

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

XINIAL SYSTEMS GMBH & CO. KG,
Petitioner,

v.

MEDMIX SWITZERLAND AG,
Patent Owner.

IPR2022-01462
Patent 9,010,578 B2

Before JEFFREY N. FREDMAN, TAWEN CHANG, and
CYNTHIA M. HARDMAN *Administrative Patent Judges*.

FREDMAN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Xinial Systems GmbH & Co. KG (“Petitioner”), on September 14, 2022, filed a Petition to institute *inter partes* review of claims 1–3, 9–13, 16, and 17 (“the challenged claims”) of U.S. Patent No. 9,010,578 B2 (Ex. 1001, “the ’578 patent”). Paper 2 (“Pet.” or “Petition”). Medmix Switzerland AG (formerly known as Sulzer Mixpac AG) (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). On March 2, 2023, the Board instituted an *inter partes* review of all claims of the ’578 patent. Paper 7. Subsequently, Patent Owner filed a Patent Owner Response (Paper 12, “PO Resp.”), Petitioner filed a Reply to the Patent Owner Response (Paper 14, “Pet. Reply”), and Patent Owner filed a Sur-Reply (Paper 16, “PO Sur-Reply”). An oral hearing was held on December 4, 2023. A transcript of the hearing has been entered into the record. Paper 26.

For the reasons that follow, on the full trial record, we conclude that Petitioner has proven by a preponderance of the evidence that claims 1–3, 9–13, 16, and 17 of the ’578 patent are unpatentable.

II. REAL PARTIES-IN-INTEREST

Petitioner identifies Kettenbach GmbH and Co. KG, Kettenbach LP, Libertaum GmbH & Co. KG, Libertaum Beteiligungs GmbH, 31med GmbH, 4Kettenbach Inc., and Management Inc. as the real parties-in-interest. Pet. 92. Patent Owner identifies Medmix Switzerland AG as the real party-in-interest. Paper 5, 2.

III. RELATED MATTERS

The Petition states that the ’578 patent is involved in litigation in the Eastern District of New York, specifically *Sulzer Mixpac AG v. Kettenbach GmbH and Co. KG et al*, No. 2:21-cv-06613, filed on Nov. 26, 2021. Pet. 93.

IV. THE '578 PATENT

The '578 patent issued April 21, 2015, from a PCT application filed June 29, 2010. Ex. 1001, codes (45), (22). The '578 patent claims the priority benefit of an EP 09405177 application filed August 9, 2012. *Id.*, code (30).

As background, the '578 patent¹ explains that the “invention relates to a discharge arrangement comprising a cartridge or syringe for at least two components and comprising an accessory part, with one connecting component of a connecting device being arranged on the syringe or cartridge and another on the accessory part.” Ex. 1001, 1:17–21.

The '578 patent explains that the prior art teaches a “discharge arrangement having a connecting device with bayonet closure parts, wherein the bayonet claws are beveled in order to guide the tongue-like projections of the bayonet closure part axially on the accessory part and tighten the latter.” Ex. 1001, 1:25–28. The '578 patent further explains that the prior art teaches a “discharge arrangement comprising a two-component cartridge and a mixer or other accessory part, which have means complementing each other in order to join them together in a given orientation and secure them to each other.” *Id.* at 1:32–36.

We next turn to the invention and reproduce Figure 1 of the '578 patent below.

¹ We cite to the '578 patent using column and line numbers, not the Exhibit page numbers.

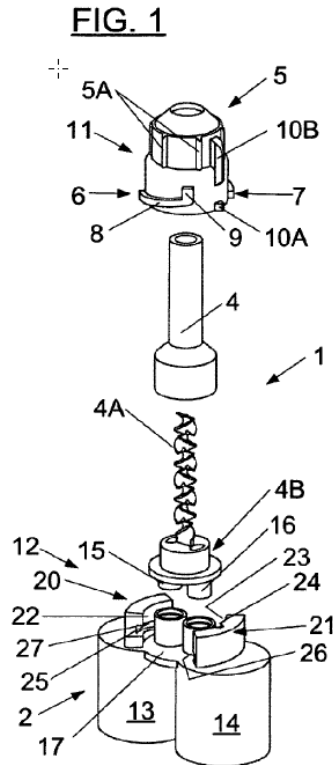


Figure 1, reproduced above, “shows an exploded view of a first illustrative embodiment of a discharge arrangement 1 with a double cartridge 2 and an accessory part 3 [not identified].” Ex. 1001, 5:4–6. The ’578 patent teaches that

Two engagement webs 6, 7 are arranged on two mutually opposite jacket sections of the connector part 5 and are in each case composed of a ramp 8 and of a rotation abutment 9. The ramp 8 extends in each case along about a quarter of the outer circumference of the connector part 5 and has an incline in the direction of the longitudinal axis of the connector part 5.

....

In the inner wall 22, 23 of the socket jaws 20, 21, a guide groove 25, 26 is respectively provided which extends at an incline about the circumference and whose incline and shape correspond substantially to the ramps on the accessory part.

Id. at 5:22–27, 6:14–17.

The '578 patent further teaches that even with the prior art disclosures it is still desirable to make some improvements to a discharge arrangement of this kind in order to further increase its user friendliness. Proceeding from this prior art, a first object is to produce a reliable and rapid connection between the cartridge and the accessory part in such a way that, with little force being applied, the accessory part can be secured sealingly on the cartridge and can also be lifted from the cartridge.

