung 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. 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. Figure 1 of Baynham is reproduced below.

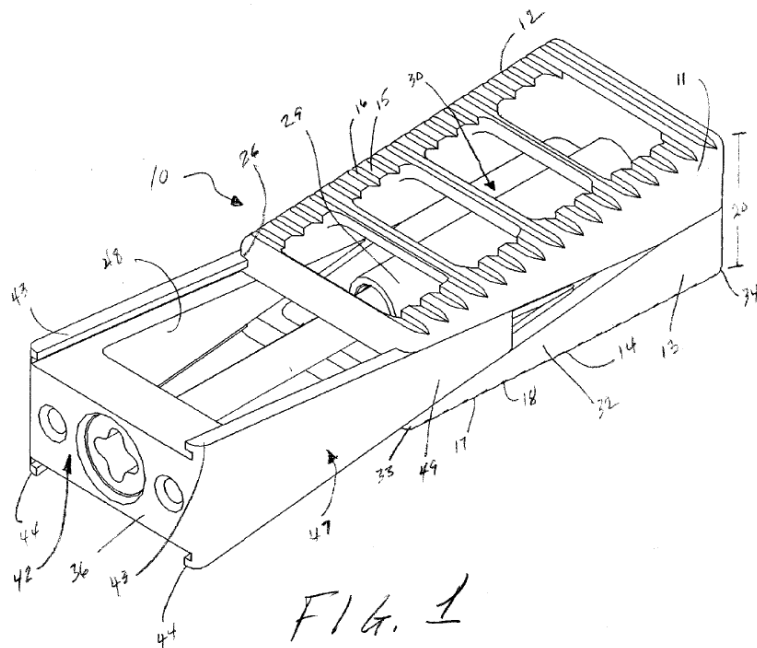
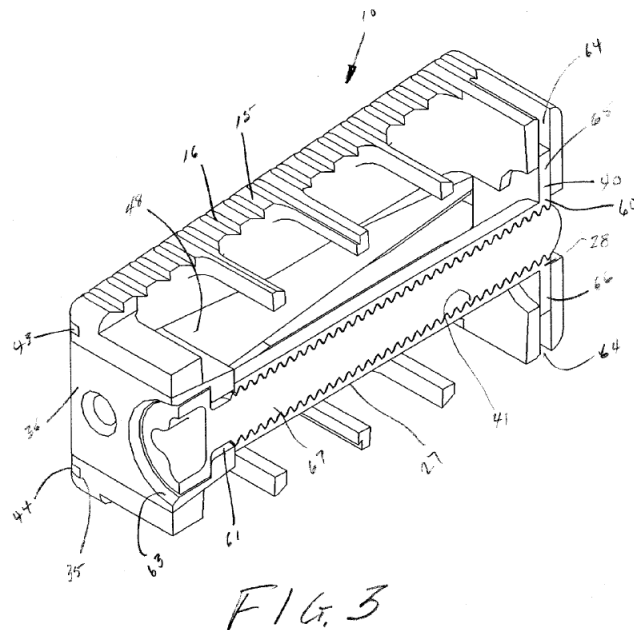


Figure 1 of Baynham is a perspective view of spinal fusion device 10 comprising upper section 11 with top surface 12 and lower section 13 with bottom surface 14. *Id.* ¶ 22. Distractor 42 is between upper section 11 and lower section 13. *Id.* ¶ 28.

Figure 3 of Baynham is reproduced below.



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 “rod receiving extension.” See Paper 9, 34. In our Institution Decision, we

provided a preliminary construction for the term “rod receiving extension.”
Inst. Dec. 18–19.

After institution, the parties addressed the construction of the terms “rod receiving extension,” “non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp,” and “pair of third grooves.” *See, e.g.*, PO Resp. 11–16, 77–80, 82–88; Pet. Reply 1–3.⁹ After considering the arguments and cited evidence of record, we determine that we need to construe these three terms, but 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)).

*1. “rod receiving extension of the central ramp”
(Independent claims 1, 10)*

Independent claims 1 and 10 recite third and fourth ramped portions that extend outwardly from a “a rod receiving extension of the central ramp” (“rod receiving extension” or “extension”). Ex. 1001, 23:57–58, 24:62–63;

⁹ Patent Owner asserts that Petitioner’s Reply brief “presents copious new evidence and theories that exceed the scope of proper reply” and “[t]he Board should refuse to consider” it. Sur-reply 7–9. 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.

see also Pet. 45 (limitation 1[u]), 53 (limitation 10[o]). Prior to institution, Patent Owner argued that a “rod receiving extension” is “a structure that both increases the axial length (i.e., extends) of the central ramp and receives a rod.” *See* Prelim. Resp. 34. Petitioner disputed Patent Owner’s proposed construction, arguing that it unduly restricted the term to a structure that extends the length of the central ramp, thereby assigning a special meaning to the term. Prelim. Reply 3.

In the Institution Decision, we discerned no meaningful difference between the parties’ interpretations, noting that at most, it appeared “that the parties disagree about the length of the extension.” Inst. Dec. 18. In particular, we noted Petitioner’s statement in the Preliminary Reply that the term “is broad and merely requires a longitudinal protrusion on the central ramp that receives a rod. *Id.* (quoting Prelim. Reply 2). For purposes of deciding whether to institute, we applied that construction. *Id.* at 19.

Following institution, Patent Owner argues that our preliminary construction was correct, and aligned with the uses of the term in the Specification and prosecution history. PO Resp. 11–16. Patent Owner, as supported by Mr. Culbert’s testimony, argues that a POSITA would understand a “rod receiving extension” to refer to rod-like structures that increase axial length and receive a rod. *Id.* at 16 (citing Ex. 2031 (Culbert Decl.) ¶ 65).

In reply, Petitioner contends that “rod receiving extension” should be interpreted consistently with how it was construed in co-pending IPR2022-01434, as “an addition to a main structure.”¹⁰ Pet. Reply 1. Petitioner

¹⁰ Patent Owner argues that Petitioner offers “new evidence and explanation” that differs from that offered in the Petition in Reply. *See* Sur-reply 12. Petitioner,

argues against a construction requiring any lengthening of the ramp as inconsistent with how the '001 patent uses the terms “extensions” and “longitudinal.” *Id.* at 1 (citing Ex. 1036 (Drewry Decl.) ¶¶ 9–10).

According to Petitioner, the Specification “uses ‘extension’ to refer to a myriad of structures,” and “[t]he Examiner applied ‘extension’ broadly to a variety of structures.” *Id.* at 1–2 (citing Ex. 1001, 6:24–36, Fig. 10, 11:66–12:1, 13:34–36, Fig. 23, 10:27–32, 10:55–11:7, Fig. 24; Ex. 2013 (prosecution history), 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 2. Petitioner argues that Patent Owner’s “narrowing construction based on specific embodiments should not be read into the claims.” *Id.* (citing, *e.g.*, *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014)). Petitioner argues that any requirement of a “longitudinal protrusion” of the rod-receiving extension relates “only to the *direction* of the extension, not to its *extent*.” *Id.* at 2 (citing Ex. 1036 (Drewry Decl.) ¶ 9).

Although our preliminary construction relied in part on a statement in Petitioner’s Preliminary Reply, we understand Petitioner to have clarified its

however, did not offer a construction of “rod receiving extension” in the Petition. Instead, Patent Owner mischaracterizes Petitioner’s mapping of the prior art to the “rod receiving extension” claim limitation as a claim construction. *See id.*; Pet. 45–47. Patent Owner first identified the term as one needing a 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.

position for consistency across the related cases. *See* Pet. Reply 1 (“[t]he term ‘extension’ should be construed here consistent with its construction in co-pending IPRs – i.e., as ‘an addition to a main structure.’ *E.g., Life Spine, Inc. v. Globus Medical, Inc.*, IPR2022-01434, Paper 12 at 17 (PTAB Mar. 24, 2023)”). Patent Owner argues that “rod receiving extension” is “exclusively used to refer to a longitudinal protrusion from the central ramp that receive [*sic*, receives] a rod,” and asserts Petitioner’s proposal is an improper broadening of meaning because “a ‘longitudinal’ protrusion must necessarily ***stick out longitudinally***” as exemplified in the Specification. PO Sur-reply, 9–10.

We consider our analysis based on the full record with further evaluation of the intrinsic evidence.

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 to the meaning of particular claim terms.”). Independent claims 1 and 10 recite the term “rod receiving extension” in connection with identifying the third and fourth ramped portions of the central ramp. Both limitation 1[u] and 10[o] recite: “wherein the third ramped portion and the fourth ramped portions extend outwardly from a ***rod receiving extension*** of the central ramp.” Pet. 123, 126 (emphasis added).

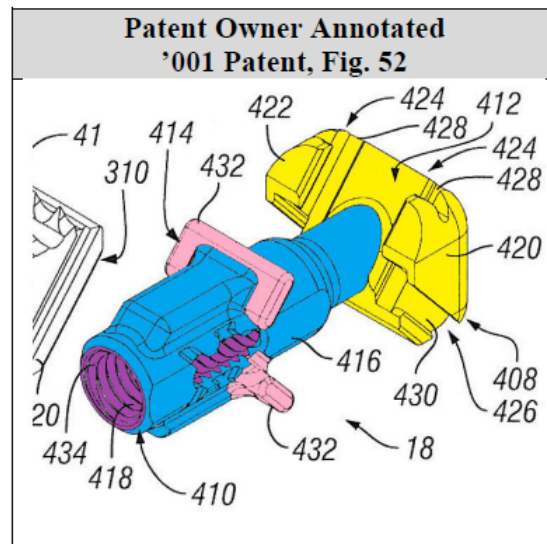
Based on the language of the claims, we do not see the necessity that the “rod receiving extension” requires that the extension be longitudinal, so long as the extension is able to receive the “rod,” which is not further addressed by the claims. Although our preliminary construction included the phrase “longitudinal protrusion,” that phrase does not appear in the claim language and Patent Owner does not explain—and we otherwise fail to

discern—what Patent Owner contends in the claim language indicates that the term “extension” carries a meaning of protruding in a longitudinal direction.

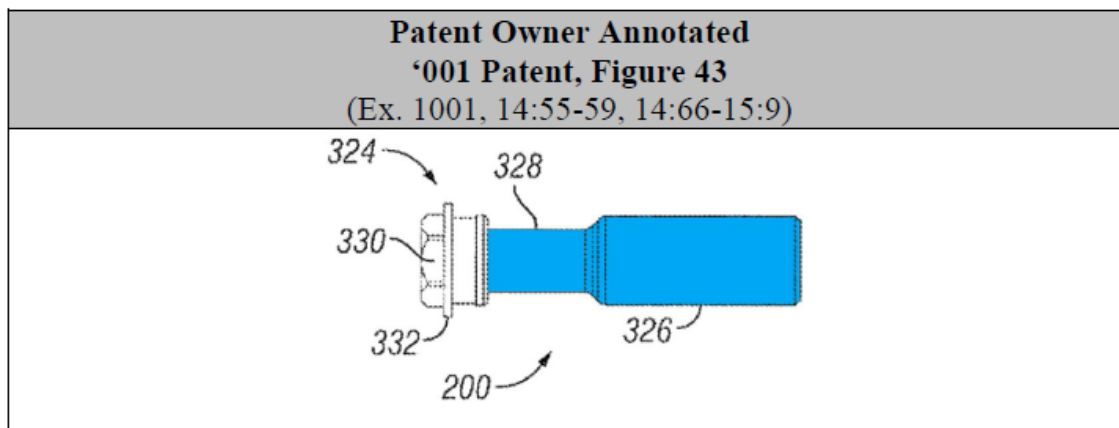
We further discern from the claims that the rod receiving extension is situated between the “third ramped portion” and the “fourth ramped portion” of the second end of the central ramp, and those ramped portions are described in the claim as extending outwardly from the rod receiving extension of the central ramp. Ex. 1001, 23:4–60.

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 supports its proposed construction by arguing (among other things) that the only two embodiments in which “rod receiving extension” is referred to identify rod receiving extensions that are longitudinal protrusions from the central ramp. PO Resp. 11–13 (citing embodiments addressed in Ex. 1001, Figures 40–49 and 50–57; Ex. 2031 (Culbert Decl.) ¶ 57).

To illustrate, Patent Owner provides annotated versions of Figures 52 (excerpt) and 43 of the ’001 patent, which we reproduce below.



PO Resp. 12–13. Patent Owner’s excerpt of Figure 52 depicts the central ramp portion of an expandable fusion device. Ex. 1001, 4:53–54, 19:5–6.



Patent Owner’s excerpt of Figure 43 depicts head portion 324 of the actuator assembly of an expandable fusion device. Ex. 1001, 4:30–31, 14:55–59. These figures depict rod receiving extensions (blue). Patent Owner argues that the purpose of the rod receiving extension in both embodiments is to “lengthen and receive a rod, which allows the actuator to threadingly engage the central ramp at a shorter distance” as well as permit the implant to “expand without the actuator protruding from the implant, while also

providing the threaded connection between the central ramp and actuator.”
PO Resp. 13 (citing Ex. 2031 (Culbert Decl.) ¶¶ 59, 60).

In reply, Petitioner correctly points out that the Specification uses the term “extension” to refer to a multitude of structures, not all of which extend the length of some other structure. *See* Pet. Reply 1; *see also* Ex. 1001, 6:24–36, Fig. 10 (element 46), 11:66–12:1, 13:34–36, Fig. 23 (elements 250, 254), 10:27–32, 10:55–11:7, Fig. 24 (elements 202, 204, and 224).

As one example, we reproduce below Figure 24 of the ’001 patent, with certain reference numerals highlighted in yellow.

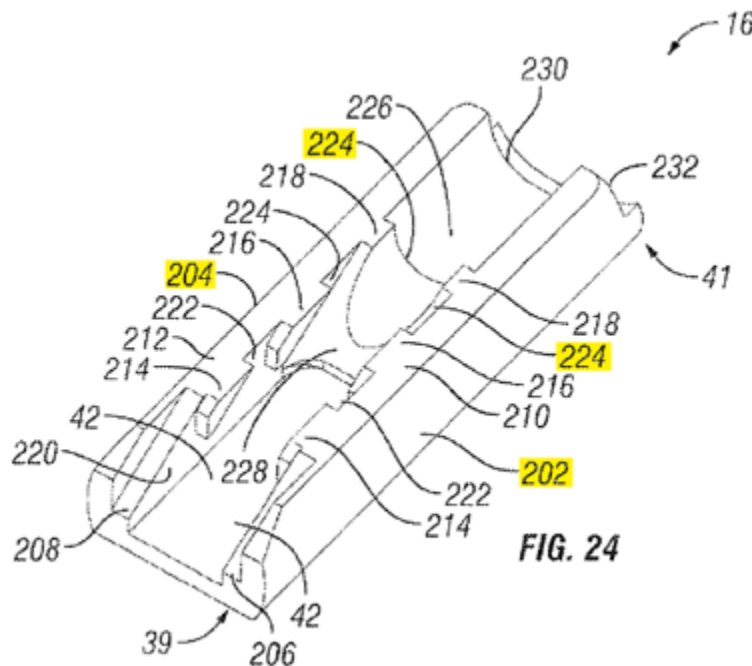


Figure 24 depicts endplate 16, wherein “the first and second side portions 202, 204 [highlighted in yellow] are extensions from the lower surface 42. . . In the illustrated embodiment, the central extension 224 [highlighted in yellow] extends between the first and second side portions 202 and 204.”

Ex. 1001, 10:31–32, 10:58–59, 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 the construction Patent Owner advocates here improperly reads in limitations from the embodiments depicted in Figures 52 and 43 of the '001 patent. *See* Pet. 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)). The Specification uses the term “extension” broadly to refer to a variety of structures, not merely to structures that “increase axial length and receive a rod.” *See, e.g.*, Pet. Reply 1–2; Ex. 1001, 6:24–36, Fig. 10 (element 46), 11:66–12:1, 13:34–36, Fig. 23 (elements 250, 254), 10:27–32, 10:55–11:7, Fig. 24 (elements 202, 204, and 224).

With regard to “rod receiving,” the claim language recites that the purpose of the extension is to receive the rod. The Specification further explains that the rod receiving extension may sit within the actuator assembly (Ex. 1001, 14:56–59) or the central ramp (*id.* at 20:5–10).

Turning to the prosecution history, Patent Owner argues that the Examiner distinguished the guides of Olmos from the “rod receiving extension” of the claimed subject matter because the Examiner allowed the claims over Olmos’s Figure 16 embodiment when the “rod receiving extension” was added to the independent claims. PO Resp. 13–14 (citing Ex. 1004 (prosecution history), 38, 64, 66–67, 72–73, 77, 107–109, 143,

180, 214, 254–256, 259, 289, 291, 294–295). Patent Owner argues that Olmos’s guides 232/272 are not “rod receiving extensions” because they do not longitudinally protrude, seeming to imply that the allowance was because the recited “rod receiving extension” longitudinally protrudes. *Id.* at 14.

The Examiner, however, also identified extensions of endplates that did not increase the length of the central ramp. *See, e.g.*, Ex. 2013 (prosecution history), 42–44, 66–67, 126–127. Patent Owner seeks to ignore these portions of the prosecution history because, in its view, a “rod receiving extension” of the central ramp must lengthen axially the central ramp, as well as receive the rod. *See* PO Resp. 15; Ex. 2031 (Culbert Decl.) ¶ 63. But, like the claims and Specification, nothing in the prosecution history indicates that the applicant intended one definition for “extension” in the context of the term “rod receiving extension” and another in the context of other extension structures such as the endplate or actuator. Nor do we interpret this to be so, absent clear indication by the applicant. *Liebel–Flarsheim*, 358 F.3d 898 at 906.

The prosecution history also shows that the Examiner distinguished the rod receiving extension only to the extent that it is the physical part of the extension where the rod enters the central ramp, not because it axially lengthened the central ramp or protruded longitudinally.

For the reasons above, we agree with Petitioner’s proposed construction (*see* Reply 1) and determine that the plain and ordinary meaning of “extension” is simply “an addition to a main structure,” which does not require lengthening in a particular direction. *See* Ex. 3002 (Am. Heritage Dictionary), 4. This is consistent with our construction of

“extension” in the related patent challenged in IPR2022-01434. *See* IPR2022-01434, Paper 49, 23–28. Based on this understanding, we construe “rod receiving extension” as “an addition to a main structure, wherein the addition receives a rod.”

2. “*non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp*”
(Independent Claim 1)

The parties dispute the meaning of the term “non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp” as recited in independent claim 1. *See* Ex. 1001, 23:34–38; *see also* Pet. 37 (limitation 1[n]).

Prior to institution, Patent Owner asserted that a “non-threaded through bore” is “a bore through an object that has no threading” and that to extend from the first end to the second end of the driving ramp requires that the bore extend the entire length end of the driving ramp. Prelim. Resp. 92–93. Petitioner did not provide an express construction in response. *See* Prelim. Reply. Based on the arguments and evidence presented prior to institution, we stated that “[b]y the plain language of claim 1, the non-threaded longitudinal through bore must extend from the first end to the second end of the driving ramp.” *See* Inst. Dec. 28.

In its Patent Owner Response, Patent Owner agrees with our preliminary construction. PO Resp. 9, 78.

Petitioner states that Patent Owner’s interpretation is “inconsistent with applicable evidence” but does not propose an alternative construction. Pet. Reply 20. Instead, Petitioner addresses how the claim term should be interpreted in the context of the claim language and Specification figures. *Id.* at 20–25.

Below we consider the construction of “non-threaded through bore,” based on the full trial record. While both parties agree that Chung has a through bore that extends from the first end to the second end of the driving ramp, the parties disagree about (1) whether the through bore is threaded; and (2) the locations of the “first end” and “second end.” *See, e.g.*, Pet. 37–38; PO Resp. 77–80. Thus, we analyze these two issues.

a. “non-threaded longitudinal through bore”

We begin with the language of the claims. Independent claim 1 recites: “wherein the driving ramp has a non-threaded longitudinal¹¹ through bore extending from the first end to the second end of the driving ramp.” Ex. 1001, 23:34–38.

We determine that the phrase “non threaded . . . through bore,” in the context of claim 1, indicates that the bore does not have threads. The claim language does not otherwise provide insight into the meaning of the term and there is no suggestion in the claim language that the term is accorded a special meaning in the context of the ’001 patent.

We next turn to the Specification. The term “non-threaded” does not appear in the Specification aside from claim 1. Figure 9 of the Specification, reproduced below, is described as having through bore 262.

¹¹ The meaning of longitudinal” is not disputed.

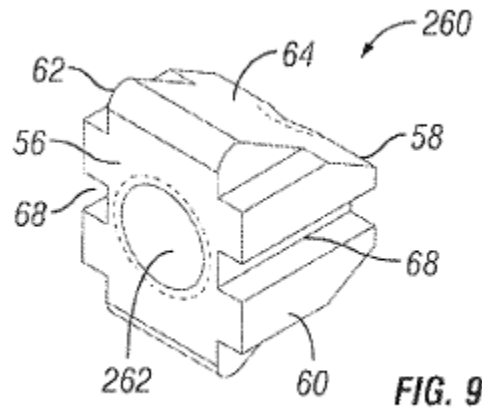


Figure 9 of the Specification, is a perspective view of the driving ramp of an intervertebral implant depicting through bore 262 on the left. *Id.* at 2:47–48.

We next turn to the prosecution history. The claim term “wherein a portion of the actuator extends through the non-threaded longitudinal through bore, and the actuator is fixed within the non-threaded longitudinal bore” was added to distinguish over the Examiner’s rejection based on Figures 23A and 23B of Olmos, which showed “wedge members 206, 208 hav[ing] threaded central apertures 300 to correspond to threads 294 of the actuator shaft 210.” *See* Ex. 1004 (prosecution history), 273, 277. Nonetheless, the Examiner continued to reject the claims over Olmos, pointing for instance to a different embodiment in Figures 5–7 of Olmos as having a driving ramp with a non-threaded longitudinal bore extending from the first end to the second end of the driving ramp, noting “Figs 5-7 where the non-threaded bore houses collar #52 and actuator #50.” Ex. 1004 (prosecution history), 64. Figure 6 of Olmos is shown below.

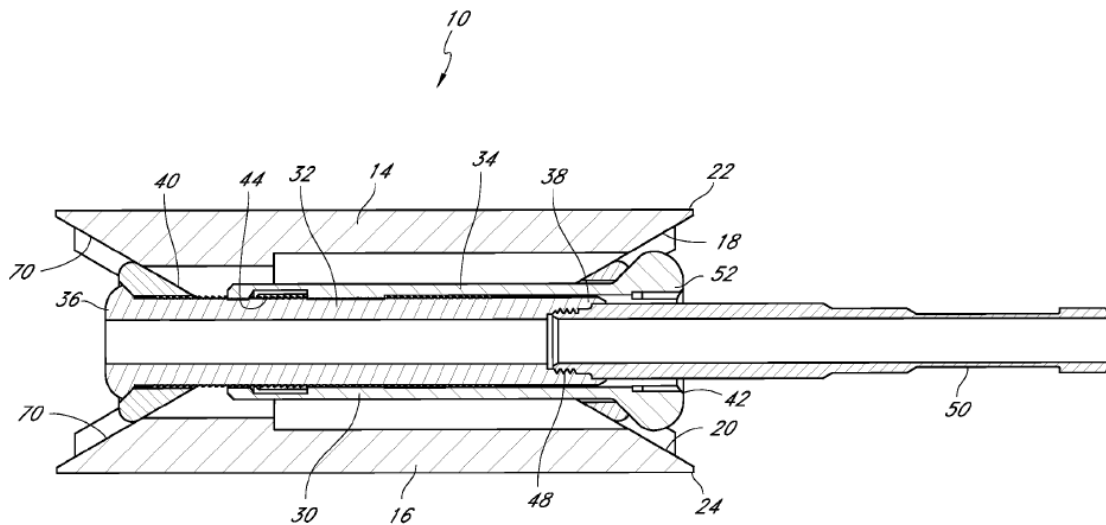


FIG. 6

Ex. 1004 (prosecution history), 64. Figure 6 of Olmos, depicting a lumbar insert, is shown above.

The applicant amended the term to specify that “the longitudinal bore the [sic] of the central ramp and the non-threaded longitudinal through bore of the driving ramp are *coaxially aligned*,” thus pursuing an argument unrelated to the existence of a non-threaded longitudinal through bore.

Ex. 1004 (prosecution history), 232, 239. Nevertheless, the Examiner continued to reject the claims over Olmos, finding that Figures 5–7 of Olmos taught the non-threaded through bore limitation. *Id.* at 64. The claims were amended in other regards (*id.* at 47–52), and were subsequently allowed.

The parties agree that the term “non-threaded . . . through bore” has a plain and ordinary meaning. *See* Pet. 5 (stating that no terms “require constructions differing from their plain and ordinary meaning”); PO Resp. 77–78 (citing Ex. 2031 (Culbert Decl.) ¶¶ 153–154) (through expert Mr. Culbert, arguing that a POSITA would interpret a “non-threaded

through bore” as a “bore through an object that has no threading”). In other words, neither party argues that the applicant acted as its own lexicographer in giving this term a specialized meaning. Nor does either party argue that the patentee disavowed claim scope during prosecution. Accordingly, our task is to discern the plain and ordinary meaning of “non-threaded . . . through bore.” *See Hill-Rom*, 755 F.3d at 1371 (“We depart from the plain and ordinary meaning of claim terms based on the specification in only two instances: lexicography and disavowal.”).

We turn to Petitioner’s arguments regarding interpretation of this term.

Petitioner argues that the claims describe “non-threaded longitudinal through bore” in terms of the driving ramp’s relationship with the actuator, meaning that any threading on Chung’s driving ramp relates only to the wrapper, not the actuator. Pet. Reply 20. Petitioner, through Mr. Drewry, argues that “any threads depicted in the driving ramp’s bore are incapable of interacting with the actuator” and thus the POSITA would understand the opening to be unthreaded as it pertains to the actuator. *Id.* (citing Ex. 1036 (Drewry Reply Decl.), ¶¶ 37–39).

Patent Owner responds that the claim requires that the bore be non-threaded, and whether the threads are designed to relate to a separate component is irrelevant. PO Sur-Reply 78.

We agree with Patent Owner and determine that “non-threaded” means not having threads in the portion of the through bore spanning the first end to the second end, regardless of the structure the threads are intended to interact with. The applicant attempted to distinguish its claimed subject matter from Olmos by noting that the recited through bore was non-

threaded. *See* Ex. 1004 (prosecution history), 273, 277. The Examiner similarly understood a “non-threaded through bore” as having no threads, as shown by the Examiner’s use of a different embodiment of Olmos without threading as the basis for a further rejection. *Id.* at 64. Nowhere in the prosecution history did the relationship between the actuator and the through bore figure into the interpretation of “non-threaded through bore.”

In sum, based on the intrinsic and extrinsic evidence of record and consistent with *Philips*, we find that the plain and ordinary meaning of the term “non-threaded longitudinal through bore” means “a longitudinal through bore lacking threads in the bore.”

b. “from the first end to the second end of the driving ramp”

We begin with the language of the claims. Independent claim 1 recites: “wherein the driving ramp has a non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp.” Ex. 1001, 23:34–38.

We determine that “from the first end to the second end of the driving ramp,” in the context of claim 1, defines the passageway of the through bore as it traverses the driving ramp between the first end to the second end. Limitations 1[l] and 1[m] identify the orientation of the first and second sides. *See* Pet. 122 (claims appendix). There is no suggestion in the claim language that the terms “first end” and “second end” are accorded a special meaning in the context of the ’001 patent.

We next turn to the Specification. There are multiple instances of “first end” and “second end” identifiers in the Specification. For example, the Specification states: “With additional reference to FIG. 24, in an exemplary embodiment, the second endplate 16 has a first end 39 and a

second end 41.” Ex. 1001, 9:67–10:2. Figure 24 of the ’001 patent is reproduced below with first end 39 and second end 41 marked in orange circles.

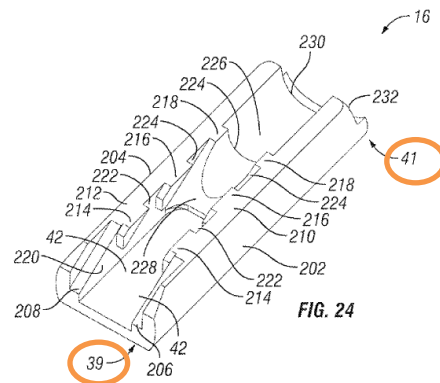


Figure 24, reproduced above, is a perspective of an endplate of the expandable fusion device. *Id.* at 3:30–31. First end 39 and second end 41 each designate their respective outer edges of the device. The same is true for other figures in the Specification. *See id.* at, *e.g.*, 7:9–12; 11:8–10; 14:15–18; 17:39–41. Thus, the Specification tells us that “first end” and “second end” each designate their respective outer edges of the device or noted object, meaning that “from the first end to the second end of the driving ramp” would indicate the respective outer edges of the driving ramp.

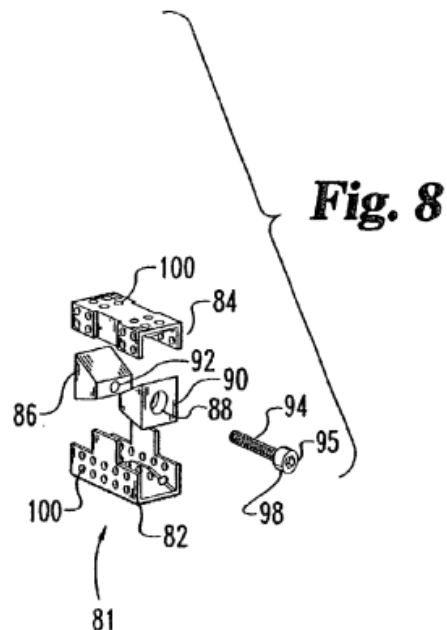
We next turn to the prosecution history. The Examiner rejected claim 1 over the combination of Michelson¹² and Olmos. Ex. 1004 (prosecution history), 217–218. The Examiner found, among other findings, that Michelson disclosed a non-threaded longitudinal through bore of the driving ramp. *Id.* at 218.

¹² Michelson, Gary, US 2003/0065396 A1, published April 3, 2003 (Ex. 3004, “Michelson”).

In response, the applicant amended to further describe the non-threaded longitudinal bore as “extending from the first end to the second end of the driving ramp.” *Id.* at 190–191. The applicant argued

Michelson, alone or in combination with the other cited references, does not teach or suggest that a non-threaded longitudinal through bore extends from first end to the second end of the driving ramp. On page 14 of the Office Action, wedges 86 and 88 were suggested as being the central and driving ramps. In paragraph [0100] of Michelson it states that wedges 86 and 88 have threaded central openings 90 and 92. Since the openings 90, 92 are threaded Michelson fails to teach or otherwise disclose that the longitudinal bore is non-threaded from a first end of the wedge to a second end of the wedge.

Ex. 1004 (prosecution history), 197. The relevant Figure 8 of Michelson is reproduced below.



Ex. 3003 (Michelson), Figure 8. Figure 8 is “an exploded perspective” of an artificial spinal fusion implant. *Id.* ¶ 70. Michelson describes the embodiment of Figure 8 as follows:

[0100] The wedges 86 and 88 have a central threaded opening 90 and 92 in alignment with each other for receiving threaded screw 94. Deformable burrs 95 on the head 98 of the screw 94 are used for locking the screw in place. The implant has a series of holes 100 throughout the body of the implant to assist in the ingrowth process.

Id. ¶ 100.

The Examiner was not persuaded by the amendment, finding that a different embodiment of Olmos lacked threads along the bore in the recited “first end to the second end of the driving ramp.” *See* Ex. 1004 (prosecution history) at 179–181, finding that Olmos alone disclosed all present limitations including a “driving ramp has a non-threaded longitudinal bore extending from the first end to the second end of the driving ramp.” No other relevant prosecution history pertains to the non-threaded longitudinal through bore term.

The parties agree that the term “from the first end to the second end of the driving ramp” has a plain and ordinary meaning. *See* Pet. 5 (stating that no terms “require constructions differing from their plain and ordinary meaning”); PO Resp. 78 (applying the meaning “from the distal *end* to the proximal *end*”). In other words, neither party argues that the applicant acted as its own lexicographer in giving this term a specialized meaning. Nor does either party argue that the patentee disavowed claim scope during prosecution. Accordingly, our task is to discern the plain and ordinary meaning of “from the first end to the second end of the driving ramp.” *See Hill-Rom*, 755 F.3d at 1371.

We turn to Petitioner’s arguments regarding interpretation of this term.

Petitioner argues that when the ’001 patent refers to an “end,” it includes three-dimensional structures as part of that end. Pet. Reply 20–21 (citing Ex. 1036 (Drewry Reply Decl.) ¶ 40). Petitioner argues that claims 1 and 10 require that a single end includes structures such as angled or ramped portions and pairs of grooves. *Id.* (citing Ex. 1036 (Drewry Reply Decl.) ¶ 41). As one example, Petitioner cites to 19:5–16 of the ’001 patent, which we reproduce below:

With reference to FIGS. 51, 52, and 56, the central ramp 18 has a first end 408 and a second end 410. In an embodiment, the central ramp 18 includes a first expansion portion 412, a second expansion portion 414, a rod-receiving extension 416, and a through bore 418 that extends longitudinally through the central ramp 18. In an exemplary embodiment, first expansion portion 412 can be proximate the first end 408 of the central ramp 18. As best seen in FIG. 56, the first expansion portion 412 may include side portions 420, 422. In an embodiment, each of the side portions 420, 422 includes dual, overlapping ramped portions that extend in oblique directions with respect to the through bore 418.

Ex. 1001, 19:5–16. This text references Figures 51, 52, and 56. We reproduce Figure 56 below:

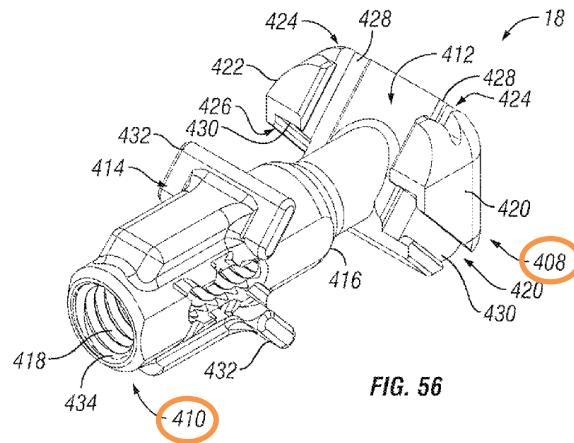


Figure 56 is “a perspective of a central ramp of the expandable fusion device.” *Id.* at 4:65–66. We have annotated the figure to add orange circles to ends 408 and 410.

We understand Petitioner’s argument to mean that “end” 410 on the left side of the figure above includes the entire structure of the cylinder having opening 434. Likewise, Petitioner’s argument would mean that “end” 408 on the right would include all of the features on the flat, vertical structure (*e.g.*, 428, 412, 424, 420, 428 etc.).

We are not persuaded that patent descriptions cited by Petitioner require reading an “end” to include the structures mentioned above. In particular, the following language describing Figure 52, “[i]n an exemplary embodiment, first expansion portion 412 *can be proximate the first end 408* of the central ramp 18,” indicates that end 408 is the distal side (backside) of 412, and is thus distinct from 408. *Id.* at 19:10–12. In particular, the fact that 412 “can be proximate” to end reinforces that 412 is not co-located with end 408.

We next turn to Petitioner’s declarant’s testimony on this issue. Mr. Drewry testifies that “a POSITA would recognize that the ’001 patent

uses the term ‘end’ to refer to a three-dimensional structure with depth, not to a two-dimensional plane corresponding to either the distal or proximal surface of a ramp.” Ex. 1036 ¶41. Mr. Drewry testifies that the language in claims 1 and 10 “a first end and a second end, wherein **the second end includes a first angled portion** configured to engage a portion of the first endplate and **a second angled portion** configured to engage a portion of the second endplate” in reference to the driving ramp means that first and second angled portions are part of the second end. *Id.* (emphasis original).

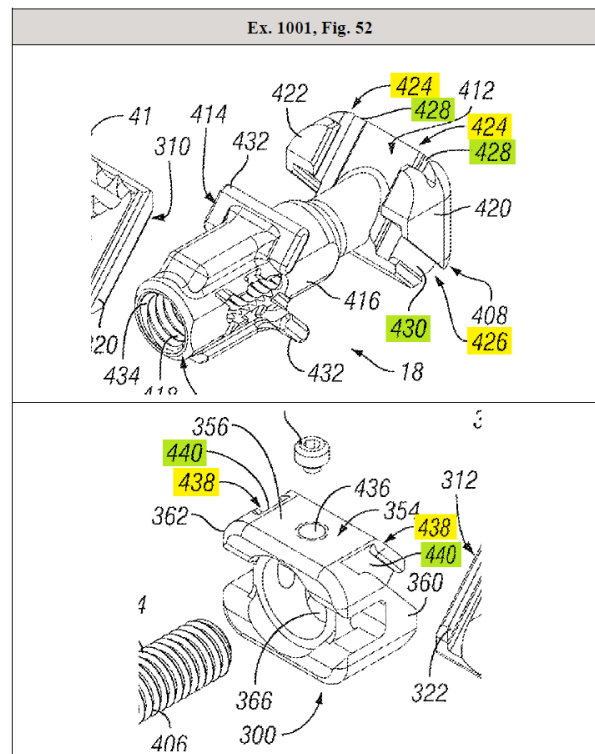
Mr. Drewry also cites Ex. 1001, 20:58–21:25 as support. This language is copied below.

As the central ramp 18 is pulled towards the actuator assembly 200, the central ramp 18 acts to push endplates 14, 16 outwardly into the expanded position. By way of example, the first ramped portions 424, second ramped portions 426, and central ramped portions 432 push against the corresponding ramped portions in the first and second endplates 14, 16. The first ramped portions 424 in the first expansion portion 412 of the central ramp 18 push against the second ramped portions 310, 312 of the second endplate 16 with the corresponding tongues 320, 322 in the second ramped portions 310, 312 of the second endplate 16 riding in angled grooves 428 in the first ramped portions 424 in the first expansion portion 412. The second ramped portions 426 in the first expansion portion 412 push against the first ramped portions 316, 318 of the first endplate 14 with the corresponding tongues 316, 318 in first ramped portions 316, 318 of the first endplate 14 riding in angled grooves 430 in the second ramped portions 426 in the first expansion portion 412. The central ramped portions 432 in the second expansion portion 414 push against the central ramped portion 402 in the first and second endplates 14, 16.

As discussed above, the actuator assembly 200 also engages driving ramp 300; thus, as the actuator assembly 200 is rotated in a first direction, the actuator assembly 200 pushes the

driving ramp 300 towards the central ramp 18 in a linear direction. As the driving ramp 300 is pushed towards the central ramp 18, the driving ramp 300 also acts to push the endplates 14, 16 outwardly into the expanded position. By way of example, the ramped portions 438 of the driving ramp 300 push against ramped portions 306, 308 at the first end 39 of the second endplate 16. As the endplates 14, 16 move outwardly, the tongues 316, 318 in the ramped portions 306, 308 of the second endplate 16 ride in the angled grooves 440 in the ramped portions 438 of the driving ramp 300.

Ex. 1001, 20:58–21:25. Mr. Drewry states about this text that “the ’001 specification teaches pairs of ‘angled grooves’ as being ‘in’ the central ramp’s first ramped portions 424 and second ramped portions 426 and ‘in’ the driving ramp’s ramped portions.” Ex. 1036 (Drewry Reply Decl.) ¶ 42. Mr. Drewry provides annotated figures in support of his position, stating that the figures “confirm that each of these disclosures describes the presence of three-dimensional structures ‘in’ another set of three-dimensional structures.” *Id.* We reproduce those figures below.



Ex. 1001, Figure 52, is an exploded view of an expandable fusion device.

Ex. 1001, 4:53–54. Mr. Drewry opines that the respective ends of the central and driving ramps must be the three-dimensional structures that include the ramped and angled portions (shown in yellow in the annotated figure), and grooves (shown in green) in light of the term “include.” Ex. 1036 (Drewry Reply Decl.) ¶¶ 42–43.

After consideration of the evidence and arguments of the parties, we find, consistent with our statement in the Institution Decision, that “from the first end to the second end of the driving ramp” means extending the entire length of the driving ramp, from the proximal to the distal end. Inst. Dec. 28–29. This interpretation is consistent with how “end” is used to refer to multiple embodiments in the Specification. *See, e.g.*, Ex. 1001, 3:30–31; 7:9–12; 11:8–10; 14;15–18; 17:39–41.

While the implications of Mr. Drewry's testimony (*see* Ex. 1036 ¶¶ 45–47) are difficult to follow, it seems that under his and Petitioner's interpretation, the claim language “non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp” would not exclude the presence of threads at the exterior opening of the through bore so long as those threads do not extend past the structures deemed to comprise the “first end.”

However, Mr. Drewry and Petitioner's interpretation does not square with the applicant's amendment to add “extending from the first end to the second end of the driving ramp” to distinguish Michelson, which disclosed a device with threads in the wedges at each end of the driving ramp, including at the distal end of the first end. *See* Ex. 1004 (prosecution history), 190–197. While the “ends” may be three-dimensional and contain the structures Mr. Drewry mentions, the phrase “extending from the first end to the second end of the driving ramp,” to be consistent with the prosecution history, requires that the *entire length* of the “ends” be considered as part of the distance. To be clear, we note that the remainder of the relevant part of the claim, e.g., the portions Mr. Drewry mentions regarding the ends “including” specific portions, was present in the claim at the time of the amendment adding “extending from the first end to the second end of the driving ramp.” *Id.*

In sum, based on the intrinsic and extrinsic evidence of record and consistent with *Philips*, we find that the plain and ordinary meaning of the term “from the first end to the second end of the driving ramp” is extending the entire length of the driving ramp, from the proximal to the distal end.

3. “pair of third grooves” (Claim 11)

The parties dispute the meaning of the term “pair of third grooves” as recited in independent claim 11. *See* Ex. 1001, 24:44–25:2; *see also* Pet. 114 (limitation 11[b]). Claim 11 depends from claim 1 and further recites:

[a]¹³ “wherein the driving ramp includes a first side portion and an opposite second side portion extending from an upper portion to a lower portion of the driving ramp”

[b] “wherein the first side portion and the second side portion include a pair of third grooves extending into the first and second side portions, respectively”

Ex. 1001, 24:44–25:2. Limitation [b], the “pair of third grooves” limitation, was not at issue prior to institution. *See generally* Inst. Dec.

Following institution, the parties’ dispute pertaining to the meaning of the term “pair of third grooves” distilled into whether Olmos’s anti-torque structures 250 can be “grooves.” *See* Pet. 60, 71 (alleging Olmos’s anti-torque structures 250 teach limitation 11[b] and it would have been obvious to add them to Chung’s driving ramp); 114, 116 (alleging Olmos’s anti-torque structures 250 teach limitation 11[b]); *see also* PO Resp. 82 (stating “Petitioner relies exclusively on Olmos’ disclosure of anti-torque structures 250”).

Patent Owner alleges that the plain and ordinary meaning of “groove” requires “a long, narrow furrow or channel.” PO Resp. 82 (citing Ex. 2031

¹³ Again, we adopt Petitioner’s limitation identification, for consistency.

(Culbert Decl.) ¶ 162 (citing Ex. 2033, 2034, 4, 6, 7 definitions of “channel,” “furrow,” and “groove”)). Patent Owner alleges this meaning is applied in the patent Specification. PO Resp. 83–85 (citing Specification Figures 9, 46–49, 56, 57). Patent Owner argues that a POSITA would have understood grooves to be “sized to receive an opposing structure of a surgical tool to help maintain physical control of the implant.” *Id.* at 85 (citing Ex. 2031 (Culbert Decl.) ¶ 163). Patent Owner further alleges that this meaning is consistent with the Examiner’s application during prosecution (*id.* at 86–87, citing Ex. 2031 (Culbert Decl.) ¶ 164), Olmos’s only reference to “grooves” (*id.* at 87–88, citing Ex. 2031 (Culbert Decl.) ¶¶ 164–66), Petitioner’s own use of “grooves” in a patent application (*id.*, citing Ex. 2031 (Culbert Decl.) ¶¶ 164–66), and as construed in certain patent cases (*id.* at 88, citing cases).

Petitioner replies that the intrinsic evidence does not support limiting “groove” to “a long, narrow furrow or channel,” and urges we reject doing so. Pet. Reply 3.

Patent Owner argues that Petitioner’s reply does not rebut its proposed construction. PO Sur-reply 10.

We begin our analysis with the language of claim 11, which recites:

11[a] The method of claim 1, wherein the driving ramp includes a first side portion and an opposite second side portion extending from an upper portion to a lower portion of the driving ramp,

11[b] wherein the first side portion and the second side portion include a pair of third grooves extending into the first and second side portions, respectively.

Ex. 1001, 24:44–25:2. Claim 11 depends from claim 1, which contains the following limitations reciting grooves:

[i] wherein the first ramped portion has a pair of first grooves, each of the first grooves sized to receive one of the first tongues, and [j] wherein the second ramped portion has a pair of second grooves, each of the second grooves sized to receive one of the second tongues; . . .

[t] wherein the first tongues and the second tongues are configured to move within corresponding first grooves and second grooves to expand and compress the expandable implant;

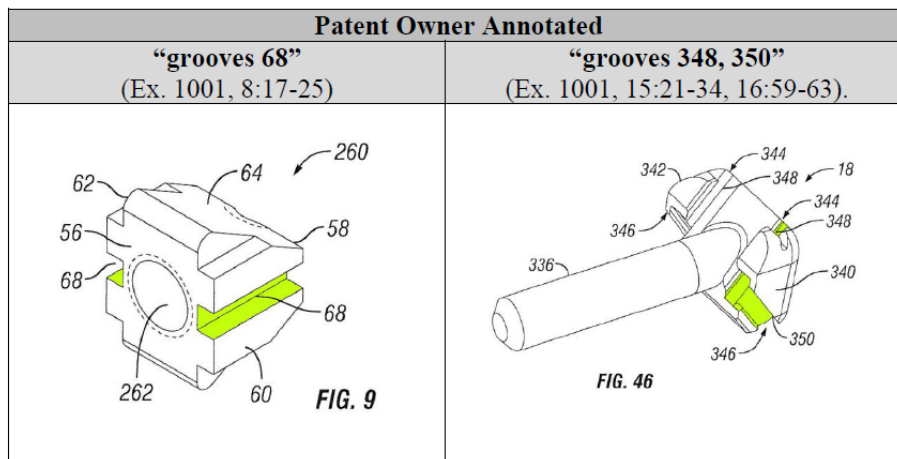
Ex. 1001, 23:4–60.

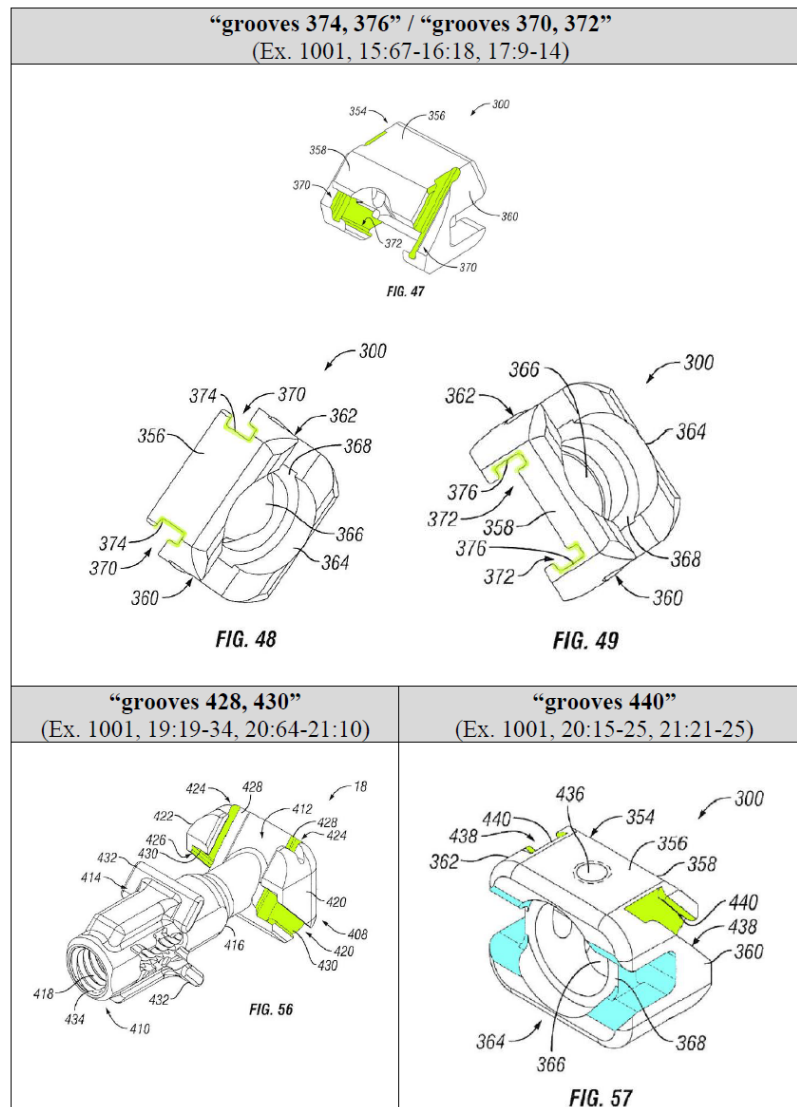
We discern from the language of claims 1 and 11 that a “groove” has some level of depth, because it either is sized to receive a tongue and/or to have a tongue move within it, or, for the “pair of third grooves,” each groove “extend[s] into” the side portions. *Id.* There is no suggestion in the claim language that “groove” is accorded a special meaning in the context of the ’001 patent.

Based on the language of the claims, we see little support for Patent Owner’s proposed construction. Patent Owner’s construction includes both a length and a width (narrow) component. Patent Owner, however, fails to explain—and we otherwise fail to discern—what it contends in the claim language indicates that the term “groove” requires that the groove be long or narrow. Limitation 11[b] specifically recites that the groove “extend[s] into the first and second side portions,” but there is no length or width requirement indicating to what extent each groove must extend. *See* Pet. Reply 3.

We next turn to the Specification. Patent Owner seeks to support its proposed construction by arguing that the many uses of “groove” in the Specification are long, narrow furrows or channels. PO Resp. 83–85. To

illustrate, Patent Owner provides annotated versions of Figures 9, 46–49, 56 and 57 of the '001 patent, which we reproduce below.





PO Resp. 83–85. The Figures above depict grooves in green highlighting. Mr. Culbert opines that, in view of these Figures, “a POSITA would understand that these additional grooves are sized to receive an opposing structure of a surgical tool to help maintain physical control of the implant.” Ex. 2031 (Culbert Decl.)¶ 163.

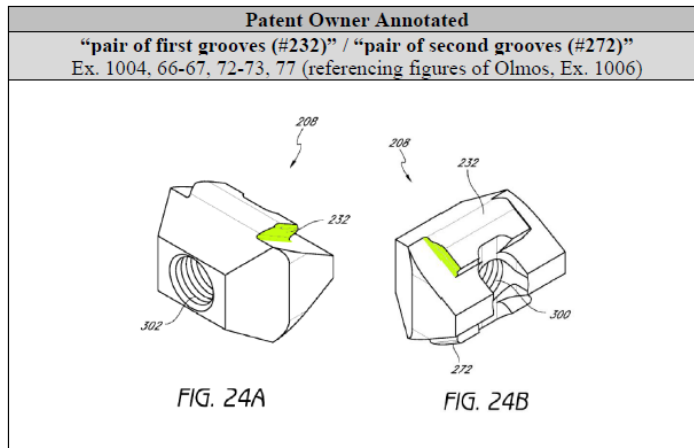
In reply, Petitioner alleges that the intrinsic evidence does not support limiting “groove” to “a long, narrow furrow or channel.” Pet. Reply 3.

We see support for Patent Owner’s argument that the Specification uses the term “groove” consistent with the meaning provided in its dictionary definitions, which define “groove” as a long, narrow furrow or channel. *See* PO Resp. 82–83 (citing Ex. 2033, 6; Ex. 2034, 7). While some of the grooves shown in the Figures are narrow (Figure 9), others are flat and wide (Figure 57). However, all grooves have more length than width. The Specification does not use “long” or similar terms to describe a groove, but does state, e.g., that “[t]he first and second side portions **60**, **62** may each include grooves **68** that extend, for example, in a direction parallel to the longitudinal axis of the through bore” and that the “grooves **68** together with the central guide **37** can surface to guide the translational movement of the driving ramp **260** in the central ramp **18**.” Such descriptions support grooves having more length than width, based on the overall shape of the intervertebral implant.

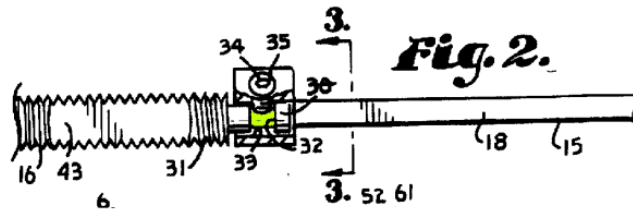
With regard to function, the Specification discloses that a “groove” can be “sized to receive” a “corresponding tongue” or can “guide the translational movement of the driving ramp.” Ex. 1001, 8:24–25. The grooves in Figure 9 as described (*see id.*) do not facilitate use of a surgical tool as Mr. Culbert suggests, but rather guide movement of the driving ramp during expansion. The various uses of grooves are commonly described as guiding or facilitating movement in a direction (*id.* at 8:24–25) or receiving a tongue to permit alignment during movement (*id.* at 15:21–34). We see nothing in the Specification that either supports or precludes the use of grooves to facilitate use of a surgical tool. We note, however, that the pair of third grooves is not connected in the claim language or Specification to

the function of corresponding tongues as are the first and second pair of grooves. Ex. 1001, 23:4–60, 24:64–25:2.

Turning to the prosecution history, Patent Owner argues that its proposed definition is consistent with the Examiner’s application during prosecution. PO Resp. 85–87, citing Ex. 2031 (Culbert Decl.) ¶ 164. According to Patent Owner, the Examiner identified as grooves the elements shown in green in the figures reproduced below:



“a set screw (#25) extending through a housing (#22) and engaged with a groove (#31) of an actuator (#16)”
Ex. 1004, 66-67, 73, 77, 110, 115, 118 (referencing Figure 2 of U.S. Patent 5,720,751 (“Jackson”), Ex. 2035); See also Ex. 2035, 6:43-53 (describing “peripheral groove” 31/32)



“a rotatable shaft (#30) with a groove on one end (#33)”
Ex. 1004, 150 (referencing Figure 1 of U.S. Patent App. Pub. 2005/011317 (“Hsien”), Ex. 2036)

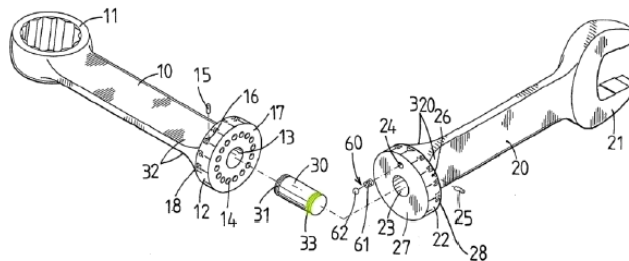
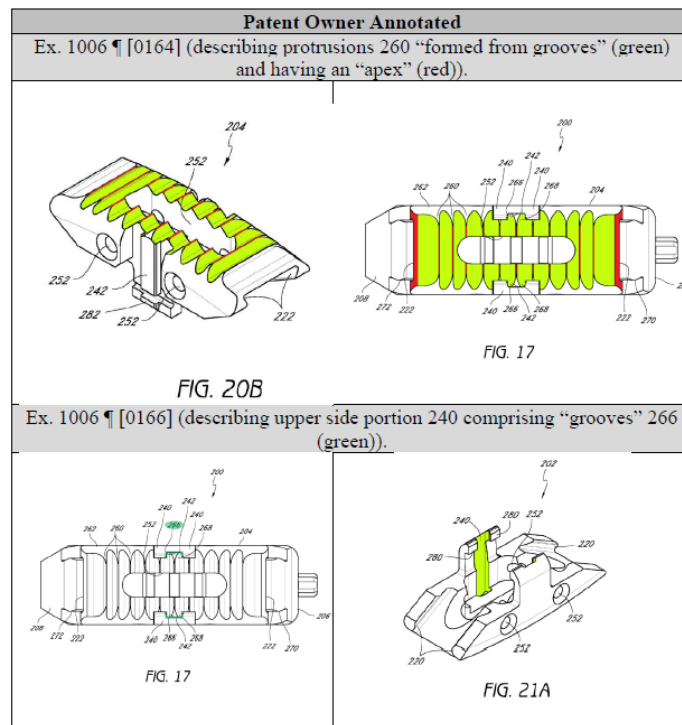


FIG. 1



PO Resp. 85–87. The figures above, according to Patent Owner, are prior art figures in which the Examiner identified “grooves” (reflected in green). *Id.* From the prosecution history we discern that, as applied by the Examiner, a “groove” referred to a channel or area of depression into or along a surface. Ex. 1004 (prosecution history), *passim*.

After consideration of the evidence and arguments of the parties, we find that Patent Owner’s construction is consistent with the plain and ordinary meaning as well as the intrinsic evidence. *See* PO Resp. 82–85 (citing Ex. 2031 (Culbert Decl.) ¶ 162; Ex. 1001, Figures 9, 46–49, 56, 57 Exs. 2034, 2035). We therefore adopt Patent Owner’s construction of “groove” as meaning “a long, narrow furrow or channel.”

E. Anticipation by Chung

Petitioner asserts that claims 1, 3, 4, and 10 are unpatentable as anticipated by Chung. *See* Pet. 3 (Ground 1), 6–53. Patent Owner disputes Petitioner’s contentions. *See* PO Resp. 10–25, 76–77.

After considering all of the arguments and cited evidence of record (including Patent Owner’s arguments discussed below), we find that Petitioner demonstrates by a preponderance of the evidence that Chung anticipates claim 10, but does not demonstrate the same for claims 1, 3, and 4. We start by addressing claims 1, 3 and 4, then turn to claim 10.

1. Analysis of Claims 1, 3, and 4

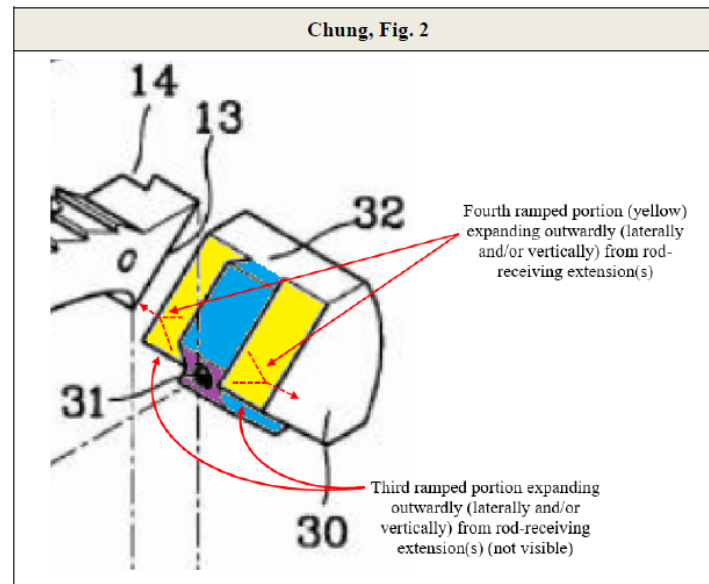
a. Independent Claim 1

Petitioner provides a limitation-by-limitation analysis alleging that Chung discloses a surgical method meeting each and every limitation of challenged claim 1. *See* Pet. 7–47. Patent Owner disputes two aspects of Petitioner’s mapping of Chung to claim 1, namely: (1) whether Chung discloses the claimed “rod receiving extension,” (recited in limitation 1[u]); and (2) whether Chung discloses the “non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp” (recited in limitation 1[n]). *See* PO Resp. 25–33, 76–80; *see also* Pet. 122 (claims appendix showing claim limitations).

We determine that Petitioner has shown by a preponderance of the evidence that Chung discloses claim limitations 1[a–m], [o–t], and [v]. We adopt Petitioner’s undisputed analysis of claim limitations 1[a–m], [o–t], and [v] as our own. *See* Pet. 7–36, 38–44, 47–48; Ex. 1002 (Drewry Decl.) ¶¶ 81–129, 133–155, 159–166. Below we address the parties’ arguments directed to disputed limitations 1[u] and 1[n].

*i. Limitation 1[u]: wherein the third ramped portion and the fourth ramped portions extend outwardly from a **rod receiving extension** of the central ramp*

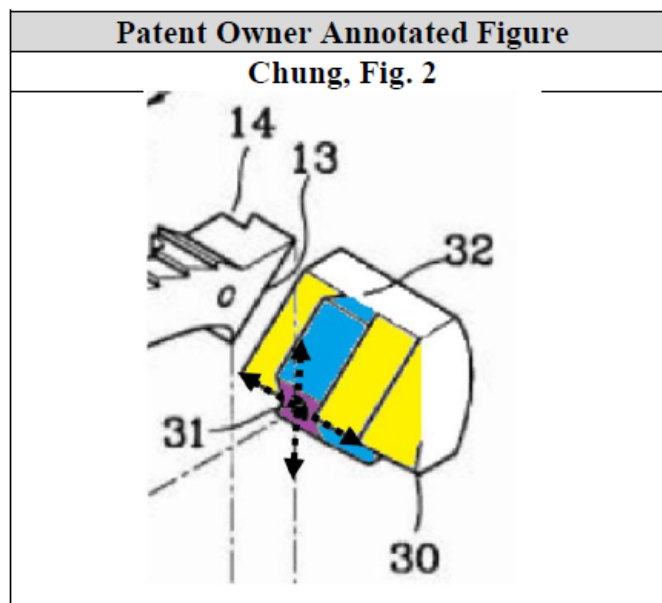
As noted above, Patent Owner disputes whether Chung discloses the claimed “rod receiving extension” recited in limitation 1[u]. To provide context for our analysis, we reproduce below Petitioner’s annotated excerpt of Chung’s Figure 2:



Pet. 46. Petitioner’s annotated excerpt of Chung’s Figure 2 above shows Chung’s lead wedge 30, which Petitioner maps to the claimed central ramp. *See* Pet. 45–47. Petitioner asserts that Chung discloses limitation 1[u] in two ways. First, Petitioner argues that “Chung’s dovetail 32 ‘extends’ from the surface of lead wedge (30) and houses bore hole 31 for receiving the rod-shaped groove fastening screw (50), thus serving as one embodiment of a ‘rod receiving extension.’” *Id.* at 45. Second, Petitioner argues that “part of dovetail 32 further extends longitudinally from lead wedge (30) toward opposing wedge (40), having bore hole 31 for receiving the rod-

shaped groove fastening screw, which thereby represents a second embodiment of the claimed ‘rod receiving extension’” *Id.*

Patent Owner argues that, when properly annotated, Figure 2 shows that Chung’s dovetail does not extend in a longitudinal direction past the plane where the expanded portions of the central ramp terminate. PO Resp. 27. Patent Owner’s annotated excerpt of Chung’s Figure 2 is shown below.



Id. at 27. Patent Owner’s annotated excerpt of Chung’s Figure 2 above shows Chung’s lead wedge 30. Patent Owner argues that the proximal plane, as indicated by black-dashed arrows, shows that the bore hole 31 is on the same plane as the central ramp’s termination. *Id.* According to Patent Owner, because the bore hole 31 is on the same plane and thus does not longitudinally protrude as under Patent Owner’s proffered claim construction, the bore hole 31 is not a rod receiving extension. *Id.* at 28–33 (citing Ex. 2031 (Culbert Decl.) ¶¶ 79–82). This argument is unavailing, because as we discussed above, we do not adopt Patent Owner’s proposed construction of “rod receiving extension.” *See supra* Section II.D.1.

Patent Owner next argues that Chung fails to disclose a rod receiving extension because Chung's dovetail 32 "serves the same purpose and function" as the claimed "expansion portion," not the claimed "extension." *See* PO Resp. 34–37 (citing Ex. 2031 (Culbert Decl.) ¶¶ 83–84). This argument is unavailing.

To arrive at its conclusion that Chung's dovetail 32 maps to the claimed "expansion portion," Patent Owner improperly compares Chung's lead wedge with an embodiment depicted in Figure 52 of the '001 patent. *See* PO Resp. 36. The proper comparison, however, is to compare Chung to the claims as properly construed. Applying our construction of "rod receiving extension" as meaning "an addition to a main structure, wherein the addition receives a rod," we find that Chung's dovetail 32 discloses this limitation. That is, Petitioner sufficiently shows that Chung's dovetail 32 comprising bore hole 31 is an addition to a main structure, the central ramp/lead wedge 30, and that bore hole 31 receives the "rod-shaped groove fastening screw 50." This can be seen, for example, in Petitioner's annotated excerpt of Chung's Figure 2, reproduced above (*supra* Section II.E.1.a.i), 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, and where Chung's bore hole 31 receives the rod-shaped fastening screw. Pet. 45–46; *see also id.* at 47, annotated diagram of Chung Figure 4.

Patent Owner also argues that because Chung's dovetail facilitates expansion, it is part of the claimed "expansion portion," and cannot be an "extension." PO Resp. 36. Patent Owner's attempt to exclude a structure from being an "extension" if it facilitates expansion is contrary to the Specification. Indeed, we agree with Petitioner that the Specification

teaches that (i) “an extension can have ramped surfaces that facilitate expansion (*e.g.*, Ex. 1001, 19:36–46),” and (iii) “two expansion portions can have a dovetail between them with its own ramped surfaces interacting with the endplates (*id.*, 11:26–38, Fig. 25).” Pet. Reply 18. Thus, we disagree with Patent Owner’s argument that Chung’s dovetail cannot map to the claimed extension because it instead maps to the claimed expansion portion.

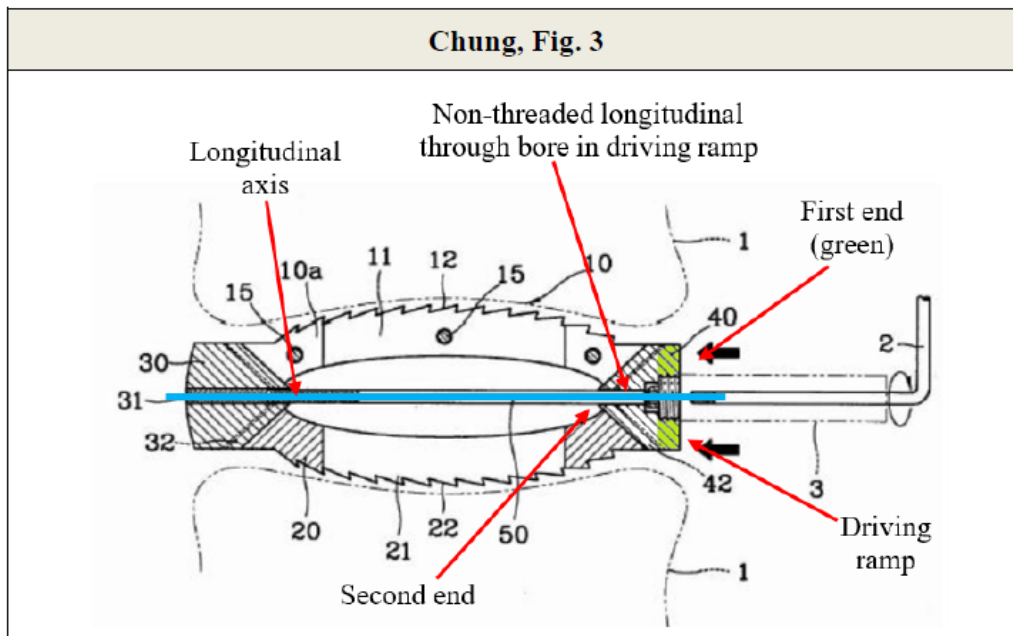
On the full trial record, we determine that Petitioner has shown by a preponderance of the evidence that Chung’s dovetail 32 comprising bore hole 31 teaches the claimed “rod receiving extension.”

ii. Limitation (1[n]): a non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp

The parties dispute whether Chung discloses this limitation. While both parties agree that Chung has a through bore that extends from the first end to the second end of the driving ramp, the parties disagree about (1) the locations of the “first end” and “second end;” and (2) whether the through bore is “non-threaded,” or is instead threaded along any length of the driving ramp. *See, e.g.*, Pet 37–38; PO Resp. 77–80.

(1) The Parties’ Arguments

Petitioner contends that Chung discloses a driving ramp (opposing wedge 40) that includes “a non-threaded longitudinal through bore (‘penetrating hole (41)’) extending from the first end to the second end.” Pet. 37 (citing Ex. 1005 (Chung), 6); *see also id.* at 30 (citing Ex. 1005, 4), 31 (citing Ex. 1005, Figs. 1–4). In support of its contention that the longitudinal through bore is non-threaded and extends from the first end to the second end of the driving ramp, Petitioner relies on an annotated version of Chung Figure 3, which we reproduce below:

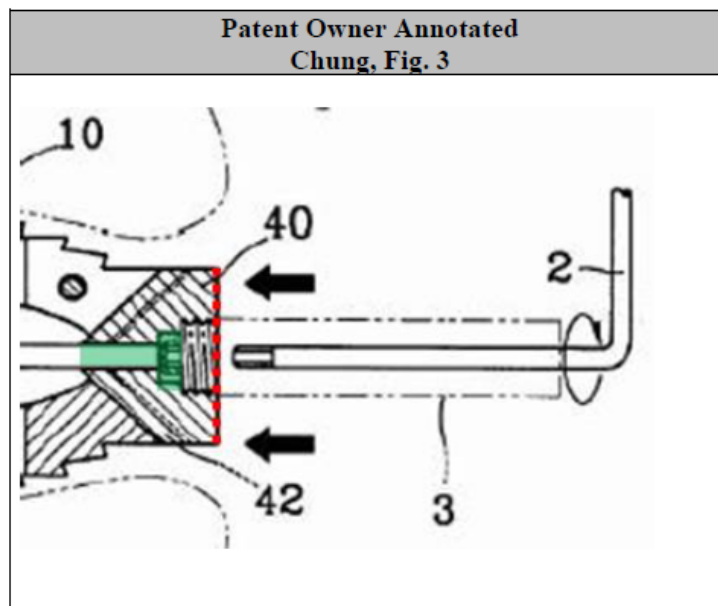


Pet. 37. Petitioner’s annotated version of Chung’s Figure 3, reproduced above, depicts an embodiment of Chung’s lumbar holder. Petitioner annotates the “[f]irst end” of the driving ramp in green, the “[s]econd end” of the driving ramp with a red arrow, and the “[n]on-threaded longitudinal through bore” with a red arrow. *See id.* Petitioner argues that because these structures are described as three-dimensional in the claims and Specification, the first end terminates at the left border of the green demarcation shown above, and the second end is the tip (distal end) of wedge 40. *See, e.g.,* Pet. Reply at 21 (citing Ex. 1001, 19:5–16, 19:58–20:11; Ex. 1036 (Drewry Reply Decl.)) ¶¶ 40–46).

Petitioner acknowledges that a portion of Chung’s bore hole “shows some threads,” but contends that those threads are “situated *within* the first end itself, and are not related to the operation of the groove fastening screw.” *Id.* at 38 (emphasis added). Petitioner also contends that “these threads facilitate attachment of a structure Chung identifies as a ‘wrapper

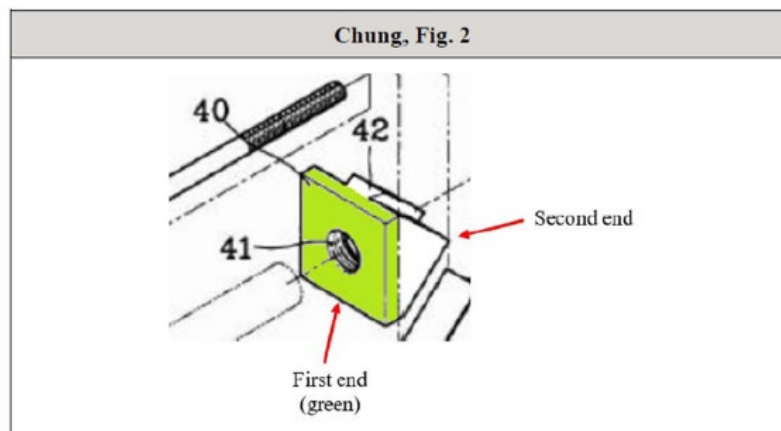
(3),’ which the surgeon uses to maintain control and positioning of the device.” Pet Reply at 38. (citing Ex. 1005 (Chung), 6).

Patent Owner cites Petitioner’s admission that the outermost portion of the bore has threads and, though its expert Mr. Culbert, argues that a POSITA would interpret a “non-threaded through bore” as a “bore through an object that has no threading.” PO Resp. 77–78 (citing Ex. 2031 (Culbert Decl.) ¶¶ 153–154). Patent Owner dismisses as irrelevant whether the screw 50 can be inserted with a wrapper because the claim limitation pertains to the bore hole, not screw operation. *Id.* at 78. Patent Owner also disagrees with Petitioner’s mapping of the first and second ends, as shown in Patent Owner’s annotated version of Chung, Figure 3 below.

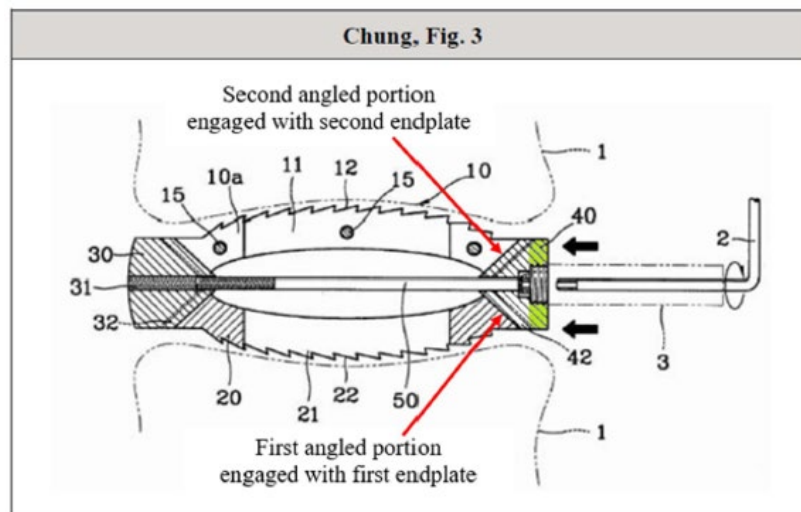


Id. at 79. Chung Figure 3 above shows the actuator insertion side of a lumbar holder. According to Patent Owner, “the portion of the hole 41 without threading (green) does not extend from the distal *end* to the proximal *end* (red-dashed line),” and thus the bore limitation [n] is not met. *Id.* at 78.

On reply, Petitioner argues that the claims describe a “non-threaded longitudinal through bore” in terms of the driving ramp’s relationship with the actuator, meaning that any threading on Chung’s driving ramp relates only to the wrapper, not the actuator. Pet. Reply 20. Petitioner, through Mr. Drewry, argues that “any threads depicted in the driving ramp’s bore are incapable of interacting with the actuator” and thus the POSITA would understand the opening to be unthreaded as it pertains to the actuator. *Id.* (citing Ex. 1036 (Drewry Reply Decl.), ¶¶ 37–39). Petitioner also argues that the unthreaded portion of the bore extends from the first end to the second end, which is a three-dimensional structure with thickness. *Id.* at 21. Petitioner cites to an annotated Figure 2 of Chung to explain its designation of the first end:



Pet. Reply 24. Shown above in Petitioner’s annotated version of Chung Figure 2 is a side perspective of the driving ramp, with the “first end” designated in green. *Id.* Petitioner’s annotated Figure 3 of Chung is shown again below, and is marked by Petitioner with red arrows showing the angled portions that Petitioner argues terminate against Petitioner’s demarcation of the “[f]irst end.” *Id.* (showing first and second angled portions).



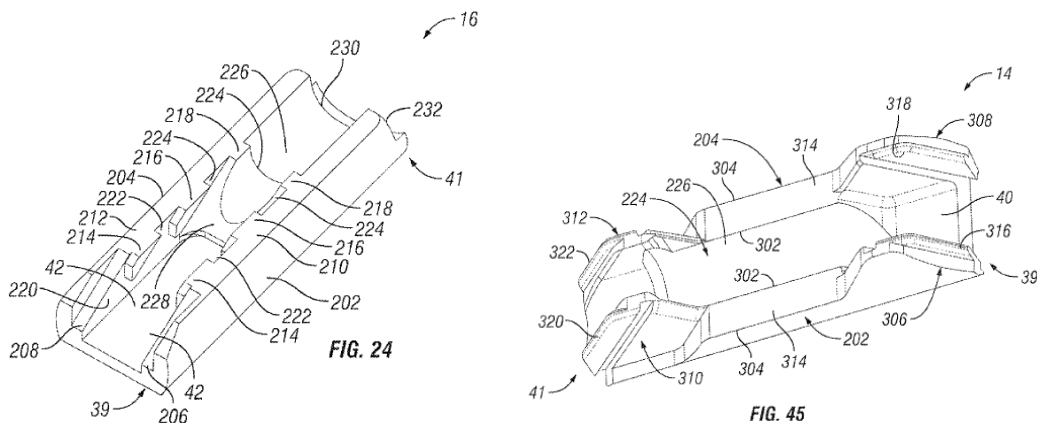
Shown above is Petitioner’s annotated version of Chung Figure 3. Reply 24. Petitioner argues that, with this understanding, the bore in the driving ramp is non-threaded because it does not include the first end. *Id.* at 25 (citing Ex. 1036 (Drewry Reply Decl.) ¶¶ 44–47). Mr. Drewry opines that “each end of the driving ramp is correctly shown as a three-dimensional structure, with the second end comprising the portion of the ramp including both the entirety of the ramped or angled portion and their related pairs of grooves . . . and the first end comprising the remaining portion of the ramp that does not include these structures.” Ex. 1036 (Drewry Decl.) ¶ 45. According to Mr. Drewry, a POSITA would have understood the second end to stop “where the grooves and ramps stop, which then represents the start of the first ‘end.’” *Id.* at ¶ 47.

Patent Owner responds that the claim term requires that the non-threaded bore extend the entire distance of one end of the driving ramp to the other, regardless of whether the bore interacts with the actuator. Sur-reply at 16. Patent Owner critiques the designations of first and second ends drawn by Petitioner as unreasonable and arbitrary. *Id.* at 17–18.

(2) Analysis

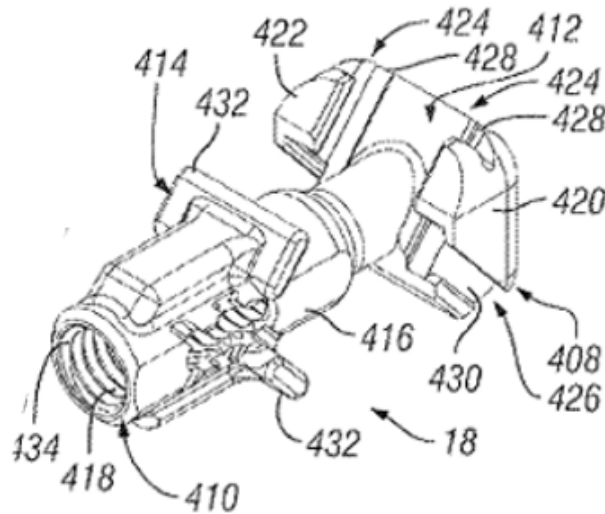
After evaluation of the arguments and evidence on the full trial record, we find that Petitioner has not demonstrated that Chung anticipates limitation 1[n]. With regard to the interpretations of “first end” and “second end,” we agree with Patent Owner that Petitioner’s designation of the first end of the driving ramp is arbitrary. As stated above, we interpret the plain and ordinary meaning of the term “from the first end to the second end of the driving ramp” consistent with its plain and ordinary meaning as extending the entire length of the driving ramp, from the proximal to the distal end.

We find the consistent uses of “first end” and “second end” in various figures in the ’001 patent to be instructive on this issue. For instance, with respect to Figures 24 and 45, reproduced below, the Specification states: “With additional reference to FIG. 24, in an exemplary embodiment, the second endplate 16 has a first end 39 and a second end 41.” Ex. 1001, 9:67–10:2; *see also id.* at 13:55–57 (similarly described).



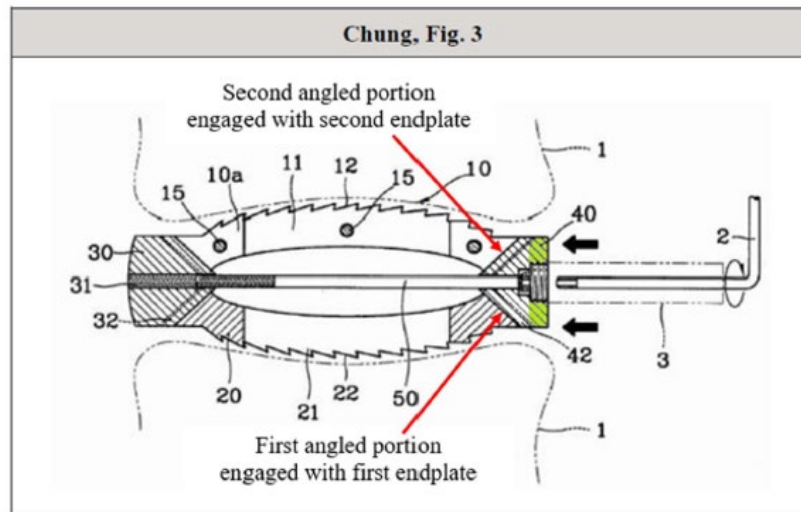
Figures 24 and 45, reproduced above, are perspective views of endplates of expandable fusion device embodiments. Ex. 1001, 3:3–31; 4:38–39. Figure

52, reproduced below, also identifies ends 408 and 410 as the outermost edges of the device.



Ex. 1001, Figure 52 (excerpt). End 410 identifies the outer edge of a cylindrical object while end 408 identifies the outer edge of a plate. We note that 416 identifies a “rod-receiving extension,” which is separate structure from the end 410. That 416 is separately identified undercuts Petitioner’s argument that the “end” represents a three-dimensional object because, under Petitioner’s theory, 416 would be a superfluous description of a single cylindrical object. Thus, to be consistent with the use of the term in the ’001 patent, the “second end” with regard to Chung Figure 3 refers to the outer edge (right side of the figure) of 40, i.e., the right edge of the portion marked green as shown below, and is not arbitrarily fixed at the left end of the portion marked green below.

Petitioner’s annotated version of Chung Figure 3 is reproduced again below for reference.



Pet. 24. Petitioner’s annotated version of Chung Figure 3 shows a side cross section of an intervertebral implant with a portion of the wedge 40 marked in green.

After consideration of the evidence and applying this rationale, we determine that Chung’s through bore has threads in a portion that extends “from the first end to the second end of the driving ramp,” specifically in the green-shaded region of wedge 40, as Petitioner acknowledges. *See* Pet. 38. We are not persuaded that a POSITA would nonetheless interpret the bore to *have no threads*, even if the functionality of the threads might pertain solely to the process of insertion using the wrapper. *See* Pet. 78. The plain meaning of the claim term “non-threaded” means having no threads. In this regard, we are persuaded by Mr. Culbert’s testimony (*see* Ex. 2031 (Culbert Decl.) ¶¶ 154–156) testifying that the plain meaning of a “non-threaded through bore” is “a bore through an object that has no threading” and identifying figures in ’001 patent consistent with this interpretation. Petitioner has not met its burden to show by a preponderance of the evidence that Chung’s partially threaded bore hole anticipates this claim term.

Accordingly, we find Petitioner has not shown that claim 1 is unpatentable as anticipated by Chung.

b. Claims 3, 4

Claims 3 and 4 depend from claim 1. Petitioner does not allege a separate teaching of limitation 1[n] for these claims. For the same reasons that claim 1 is not shown to be anticipated by Chung, Petitioner has not met its burden to show by a preponderance of the evidence that claims 3 and 4 are unpatentable as anticipated by Chung.

2. Independent Claim 10

Petitioner provides a limitation-by-limitation analysis alleging that Chung discloses a surgical method meeting each and every limitation of challenged claim 10. *See* Pet. 50–53. Patent Owner disputes one aspect of Petitioner’s mapping of Chung to claim 10, namely whether Chung discloses the claimed “rod receiving extension” recited in limitation 10[o].¹⁴ *See* PO Resp. 10–16, 25–37 (arguing limitations of independent claim 1); *see also* Pet. 125–126 (claims appendix showing claim limitations).

We addressed Patent Owner’s arguments above in the context of analyzing claim limitation 1[u]. For the reasons discussed above, Patent Owner’s arguments are unavailing, and we find that Chung discloses the claimed “rod receiving extension.” *See supra* Sections II.E.1.a.i.

After considering all of the arguments and cited evidence of record, for the reasons discussed in the Petition and above, we determine that Petitioner has shown by a preponderance of the evidence that Chung

¹⁴ Claim 10 does not recite the limitation “non threaded through bore.” *See* Ex. 1001, 24:15–63.

discloses an intervertebral implant that teaches each and every limitation of claim 10, and therefore anticipates claim 10. *See* Pet. 50–53; *supra* Section II.E.1.a.i.

3. Conclusion – Anticipation by Chung

For the reasons we discussed above, we find that Petitioner demonstrates by a preponderance of the evidence that Chung anticipates claim 10, but does not demonstrate the same for claims 1, 3, and 4.

F. Obviousness Over Chung

1. The parties' arguments

Petitioner asserts that claims 1, 3, 4, and 10 are unpatentable as obvious over Chung. *See* Pet. 3 (Ground 1), 6–53. Patent Owner disputes Petitioner's contentions. *See* PO Resp. 10–25, 76–77. As we have concluded above that the sole limitation still at issue with respect to Chung's teachings is limitation 1[n], we focus on Petitioner's allegations in that regard.

Petitioner contends that an ordinarily skilled artisan “would have been well aware of other methods and configurations for maintain[ing] control and positioning of the device,” and thus, “it would have been an obvious modification to simply omit these particular threads from the outer portion of Chung's bore hole, thereby providing an entirely unthreaded bore hole.” Pet. 38 (citing Ex. 1002 (Drewry Decl.) ¶ 139).

Patent Owner argues that Petitioner's obviousness analysis is conclusory and legally deficient, including because Petitioner fails to articulate why a POSITA would have modified its wrapper hole to avoid threads, or provided a rational underpinning supporting its legal conclusion of obviousness. PO Resp. 94–95. Patent Owner points out that

Mr. Drewry’s testimony on this issue addresses the ease with which the threaded wrapper could be replaced, but lacks support for motivation to do so or a discussion on reasonable expectation of success given that the insertion mode would also change. *Id.* at 95.

On reply, Petitioner argues that Chung’s wrapper would be superfluous if the threading of the through bore were removed and thus a POSITA would have omitted the threading.¹⁵ Pet. Reply 29.

2. *Analysis*

After consideration of the evidence of record and the parties’ arguments, we determine that Petitioner has not met its burden to show that a POSITA would have been motivated to omit the threads simply based on awareness of other options. What is missing is some articulated reasoning with rational underpinnings supporting a motivation to modify Chung as Petitioner proposes. *See, e.g., In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”)

3. *Conclusion*

For the reasons we discussed above, we find that Petitioner demonstrates by a preponderance of the evidence that Chung anticipates

¹⁵ Petitioner’s argument at Reply 29–30 regarding the addition of grooves was not included in the Petition with respect to Ground 1 and therefore we do not consider it here.

claim 10, but does not demonstrate that Chung anticipates or renders obvious claims 1, 3, and 4.

G. Obviousness Over Chung with the Knowledge of a POSITA or Olmos

Petitioner asserts that claims 2, 5–9, and 11 are unpatentable as obvious over Chung in combination with the knowledge of a POSITA and/or Olmos. *See* Pet. 54–66 (Ground 2). In the Petition, Petitioner relies on Chung as disclosing an intervertebral implant meeting most limitations of the claims,¹⁶ and relies on the knowledge of a POSITA and/or Olmos as disclosing the limitations claimed in the dependent claims, including creating a surgical access path via a posterolateral approach, introducing a second expandable implant into the disc space, introducing the second expandable implant through the same access path as the expandable implant or through a different access path, the instance where one of the access paths is formed via posterolateral approaches, and where the first side portion and the second side portion include a pair of third grooves extending into the first and second side portions, respectively. *See generally id.* at 54–61. Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Chung’s device with the teachings of Olmos for multiple reasons, including “in view of Olmos’ express teachings that more than one implant is needed and used in some circumstances” and that the

¹⁶ Petitioner mentions the dependency of claim 11 on claim 1 (Pet. 59), but does not reference claim 1 for the remaining dependent claims challenged in Ground 2. Nevertheless, in Ground 2, we interpret Petitioner’s allegations of obviousness with regard to dependent claims 2 and 5–9 and references to “Chung’s device” to likewise incorporate Petitioner’s allegations regarding anticipation by and/or obviousness of claim 1 over Chung.

POSITA would have appreciated the benefits of balanced support for adjacent disks provided by multiple implants. *Id.* at 61–66.

With regard to Ground 2, Petitioner does not allege that limitation 1[n], “a non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp,” was known by a POSITA or taught by Olmos.¹⁷ Thus, for the reasons provided in Section II.E.1.a.ii regarding Petitioner’s failure to demonstrate that Chung discloses limitation 1[n] and because in Ground 2 Petitioner does not address that deficiency with other cited teachings, we find that Petitioner does not demonstrate by a preponderance of the evidence that the combination of Chung, the knowledge of a POSITA or Olmos renders claims 2, 5–9, and 11 unpatentable as obvious.

H. Obviousness Over Chung with Baynham or Baynham and Olmos

Petitioner asserts that claims 1–11 are unpatentable as obvious over Chung in view of Baynham or Baynham and Olmos. *See* Pet. 66–75 (Ground 3). In its brief, Petitioner incorporates its allegations that Chung discloses all limitations of claims 1 and 10. *Id.* at 66. Petitioner provides alternative allegations for claim limitations 1[a] and 10[a], 1[u] and 10[o], and 1[v]. *Id.* at 67–70. Additionally, Petitioner relies on the disclosures of Baynham or Baynham with Olmos as disclosing the limitations claimed in the dependent claims, including, e.g., creating a surgical access path via a posterolateral approach, introducing a second expandable implant into the disc space, introducing the second expandable implant through the same

¹⁷ We address Petitioner’s separate allegations regarding Olmos’s teachings of limitation 1[n] in regards to Grounds 4 and 5.

access path as the expandable implant or through a different access path, the instance where one of the access paths is formed via posterolateral approaches, and where the first side portion and the second side portion include a pair of third grooves extending into the first and second side portions, respectively. *See generally id.* at 71–75.

Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Chung’s device with the teachings of Baynham, including “to follow Baynham’s teachings to efficiently and safely implant Chung’s devices” using posterior access paths to “avoid interfering with internal organs and tissue” and to allow use of a shorter screw to reduce “unwanted interference with adjacent anatomy.” *Id.* at 71–73. Petitioner argues that a POSITA would have had a reasonable expectation of success in combining the teachings of the two references, including because Chung discloses introducing spinal implant material. *Id.* at 75 (citing Ex. 1005 (Chung), 3–4; Ex. 1002 (Drewry Decl.), ¶¶ 281–282). Petitioner makes no separate allegations regarding motivation to combine or likelihood of success with regard to Olmos’s teachings for the dependent claims, but incorporates its allegations from Ground 2 regarding obviousness of claims 2, 5–9, and 11 over the teachings of Chung with knowledge of a POSITA and Olmos. *Id.* at 70.

With respect to Ground 3, Petitioner does not allege that limitation 1[n], “a non-threaded longitudinal through bore extending from the first end to the second end of the driving ramp,” is taught by Baynham, Olmos, or the knowledge of a POSITA. *See generally id.* at 71–75. Thus, for the reasons provided in Section II.E.1.a.ii regarding Petitioner’s failure to demonstrate that Chung discloses limitation 1[n], we find that Petitioner does not

demonstrate by a preponderance of the evidence that the combinations of Chung and Baynham or Chung with Baynham and Olmos disclose limitation 1[n], and therefore does not demonstrate that claims 1–11 are unpatentable as obvious.

I. Anticipation by Olmos

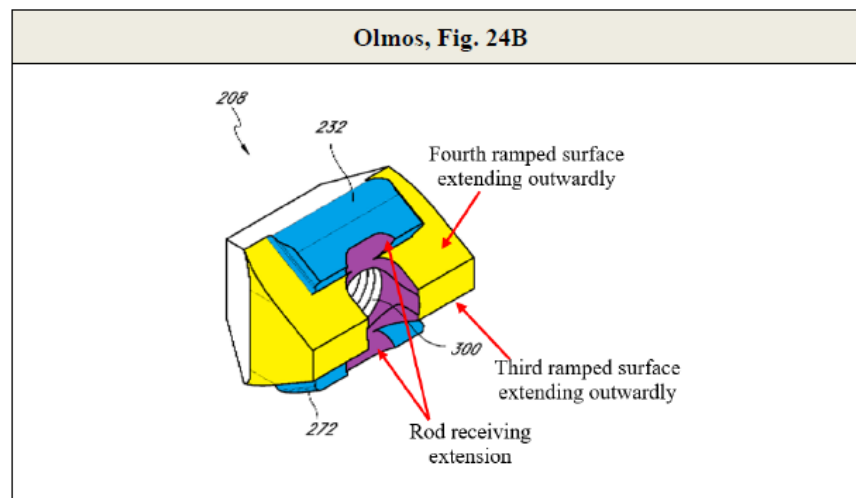
Petitioner provides a limitation-by-limitation analysis alleging that Olmos discloses a surgical method meeting each and every limitation of challenged claim 1. *See* Pet. 75–114. Patent Owner disputes a single aspect of Petitioner’s mapping of Olmos to claims 1 and 10, namely whether Olmos discloses the claimed “rod receiving extension,” recited in limitation 1[u]/10[o]. *See* PO Resp. 10–37; *see also* Pet. 122 (claims appendix showing claim limitations).

With regard to claim 11, Patent Owner disputes only whether Olmos discloses “a pair of third grooves extending into the first and second side portions” of the driving ramp. *See* PO Resp. 82–94; *see also* Pet. 122 (claims appendix showing claim limitations).

We determine that Petitioner has shown by a preponderance of the evidence that Olmos discloses claim limitations 1[a–t], and [v]. We adopt Petitioner’s undisputed analysis of claim limitations 1[a–t], and [v] as our own. *See* Pet. 75–101, 106–114; Ex. 1002 (Drewry Decl.) ¶¶ 150–353, 357–372. Below we address the parties’ arguments directed to disputed limitations 1[u]/10[o]. Because we find that Petitioner has not demonstrated that Olmos discloses claim limitations 1[u]/10[o], we need not address Patent Owner’s additional argument regarding dependent claim 11.

1. Limitation 1[u]/10[o]: wherein the third ramped portion and the fourth ramped portions extend outwardly from a rod receiving extension of the central ramp

As noted above, Patent Owner disputes whether Olmos discloses the claimed “rod receiving extension” as recited in limitation 1[u]/10[o]. To provide context for our analysis, we reproduce below Petitioner’s annotated excerpt of Olmos’s Figure 24B:



Pet. 102. Petitioner’s annotated excerpt of Olmos’s Figure 24B above shows Olmos’s distal wedge member 208, which Petitioner maps to the claimed central ramp. *Id.* at 78, 101–102. Petitioner maps the yellow portions of distal wedge member 208 to the claimed third and fourth ramped portions. *Id.* at 102. Petitioner alleges that upper guide member 232 and lower guide member 272 extend outwardly, both laterally on the side, and vertically above and below, from distal wedge member 208 and “at least partially along a longitudinal axis.” *Id.* at 101–102. Petitioner identifies the portions marked in purple in Figure 24B above, which are part of the upper and lower guide members and the third and fourth ramped surfaces, as the “rod-receiving extension.” *Id.* (citing Ex. 1002 (Drewry Decl.) ¶¶ 357–360).

Patent Owner argues Petitioner’s identification of the “rod-receiving extension” is incorrect because the guides do not longitudinally protrude, as required by Patent Owner’s proposed construction of “rod receiving extension.” PO Resp. 16–19 (citing Ex. 2031 (Culbert Decl.) ¶¶ 67–69). This argument is unavailing, because as we discussed above, we do not adopt Patent Owner’s proposed construction of “rod receiving extension.” *See supra* Section II.D.1.

Patent Owner next argues that Olmos fails to disclose a rod receiving extension because Petitioner has misidentified the portion of Olmos that receives the rod. PO Resp. 19–20. Patent Owner provides an annotated version of Figure 18 to support its explanation.

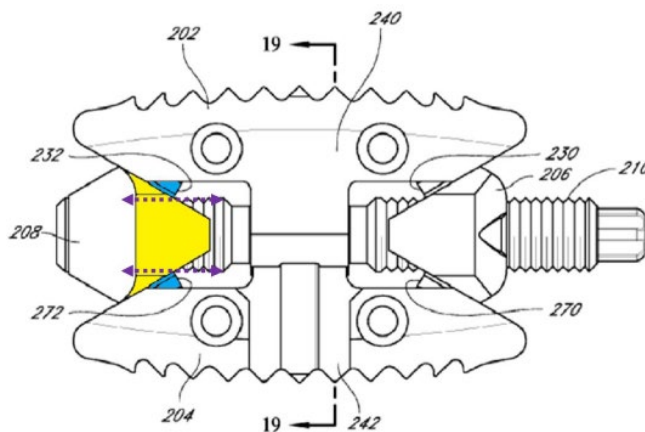


FIG. 18

Id. at 20. Patent Owner’s annotated version of Figure 18 shows a front perspective view of an embodiment of an expandable fusion device. Ex. 1001, 3:9–10. Patent Owner argues that the purple arrows added to the figure “show how the threading of the actuator 210 is received by the yellow portion that exists *between* the separate blue guides 232/272.” PO Resp. 19–20. Patent Owner argues that the blue portions, identified by Petitioner as the rod-receiving extension, do not in fact “receive” the rod. *Id.* at 20.

Patent Owner presents its own color-coded version of Figure 24, reproduced below:

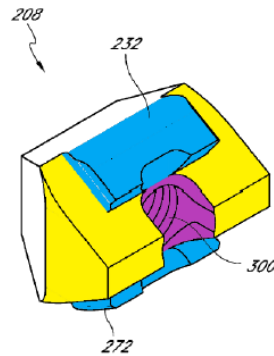


FIG. 24B

PO Resp. 21. Patent Owner’s annotated excerpt of Olmos’s Figure 24B above shows Olmos’s distal wedge member 208. Ex. 1001, 3:9–10. Patent Owner argues that, when correctly annotated, the “‘rod receiving’ portion (purple) only exists within the ramped portions (yellow), not the separate guides (blue).” PO Resp. 21. Patent Owner also argues that the blue sections 232 and 272 cannot serve as multiple claim elements where the claim language identifies elements distinctly. *Id.* at 22–24 (citing, *e.g.*, *Becton, Dickinson & Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1254 (Fed. Cir. 2010)).

Patent Owner also argues that Olmos fails to disclose a “rod receiving extension” because Olmos’s upper guide member 232 at most maps to the claimed “expansion portion,” not the claimed “extension.” *See* PO Resp. 24–25 (citing Ex. 2031 (Culbert Decl.) ¶¶ 72–73).

Petitioner replies that “Olmos’[s] dovetails constitute a ‘rod-receiving’ extension,” which is “apparent if one applies [Patent Owner’s] arguments regarding Chung consistently to Olmos.” Pet. Reply 37; *see also id.* at 36–40 (citing Ex. 1036 (Drewry Decl.) ¶¶ 103–112).

Patent Owner replies, rearguing its position that a rod receiving extension requires a longitudinal protrusion. PO Sur-reply, 10–16.

2. Analysis

Applying our construction of “rod receiving extension” as meaning “an addition to a main structure, wherein the addition receives a rod,” we find that Olmos’s upper guide member 232 and lower guide member 272 are additions to a structure (i.e., the central ramp), but we are persuaded by Mr. Culbert’s testimony that those guides are not a “rod receiving extension” because they do not receive a rod. Ex. 2031 (Culbert Decl.) ¶¶ 70–71.

Rather, the upper guide members recess away from the through bore of the central ramp (distal wedge member 208) in a manner that precludes them from receiving the rod, as Patent Owner notes (PO Resp. 20), regardless of whether we view the assembly from a cross section or in frontal view.

We are not persuaded by Petitioner’s color demarcations of Olmos Figure 24B delineating the rod receiving portion in purple. The entirety of the structure Petitioner marks as purple, aside from the curved portion of the upper guides, is part of the central ramp (distal wedge member 208) and *not an extension of* the central ramp as required by our construction. Stated differently, we agree with Patent Owner that, when Olmos’s Figure 24B is correctly annotated, the “‘rod receiving’ portion (purple) only exists within the ramped portions (yellow), not the separate guides (blue),” as shown in Patent Owner’s annotated version of Olmos Figure 24B reproduced below:

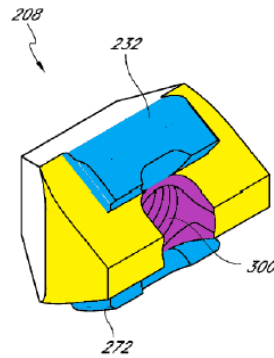


FIG. 24B

PO Resp. 21. Patent Owner’s annotated excerpt of Olmos’s Figure 24B above shows Olmos’s distal wedge member 208. Ex. 1001, 3:9–10. As Patent Owner’s annotations show, the blue portions constitute the extensions to the central ramp, yet the blue portions do not receive a rod.

We are not, however, persuaded by Patent Owner’s argument that Olmos fails to disclose a “rod receiving extension” because Olmos’s upper guide member 232 at best maps to the claimed “expansion portion,” not the claimed “extension.” *See* PO Resp. 24–25 (citing Ex. 2031 (Culbert Decl.) ¶¶ 72–73). This argument is unavailing because, in arriving at its conclusion that Olmos’s upper guide member 232 maps to the claimed “expansion portion,” Patent Owner improperly compares Olmos’s upper guide member with an embodiment depicted in Figure 52 of the ’001 patent. *See* PO Resp. 24. The proper comparison is to compare Olmos to the claims as properly construed. For this same reason, we are not persuaded by Petitioner’s argument that we consider Patent Owner’s arguments regarding Chung consistently to Olmos. *See* Reply 37.

For the reasons above, Petitioner has not met its burden to show by a preponderance of the evidence that Olmos’s upper guide member 232 and lower guide member 272 disclose this claim term. Accordingly, we find

Petitioner has not shown that claims 1–11, which each contain this claim term, are unpatentable as anticipated by Olmos.

3. Conclusion

For the reasons we discussed above, we find that Petitioner does not demonstrate by a preponderance of the evidence that Olmos anticipates claims 1–11.

J. Obviousness Over Olmos

Petitioner asserts that claims 1–11 are alternatively unpatentable as obvious over Olmos based on a proposed combination of Olmos’s Figure 8 and Figure 16¹⁸ embodiments, which it proposes teaches or suggests an intervertebral implant meeting each and every limitation of claims 1–11. *See* Pet. 75 (Ground 4), 75–115. Patent Owner disputes three aspects of Petitioner’s showing, i.e., whether Petitioner has demonstrated that (1) a person of ordinary skill in the art would have had a reason to use Olmos’s Figure 8 extension with the Figure 16 embodiment; (2) Olmos teaches or suggests the “rod receiving extension” limitation of claims 1[u]/10[o]; and (3) Olmos teaches or suggests the “pair of third grooves” limitation of claim 11[b]. *See* PO Resp. 38–66, 82–95.

¹⁸ The parties sometimes refer to Olmos’s Figure 16 embodiment as the Figure 16-24 embodiment or Figures “16-24.” *See, e.g.,* Pet. 104 (“embodiments of Figs. 16-24”); PO Resp. 8 (equating Olmos’s “Figure 16-24 embodiment” and “Figure 16 Embodiment”). We understand these terms to be interchangeable. For clarity and consistency, we refer to Olmos’s embodiment depicted in its Figures 16 through 24 as the “Figure 16 embodiment.”

After considering all of the arguments and cited evidence of record, we find that Petitioner demonstrates by a preponderance of the evidence that Olmos renders claims 1–11 unpatentable as obvious.

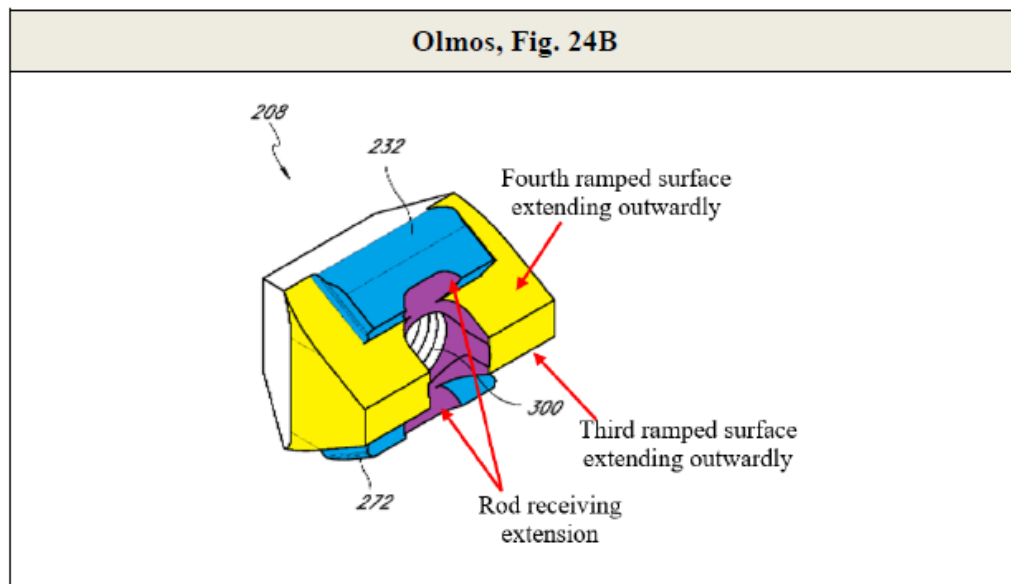
1. Whether Olmos Teaches or Suggests the “rod receiving extension” Limitation 1[u]/10[o]

As discussed *supra* at II.I.1, the sole limitation Patent Owner disputes with respect to Petitioner’s showing for claims 1–10 is whether Petitioner shows by a preponderance of the evidence that Olmos teaches or suggests limitation 1[u]/10[o]. We have reviewed Petitioner’s showing for the other limitations of these claims and find that Petitioner has sufficiently demonstrated that Olmos teaches or suggests all of the other limitations of claims 1–10. *See* Pet. 75–133 (citing Ex. 1002 ¶¶ 286–432).

Turning to limitation 1[u]/10[o], we begin our analysis below by briefly summarizing the aspects of Petitioner’s arguments in the Petition relevant to the parties’ disputes, then turn to a detailed analysis of the parties’ disputes regarding whether Petitioner has carried its burden to demonstrate (1) an adequate reason to combine Olmos’s Figure 8 and Figure 16 embodiments; and (2) that Olmos teaches or suggests the “rod receiving extension” limitation in claims 1–10.

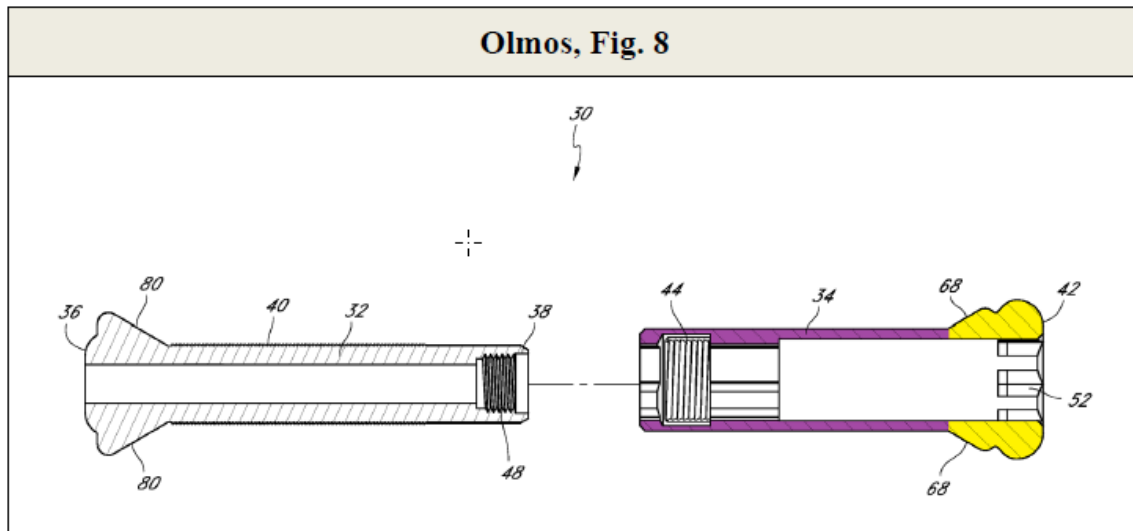
a. Brief Overview of Petitioner’s Arguments

For the recited “rod receiving extension,” Petitioner points to Olmos’s distal wedge member 208 in Olmos’s Figure 24B, reproduced below, as the central ramp:



Pet. 102. Petitioner’s annotated version of Olmos’s Figure 24B shows Olmos’s distal wedge member 208. Petitioner maps distal wedge member 208 to the claimed “central ramp.” *See id.*

Petitioner then argues that “it would have been obvious to add the further extension . . . to the central ramp of Fig. 24B,” namely, Olmos’s outer sleeve member 34 as depicted in Olmos’s Figure 8. *Id.* at 103; *see also id.* at 103–105 (discussing outer sleeve member 34). We reproduce below Petitioner’s annotated version of Olmos’s Figure 8:



Pet. 103. 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. 103. According to Petitioner, 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 102–103; Ex. 1006 (Olmos) ¶¶ 35, 81–82, 90, 106–107; Ex. 1002 (Drewry Decl.) ¶¶ 361–362.

Petitioner offers several reasons why a person of ordinary skill in the art would have used Figure 8's extension with the Figure 16 embodiment. Pet. 102–106. First, Petitioner argues that the extension would “allow the rod-shaped actuator to engage the distal wedge member/central ramp more quickly and over a greater distance and/or allow use of a shorter actuator.” Pet. 104 (citing Ex. 1002 (Drewry Decl.), ¶¶ 364–367). Second, Petitioner

argues that this modification would “make the device more robust and serve Olmos’s stated purpose of maintaining minimally invasive surgical procedures, while also maintaining the interconnecting structural components of the primary embodiments.” *Id.* (citing Ex. 1006 (Olmos) ¶¶ 364–366). According to Petitioner, a POSITA would have understood that this modification would not impact the third and fourth ramp portions from extending outwardly from the modified rod receiving extension. *Id.* (citing Ex. 1002 (Drewry Decl.) ¶ 363).

Third, Petitioner argues that combining these embodiments would enhance function by allowing the “rod-shaped actuator to engage the distal wedge member/central ramp more quickly and over a greater distance and/or allow use of a shorter actuator.” *Id.* (citing Ex. 1002 (Drewry Decl.) ¶ 364–366). Petitioner alleges the resulting device would be more robust and permit minimally invasive surgery “while also maintaining the interconnecting structural components of the primary embodiments.” *Id.* Petitioner notes that Olmos teaches that use of an integral extension is advantageous due to use of fewer parts, making manufacturing and use easier and because it enhances both structural alignment and device stability. *Id.* at 104–105 (citing Ex. 1006 (Olmos) ¶¶ 107, 156). Finally, Petitioner alleges that the proposed combination would have been made despite the changes required because of the above-mentioned advantages, and asserts that the POSITA would have added the extension to the distal wedge/central ramp because doing so would improve engagement of the actuator threads over the greatest distance. *Id.* at 105 (citing Ex. 1002 (Olmos), ¶ 367). Petitioner alleges that the combination is a simple substitution of known mechanical features for use in their expected function, and thus, the POSITA

would have had a reasonable expectation of success in combining Figure 8's rod receiving extension into the distal wedge/central ramp of Figures 16–24.¹⁹ *Id.* at 106 (citing Ex. 1002 (Olmos) ¶ 368).

With this brief overview, we turn to analyzing the disputed issues between the parties.

b. 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

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 a reason to use Olmos's Figure 8 extension with Olmos's Figure 16 embodiment. First, as noted by Petitioner's declarant Mr. Drewry in his supporting testimony (*see* Pet. 106), Olmos expressly suggests combining its various embodiments: "Olmos itself 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.'" Ex. 1002 (Drewry Decl.) ¶ 368 (citing Ex. 1006 (Olmos) ¶ 188); *see also* Ex. 1036 (Drewry Reply Decl.) ¶¶ 121–125, 133, 135, 136. We find that Olmos's express teaching that a POSITA should consider combining features from embodiments is a sufficient basis on which to credit Petitioner's motivation to combine argument.

¹⁹ Petitioner alleges at Petition 106 that the proposed combination is "Baynham's tube 27 with Chung." This appears to be a typographical error. In stating and analyzing Petitioner's proposed combination, we rely on the prior discussion regarding Olmos at Pet. 102–105 and cited Ex. 1002 (Drewry Decl.) ¶ 368.

Second, we additionally agree with Petitioner that the proposed combination “amounts to nothing more than the simple substitution of known mechanical features with each performing their known and expected function.” Pet. 106; Ex. 1002 (Drewry Decl.) ¶ 368. 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* Pet. 102–03; Ex. 1006 (Olmos) ¶ 107; Ex. 1007 (Baynham) ¶ 29 (threaded tube 27, visible in Fig. 3); *see also* Pet. 67–69 and Ex. 1002 (Drewry Decl.) ¶¶ 79–80 (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 “would allow the rod-shaped actuator to engage the distal wedge member/central ramp more quickly and over a greater distance and/or allow use of a shorter actuator.” Pet. 104. Petitioner demonstrates that a person of ordinary skill in the art would have understood that this “would increase

connection strength early in expansion” and reduce the risk of the actuator protruding from the far end of the central ramp when the device is expanded. *See, e.g.*, Pet. Reply 44–55; Ex. 1002 (Drewry Decl.) ¶¶ 292–293; Ex. 1036 (Drewry Reply Decl.) ¶¶ 111–115. As the Supreme Court observed in *KSR*, “[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.” 550 U.S. at 419–20 (2007). This is an additional reason why Petitioner has adequately demonstrated a sufficient motivation to combine with a reasonable expectation of success.

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

i. Simple Substitution

As to Petitioner’s argument that using Figure 8’s extension with the Figure 16 embodiment would have been a “simple substitution” (Pet. 106), Patent Owner argues that “[T]he simple substitution rationale does not apply,” because “‘substitution’ refers to replacing a first thing *for a second thing*,” and here “Petitioner does not propose replacing an existing component, but instead proposes *adding* an extension.” PO Resp. 61–62 (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. Pet. 104–105. This qualifies as substituting a first thing (the Figure 16 actuator assembly) for a second thing (Figure 8’s extension and a shorter actuator/screw).

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. 62 (citing Ex. 2031 (Culbert Decl.) ¶ 1206). But as we discussed 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 endplates so the extension fits within the implant when collapsed,” and “reduc[ing] the effectiveness of osseointegration [sic].” PO Resp. 62 (citing Ex. 2031 (Culbert Decl.) ¶¶ 121–22).

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 fails to establish that this speculative concern would have undermined a person of ordinary skill in the art’s reasonable expectation of achieving a spinal implant as claimed. *See* PO Resp. 62. 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. 2031 (Culbert Decl.) ¶ 121.

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.

ii. 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. PO Resp. 42–46. 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, making the device more robust 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. Pet. 104–05, Pet. Reply 41–44.

More specifically, Patent Owner argues that in Olmos’s Figure 16 embodiment, protrusion is not a problem because the distal wedge has an “elongated portion [that] was an intentional design feature added so that an extension would not be needed” and that this elongated portion “provide[s] the necessary additional threading to allow full engagement without the

actuator 210 protruding from the far end of wedge 208.” PO Resp. 45–47. Patent Owner argues that Olmos’s Figures 16B and 18 “depict the implant in the ‘expanded state’” and show that “actuator 210 clearly does not protrude,” “[n]or can it, as the implant includes motion limiting structures . . . to prevent further expansion.” *Id.* at 48 (citing, e.g., Ex. 2031 (Culbert Decl.) ¶¶ 94–96; Ex. 1006 (Olmos) ¶¶ 52, 54, 158, 171). As such, Patent Owner asserts that “Petitioner’s obviousness theory is . . . premised on addressing a ‘protrusion’ issue that does not exist.” *Id.* at 48; *see also* Ex. 2031 (Culbert Decl.) ¶¶ 92–94.

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. 42–43 (emphasis added); *see also id.* at 42–46 (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 moves only *one wedge*. *See* Pet. 105 (proposing insertion of actuator “through an unthreaded opening in the proximal wedge/driving ramp and into a *threaded* opening in the distal wedge/central ramp, thereby making engagement of actuator threads relevant only to the distal wedge/central ramp); Pet. Reply 40–41 (arguing that Patent Owner ignores the Petition’s reliance on Olmos embodiments where the single-threaded actuator is “axially-fixed relative to one ramp”); Ex. 1036 (Drewry Reply Decl.) ¶¶ 111–112 (citing Ex. 1006 (Olmos) ¶ 159 and explaining 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* Pet. Reply 41–44.²⁰ This is because “a single-threaded actuator may protrude from the back of the device significantly when expanded.” Pet. Reply 41–42; Ex. 1036 (Drewry Reply Decl.) ¶¶ 113–120, Ex. 1064 (Hatch Decl.) ¶¶ 67–71. 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 adequate threaded engagement in the collapsed position. *See* Pet. Reply 41–42; Ex. 1036 (Drewry Reply Decl.) ¶¶ 113–120.

²⁰ Patent Owner asserts that Petitioner's Reply “presents copious new evidence and theories that exceed the scope of proper reply, and which was clearly required to be in the Petition,” by arguing that “Olmos' modified design would have a protrusion problem, despite providing no such evidence or explanation in the Petition.” PO Sur-reply 8–9. We disagree and find that Petitioner's Reply contains proper reply to arguments in Patent Owner's Response. *See Corephotonics, Ltd. v. Apple Inc.*, 84 F.4th 990, 1008 (Fed. Cir. 2023). The Petition identifies a concern with making the device more robust, and cites Olmos for the structural advantage gained by using an interconnected components. *See* Pet. 103–105 (citing, *e.g.*, Ex. 1006 ¶ 156). Additionally, Petitioner indicated that its proposed modification would allow for use of a shorter screw, which the Petition identifies as beneficial to mitigate risk of screw protrusion. *See id.* at 104, 73. As we discussed above, in attempting to rebut Petitioner's argument, Patent Owner misdescribed Petitioner's proposed combination. Under the circumstances here, we find that Petitioner's Reply both appropriately elaborates on its argument in the Petition and responds to Patent Owner's counterarguments related thereto.

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. Reply 41–44; Ex. 1036 (Drewry Reply Decl.) ¶¶ 113–20.

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.) ¶ 271; 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 “had unreasonably believed that additional threaded engagement could prevent distal protrusion, he or she would have simply added more threading . . . by extending the threading to the proximal end of the distal wedge 208.” PO Resp. 49. Mr. Culbert asserts that an ordinarily skilled artisan would have elected this approach over adding an extension, because an extension would unnecessarily occupy critical space for bone graft. Ex. 2031 (Culbert Decl.) ¶ 98.

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. 1036 (Drewry Reply Decl.) ¶ 110. 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.” *See In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012). We also note that during 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. This testimony appears to be consistent with 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. 104–05, Pet. Reply 41–44.

On Sur-reply, Patent Owner argues that Petitioner’s proposed combination of Olmos embodiments would “closely resemble” Chung’s design, and there is no protrusion problem with Chung. PO Sur-reply 27–28. 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 bases its argument on Mr. Drewry’s statement that the proposed single-threaded actuator design of Olmos “more closely resemble[s] the actuator in Chung than the dual-threaded actuator” shown in Figure 16. *Id.* at 28 (quoting Ex. 1036 (Drewry Reply Decl.) ¶ 112). Patent Owner mischaracterizes this statement. Mr. Drewry does not say that Petitioner’s proposed combination of Olmos embodiments “more closely resemble[es]” Chung’s *design*, as Patent Owner suggests. *See* PO Sur-reply 27–28. Rather, Mr. Drewry refers to Olmos’s single-threaded *actuator*, and says it “functionally would more closely resemble” Chung’s single actuator than Olmos’s dual-threaded actuator. *See* Ex. 1036 (Drewry Reply Decl.) ¶ 112.

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.

iii. 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 for the stated reasons, e.g., allowing the "rod-shaped actuator to engage the distal wedge member/central ramp more quickly and over a greater distance and/or allow use of a shorter actuator," "make the device more robust," and "maintain[] the interconnecting structural components of the primary embodiments." Pet. 104–105; Pet. Reply 41–47. Patent Owner argues that beyond a certain point, adding threaded engagement between the wedge and actuator "has no noticeable or appreciable [e]ffect on the strength of the threaded connection, because the bolt [actuator] will fail for reasons unrelated to the threaded engagement (e.g., the bolt will simply break in half)." PO Resp. 52; Ex. 2031 (Culbert Decl.) ¶¶ 102–112. Patent Owner asserts that "the strength of the threaded engagement is already well beyond the point of absolute diminishing returns" for connection strength. PO Resp. 57; Ex. 2031 (Culbert Decl.) ¶ 112.

On this record, we find that Petitioner shows 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 in turn would make strengthen the device, including by improving connection strength. *See, e.g.,* Pet. 104; Pet. Reply 41–47; Ex. 1002 (Drewry Decl.) ¶¶ 364, 367–368;

Ex. 2031 (Drewry Reply Decl.) ¶¶ 110–121. Petitioner persuasively explains that the threads are under maximum stress when the user 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* Pet. Reply 46–47; Ex. 1036 (Drewry Reply Decl.) ¶¶ 91–94, 134. We also agree with Petitioner that having the actuator engage with the distal wedge member/central ramp over a greater distance would “make the device more robust,” (*see* Pet. 104–05) and “improve connection strength by supporting the actuator shaft against shear and bending forces.”²¹ Pet. Reply 46–47; Ex. 1002 (Drewry Decl.) ¶¶ 272, 364–365; Ex. 1036 (Drewry Reply Decl.) ¶ 123.

Patent Owner’s argument that additional threaded engagement would have no appreciable effect on the robustness of the implant is unavailing. *See, e.g.*, PO Resp. 50–51; Ex. 2031 (Culbert Decl.) ¶¶ 100–104. As Petitioner and Mr. Drewry demonstrate, Patent Owner’s analysis focuses on the specific issue of “whether the actuator engages sufficient threads when

²¹ Patent Owner argues that Petitioner’s argument regarding supporting the actuator shaft against shear and bending forces is an improper new argument first made on Reply. PO Sur-reply 27–28. We disagree. Mr. Drewry raised this issue in his original declaration (Ex. 1002) at paragraph 271, which Petitioner cites in connection with its argument regarding a motivation to combine Olmos’s embodiments. *See* Pet. 73. Although Mr. Drewry’s paragraph 271 addresses Petitioner’s proposed combination of Chung and Baynham, based on Petitioner’s citation of this paragraph in connection with its obviousness argument based on Olmos, we find it sufficiently clear that Petitioner was arguing that benefits of extensions Mr. Drewry discusses in paragraph 271 apply to extensions generally (not just Baynham’s extension).

the device is in its fully expanded state,” while “ignor[ing] the other strength-related issues associated with these devices.” Ex. 1036 (Drewry Reply Decl.) ¶¶ 71, 95 (explaining that Mr. Culbert’s calculations are based on Olmos’s Fig. 18, which shows the device in its expanded state); Pet. Reply 42–43.

Patent Owner argues that Petitioner’s emphasis on connection strength in early expansion is a “new theory not in the Petition.” PO Sur-reply 29. We disagree. The Petition states that “Fig. 8’s extension ... allow[s] the rod-shaped actuator to engage with the distal wedge member/central ramp **more quickly**,” i.e., in the early stages of expansion. Pet. 104 (emphasis added).

Patent Owner also asserts 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. PO Sur-reply 29. Patent Owner does not support this assertion with citation to evidence of record. But even if the assertion were true, it does not undermine Petitioner’s evidence that the actuator threads will also experience significant stress when the user first starts to rotate the actuator. Pet. Reply 29; *see also* Ex. 1036 (Drewry Reply Decl.) ¶ 94 (“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, as Patent Owner argues, the implant will have “significant clearance upon insertion.” PO Sur-reply 29–30. We understand that by “clearance,” Patent Owner is referring to the space between the implant and the adjacent vertebrae. Patent

Owner asserts that Olmos's Figure 1, reproduced below, shows this "significant clearance":

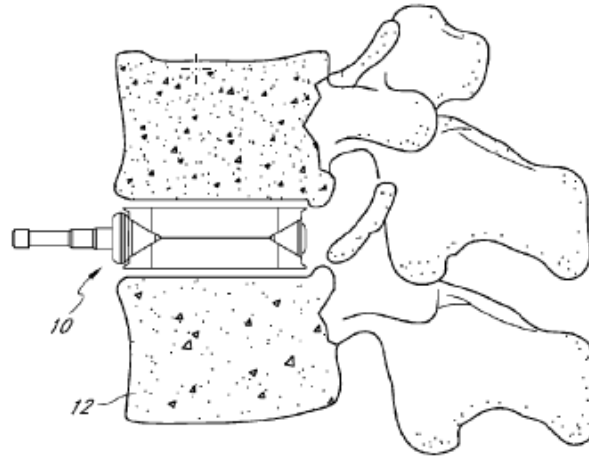
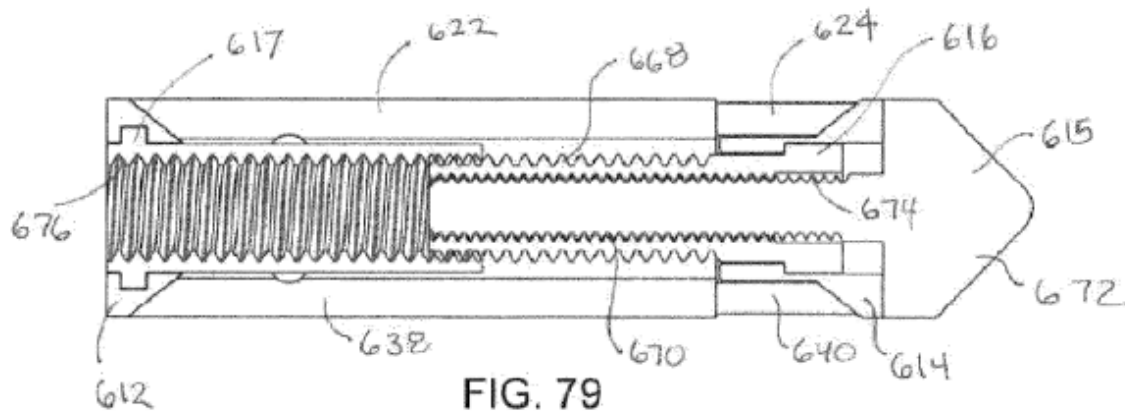


FIG. 1

Id. Olmos describes its Figure 1 as “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 “clearance” surgeons would have typically experienced upon insertion of Olmos’s implant.

Patent Owner also argues that Petitioner’s arguments are “undermined by Petitioner’s own published patent application showing minimal threaded engagement in the collapsed state.” PO Sur-reply 30. Patent Owner cites Figure 79 of Petitioner’s patent application (Butler, Ex. 2024), reproduced below:



PO Sur-reply 30 (citing Ex. 2024 (Butler) ¶¶ 98, Fig. 79). Butler Figure 79 shows a view of an expandable implant in a collapsed state. Ex. 2024 (Butler) ¶¶ 23, 98. Patent Owner’s brief reference to this figure lacks the detail necessary to persuasively show 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 discussed 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.

iv. Comparing Benefits and Drawbacks

Patent Owner argues that Petitioner’s obviousness theory cannot succeed because “[i]n determining whether a proposed modification would have been obvious, Petitioner was required to compare the benefits and drawbacks of the modification,” but did not do so. PO Resp. 63, 59–60 (citing *Arctic Cat Inc. v. Polaris Indus.*, 795 F. App’x 827, 833 (Fed. Cir.

2019)); *see also* PO Resp. 73 (arguing that a POSITA “would have simply used a different screw thread profile over the same length to avoid imparting the major drawbacks of an added extension”). This argument is unavailing, because Patent Owner mischaracterizes *Arctic Cat*. 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 (emphasis added). 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 at trial in the *inter partes* review.²²

Nor has Patent Owner established that the two alleged drawbacks it identifies would have outweighed the benefit of employing the extension. First, Patent Owner argues that “adding an extension would have occupied valuable space” for bone graft material, which is used to improve fusion and healing. PO Resp. 63 (citing Ex. 2031 (Culbert Decl.) ¶ 124). Second, Patent Owner argues that, “assuming [the extension] will be metal,” 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. 65 (citing Ex. 2031 (Culbert Decl.) ¶ 128; Exs. 2027–

²² 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.

2030 (Life Spine press releases and marketing materials)). Patent Owner concludes:

In view of these known disadvantages, a POSITA would not have been motivated to add an extension to Olmos' Figure 16 Embodiment *unless* he or she determined that any potential improvement provided by the extension would at least equal the benefits of having additional open space, particularly the significant benefit of having additional bone graft volume to facilitate long-term structural stability of the vertebrae.

PO Resp. 65–66 (citing Ex. 2031 (Culbert Decl.) ¶ 130).

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. 63–64; 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”) (emphasis removed); Ex. 2022 (Wiggins), 14–15 (the “optimal environment for fusion using cages’ ... include[s]...[u]se of the smallest cage volume (as cage volume increases, graft volume decreases)’ and ‘large amounts of graft’ and ‘maximal graft filling the interspace’”); Ex. 2031 (Culbert Decl.) ¶¶ 124–25. The art also recognized that “more bone graft is expected to provide improved fusion.” Ex. 2031 (Culbert Decl.) ¶ 125.

Nevertheless, the evidence of record does not show that “adding even a short extension would *necessarily* reduce the effectiveness of osseointegration [and] affect the long-term stability of the implant in a patient.” PO Resp. 62 (emphasis added). Instead, we agree with Petitioner that “a POSITA would not understand the minimal volume preserved by omitting an elongated extension to be meaningfully beneficial.” Pet. Reply

47. 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.²³ *See* Pet. Reply 47–48; *see also id.* at 34–35 (quoting Ex. 1007 (Baynham) ¶ 28; citing *id.* ¶¶ 25–26); Ex. 1036 (Drewry Reply Decl.) ¶¶ 87–89).

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. 41. The full trial record does not include such a comparison. In short, the record does not demonstrate that Patent Owner’s alleged drawback caused by Olmos’s Figure 8 extension taking up space would outweigh the benefits Petitioner articulated of that extension.

We also find Patent Owner’s argument “adding even a short extension would ... potentially interfere with fluoroscopy imaging quality” (POR, 62) unavailing. We agree with 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 embodiment in Olmos and the endplates’ upper and lower side

²³ Patent Owner’s references discussing the tradeoff between implant volume and space for bone graft material predate the ’001 patent and Olmos, and were published in the same year as Baynham’s earliest possible priority date. *See* Tr. 62:14–15; *compare* Ex. 2023 (Kandziora), 3 (2004 copyright) and Ex. 2022 (Wiggins), 2 (2003 copyright), *with* Ex. 1001, code 22 (2010 filing date), Ex. 1006 (Olmos), code 60 (earliest possible filing date of 2006), and Ex. 1007 (Baynham), code 63 (earliest possible filing date of 2004).

portions 240/242 in the relied-on Figure 16 embodiment. Pet. Reply 48–49; Ex. 2036 (Drewry Reply Decl.) ¶ 131; Ex. 1006 (Olmos) ¶ 157, Figs. 16A, 16B, 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, the record does not show 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 reasons for using Olmos’s Figure 8 extension with Olmos’s Figure 16 embodiment as demonstrated by Petitioner. Nor is there 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.”).

v. Petitioner’s Additional Arguments

For completeness, we address two 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 advantageous “interconnecting structural components of the primary embodiments” (Pet. 104), we agree with Patent Owner that “the fact that a newly added feature would not adversely affect existing features in a device does not provide a *reason* to add the new feature in the first place.” PO Resp. 60. 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 ‘can be advantageous in that fewer parts are required, which can facilitate manufacturing and use.’” Pet. 104–05. We agree with Patent Owner that this argument is unavailing. PO Resp. 61. 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.* (citing Ex. 2031 (Culbert Decl.) ¶ 117). 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.

c. 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. Accordingly, Petitioner has demonstrated by a preponderance of the evidence that the articulated combination of Olmos’s embodiments teaches or suggests all of the limitations of claims 1–10, including limitation 1[u]/10[o].

2. Whether Olmos Teaches or Suggests the “pair of third grooves” Limitation in Claim 11

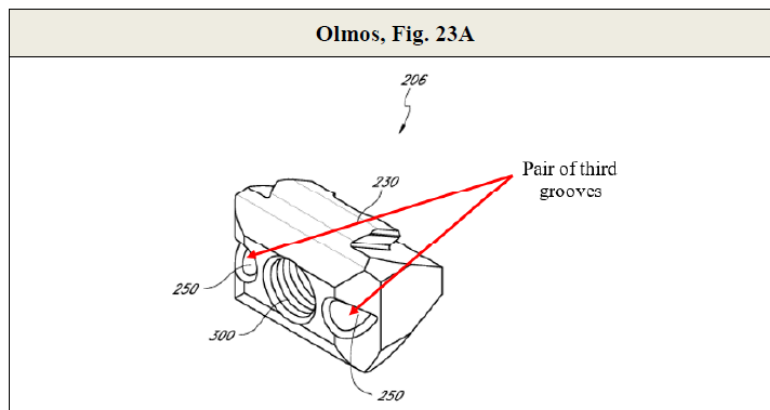
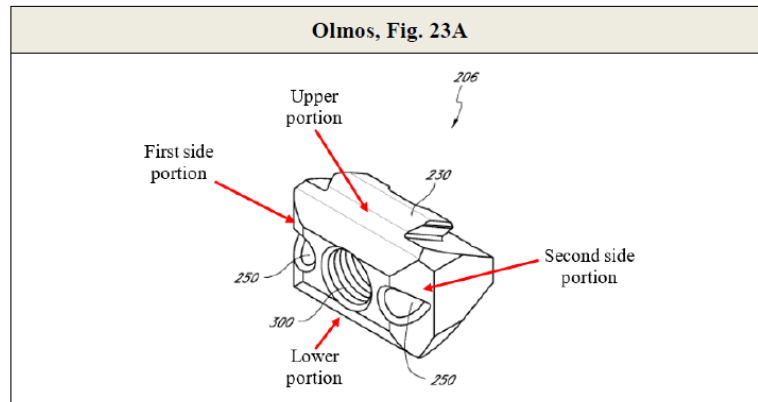
Petitioner provides a limitation-by-limitation analysis alleging that Olmos discloses a surgical method meeting each and every limitation of challenged claim 11. *See* Pet. 113–115. In addition to its challenge of independent claim 1, Patent Owner disputes an additional aspect of Petitioner’s mapping of Olmos to claim 11, namely whether Olmos discloses the claimed “pair of third grooves” recited in limitation 11[b]. *See* PO Resp. 89–96; *see also* Pet. 126 (claims appendix showing claim limitations).

We determine that Petitioner has shown by a preponderance of the evidence that Olmos discloses claim limitation 11[a]. We adopt Petitioner’s undisputed analysis of claim limitation 11[a] as our own. *See* Pet. 113–115; Ex. 1002 (Drewry Decl.) ¶¶ 433–434. Below we address the parties’ arguments directed to disputed limitation 11[b]. We begin by summarizing the parties’ arguments, then we turn to our analysis.

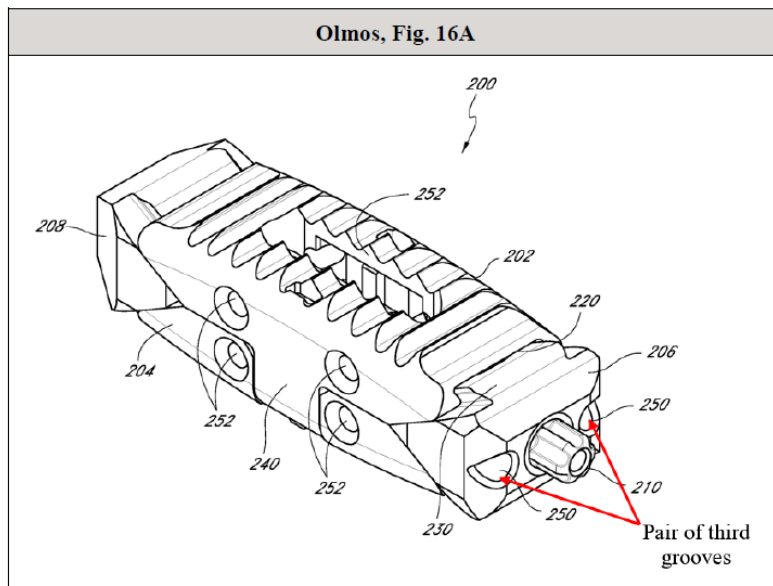
a. Overview of Parties’ Arguments

Petitioner argues that Olmos teaches the “pair of third grooves” limitation because Olmos discloses a driving ramp with “anti-torque structures 250” that “extend[] onto the first and second side portions.”

Pet. 114 (citing Ex. 1006 (Olmos) ¶¶ 161, 177). Petitioner provides two annotated versions of Olmos's Figure 23A, reproduced below:

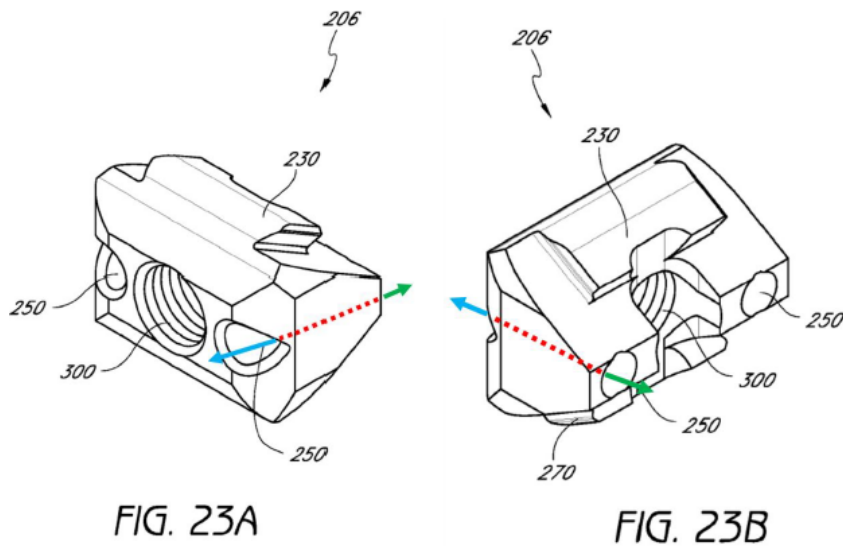


Pet. 114–115 (citing Ex. 1002 (Drewry Dec.) ¶¶ 435–437). Petitioner's annotated versions of Olmos Figure 23A show a driving ramp of an intervertebral implant. Petitioner alleges the anti-torque structures are a pair of third grooves. *Id.* In support, Mr. Drewry opines that a POSITA would have understood the anti-torque structures 250 to be a pair of third grooves extending onto the first and second side portions of the driving ramp in Figure 23A above, and also Olmos Figure 16A, reproduced below.



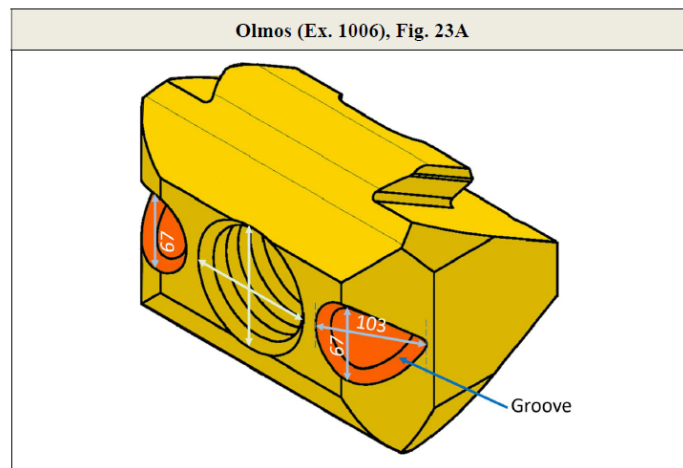
Ex. 1002 (Drewry Decl.) ¶435. Petitioner’s annotated version of Olmos Figure 16A shows a driving ramp of an intervertebral implant.

Patent Owner responds that Olmos’s anti-torque structures are not grooves, but rather holes, as shown below in Patent Owner’s annotated version of Figures 23A and 23B.



PO Resp. 89–90. Patent Owner’s annotated versions of Olmos Figures 23A and 23B show central ramps of intervertebral implants. Patent Owner argues that prior art including Olmos itself distinguishes between holes and grooves. PO Resp. 90 (citing Ex. 2036 (Hsien) ¶ 26; Ex. 1006 (Olmos) ¶¶ 161, 166; and Ex. 2031 ¶ 169 (Culbert Decl.)). Patent Owner acknowledges that Olmos teaches that the holes can instead be indentations, but alleges a POSITA would not understand anti-torque structures identified as “indentations” to be grooves, but rather dents or slight hollows. *Id.* at 90–91. Patent Owner, through Mr. Culbert, contrasts indentations and grooves in the prior art and as construed in other patent cases. *Id.* at 90–92 (citing, *e.g.*, Ex. 2031 (Culbert Decl.) ¶¶ 169–172). Patent Owner argues that grooves may serve a different purpose than anti-torque structures, such as permitting movement of the driving ramp. *Id.* at 93–94.

In reply, Petitioner alleges the intrinsic evidence does not support Patent Owner’s construction of “groove,” but rather supports that an indentation can be a groove, “provided that it is long and narrow – because both constitute ‘depressions.’” Pet. Reply 2, 26–28. Petitioner’s declarant, Mr. Hatch, analyzed the structures shown in Olmos’s Figure 23A, shown below:



Pet. Reply 26–27. Petitioner’s annotated version of Figure 23A above shows the proximal wedge of an intravertebral implant. *Id.* Petitioner notes that Mr. Culbert testified that something is “long and narrow if its ‘length is longer than the width.’” *Id.* at 26 (citing Ex. 1078 (Culbert Deposition), 28:16–17). Petitioner concludes that the anti-torque structures 250 are “grooves” even under Patent Owner’s definition because “Olmos’ anti-torque structure 250 depressions are substantially longer than they are tall.” *Id.* at 26–27 (citing Ex. 1036 (Drewry Reply. Dec.) ¶¶ 55–59; Ex. 1083 (Hatch Third Decl.) ¶¶ 5–10 (explaining measurement process and results). Petitioner further alleges that the function of the anti-torque structures serves the same purpose as grooves in the ’001 patent identified by Patent Owner as used for engaging a tool to help maintain physical control of the implant. *Id.* at 28 (citing PO Resp. 85; Ex. 1036 (Drewry Reply Decl.) ¶¶ 60–62).

Patent Owner replies that Petitioner’s allegations regarding Olmos rely on the embodiment depicting holes, not indentations. PO Sur-reply 32. Moreover, Patent Owner argues the view shown in Olmos’s Figures is not head-on and thus, the optical illusion created obscures that the hole is round, not oblong, and it is implausible that Petitioner or its expert could accurately

measure the structure. *Id.* at 32–34. Patent Owner alleges that it is clear the anti-torque structures are holes because the pins 422 of the deployment tool 400, as shown in Figure 25, are “*cylindrical* because they are intended to fit within the *circular* proximal opening of anti-torque structure 250.” *Id.* at 34. Patent Owner further argues that Petitioner’s functionality argument is irrelevant. *Id.* at 35.

b. Analysis

Applying our construction of “groove,” as “a narrow channel or depression having a greater length than breadth,” we find that Petitioner has met its burden to show that Olmos discloses a “third pair of grooves,” i.e., Olmos’s anti-torque structures 250. Olmos discloses anti-torque structures 250 that “can comprise one or more inwardly extending holes or indentations on the proximal wedge member 206.” Ex. 1006 (Olmos) ¶ 161. For this reason, we are not persuaded by Patent Owner that Petitioner relies solely on an embodiment disclosing holes, as Patent Owner alleges (PO Sur-reply 32). Rather, a POSITA, having read this disclosure, would understand that anti-torque structures could be made as either holes or indentations and that the exemplary diagrams depict embodiments that could be made in either regard. *See also* Ex. 1002 (Drewry Decl.) ¶¶ 248–249. Petitioner’s allegations of anticipation and obviousness cite this disclosure. *See* Pet. 114 (citing e.g., Ex. 1006 (Olmos) ¶ 161).

Further, the evidence of record shows that such indentations are “grooves” as recited in claim 11. *See* Ex. 1036 (Drewry Reply Decl.) ¶¶ 51–54 (citing Ex. 2031 (Culbert Decl.) ¶ 162, n.12 and summarizing Mr. Culbert’s testimony regarding definition of “groove” as a “long, narrow furrow or channel” and “furrow” as a “rut, groove, or narrow depression”));

see also PO Resp. 82, n. 12 (citing Mr. Culbert for definitions). Although Patent Owner attempts to distance itself from the synonymy of these terms by stating that an “‘indentation’ is simply a ‘dent or slight hollow,’” (*see* PO Resp. 90–91, citing Ex. 2031 (Culbert Decl.) ¶ 171), we disagree with the implication that there is a meaningful distinction to be drawn here.

Regarding the channel or depression “having a greater length than breadth,” we are persuaded by Mr. Hatch’s testimony based on the use of a measuring system designed to measure isometric figures that the alleged grooves as represented in Figure 23A are greater in length than width. Ex. 1083 (Hatch Third Decl.) ¶¶ 5–10. Patent Owner’s attorney arguments about the potential inaccuracies due to perspective do not overcome this evidence. *See In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997) (attorney arguments and conclusory statements that are unsupported by factual evidence are entitled to little probative value). We are further unpersuaded by Patent Owner’s argument that Figures 23A and 25B must disclose a circular hole (rather than oblong) because Figure 25 discloses cylindrical pins for engagement. In the scale provided in Figure 25, we are unable to discern whether pins 422 are cylindrical or even sized to fit the corresponding anti-torque structure 250 as depicted in Figure 23A and 23B. Rather, Figure 25 is exemplary, not limiting. Ex. 1006 (Olmos) ¶ 181. We therefore rely on the disclosure in Olmos (Ex. 1006 ¶ 161) and the opinions provided by Mr. Drewry and Mr. Hatch (1002 ¶¶ 248–249; Ex. 1083 (Hatch Third Decl.) ¶¶ 5–10) in reaching our conclusion that, on the full trial record, Petitioner’s evidence meets the preponderance standard.

c. Conclusion

For the reasons we discussed above, we find that Petitioner demonstrates by a preponderance of the evidence that Olmos discloses limitation 11[b], and therefore Olmos renders claim 11 obvious.

3. Conclusion for Obviousness over Olmos

After considering all of the arguments and cited evidence of record, we find that Petitioner demonstrates by a preponderance of the evidence that Olmos renders claims 1–11 unpatentable as obvious.²⁴

III. CONCLUSION²⁵

Based on the information presented, we conclude that Petitioner has demonstrated by a preponderance of the evidence that claims 1–11 are unpatentable.

²⁴ Because we find that Olmos alone renders claims 1–11 unpatentable as obvious, we do not reach Petitioner’s obviousness argument in Ground 5, which alleges obviousness of claims 1–9 and 11 based on the combination of Olmos and Chung.

²⁵ 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).

In summary:

Claims	35 U.S.C. §	Reference(s) /Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1, 3, 4, 10	102(b)/ 103(a)	Chung	10	1, 3, 4
2, 5–9	103(a)	Chung with knowledge of the person of ordinary skill in the art or Olmos		2, 5–9
1–11	103(a)	Chung with Baynham or Baynham and Olmos		1–11
1–11	102(b)/ 103(a)	Olmos	1–11	
1–9, 11	103(a)	Olmos, Chung ²⁶		
Overall Outcome			1–11	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has demonstrated by a preponderance of the evidence that claims 1–11 of U.S. Patent 10,137,001 B2 are unpatentable, and

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.

²⁶ As explained above (*see supra* Section II.J.3 n. 25), we do not reach this ground.

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