Ex. 1001, 2:12–20.

V. ILLUSTRATIVE CLAIMS

The '578 patent includes one independent claim (claim 1), which is challenged here. Claim 1 is illustrative of the other challenged claims and reads (with bracketed letters added to identify the elements):

1. [1P] A discharge arrangement, comprising:
 - [1A] an accessory part with at least two inlets;
 - [1B] a cartridge for at least two components,
 - [1C] wherein the cartridge has at least two chambers for in each case one of the components and has at least two outlets, complementary to the inlets, for the components,
 - [1D] wherein each of the outlets is adapted to be plugged into one of the inlets, or vice versa; and
 - [1E] a connecting device with a first connecting component, which is arranged on the accessory part, and a second connecting component, which is complementary to the first connecting component and is arranged on the cartridge,
 - [1F] wherein one of the connecting components comprises a socket and the other connecting component comprises a connector part that is adapted to be inserted into the socket along a longitudinal direction,
 - [1G] wherein first engagement parts of a rotational guide placed at an incline to the longitudinal direction are provided on an outer circumference of the connector part, and
 - [1H] corresponding second engagement parts of the rotational guide are provided on the inner circumference of the socket,

- [1I] wherein the connecting components are adapted to be rotated into each other over an effective connecting section along the rotational guide after the connector part has been plugged into the socket,
- [1J] wherein one of the engagement parts comprises guide grooves and the other engagement parts cooperating with the guide grooves comprise at least two ramps, which are designed corresponding to the guide grooves, and
- [1K] wherein the guide grooves and the at least two ramps are adapted to be brought increasingly into engagement with each other while being guided in the axial direction and to be disengaged from each other while being guided over an effective connecting section in the axial direction, such that, when the connection is established, the accessory part is positively guided towards the cartridge in a constrained manner, and such that, when the connection is released, the accessory part is lifted from the cartridge in a positively guided manner to cause a constrained lifting.

Ex. 1001, 9:48–10:23.

VI. ASSERTED GROUNDS

We instituted trial based on the following grounds of alleged unpatentability of claims 1–3, 9–13, 16, and 17 as presented in the Petition:

Claim(s) Challenged	35 U.S.C. §	Reference(s)
1–3, 9–13, 16, 17	103	Keller '574, ² Yu ³
1–3, 16	103	Heusser, ⁴ Yu
10, 11, 13, 17	103	Heusser, Yu, Keller '574

Petitioner also relies on the Declaration of Bruce K. Gates, Ph.D. (Ex. 1003), in support of the asserted grounds. Ex. 1003. Patent Owner filed

² Keller, US 6,769,574, issued Aug. 3, 2004. Ex. 1005.

³ Yu, CA 1,238,023, issued June 14, 1988. Ex. 1006.

⁴ Heusser et al., US 6,161,730, issued Dec. 19, 2000. Ex. 1007.

rebuttal evidence including Drake⁵ and Keller '737⁶ and a Declaration by Daniel P. Brown, Ph.D. (Ex. 2001). Based on the statements of qualifications and curriculum vitae, we find Petitioner's declarant Dr. Gates qualified to provide technical opinions from the perspective of a person of ordinary skill in the art in this proceeding. *See* Ex. 1003 ¶¶ 6–16; Ex. 1004. Also based on the statements of qualifications and curriculum vitae, we find Patent Owner's declarant Dr. Brown qualified to provide technical opinions from the perspective of a person of ordinary skill in the art in this proceeding. *See* Ex. 2001 ¶¶ 7–16; Ex. 2002.

VII. 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. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). The level of ordinary skill in the art can be evidenced by the prior art references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors pertinent to determining the appropriate level of skill in the art include:

(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field. . . . The patent's purpose can also be informative.

Best Med. Int'l, Inc. v. Elekta Inc., 46 F.4th 1346, 1353 (Fed. Cir. 2022) (citations omitted).

⁵ Drake, US 4,538,920, issued Sept. 3, 1985. Ex. 2003.

⁶ Keller, EP 1,440,737 A1, published Jan, 24, 2003 (German language). Ex. 2004.

In our Institution Decision we considered these factors and determined based on the record before us that the proposals of both Petitioner and Patent Owner were consistent with the record and that the difference in the number of years of experience did not impact the decision. Paper 7, 8.

Patent Owner contends that Petitioner’s proposed skill level “is inaccurate because it focuses on [storing, mixing, and/or discharging] ‘one or more substances.’ Pet., 9. That focus disregards the ’578 patent’s own stated field – ‘a discharge arrangement comprising a cartridge or syringe **for at least two components**.’” PO Resp. 38 (citing Ex. 1001, 1:17–21; Ex. 2006 ¶ 19). Patent Owner asserts the

field of mixing components is more complicated than the field of single-component dispensing, both in terms of the physical components necessary for a mixer versus nozzle to dispense, and the chemical properties of the reactive materials being dispensed. Ex.2006, ¶20. The reactive materials being dispensed react quickly versus typical single-component materials (like caulk). This imposes dispensing problems as the viscosity increases for mixing components as they traverse the mixer that are simply not at issue for a single-component material. Ex.2006, ¶¶20-22.

Id.

Petitioner responds that “the two proposed levels of ordinary skill in the art do not affect the outcome—the claims are obvious under either definition.” Pet. Reply 26. Petitioner asserts

If anything, the claims are even more obvious under Patent Owner’s definition. *See McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351 (Fed. Cir. 2001) (“keener appreciation of nuances taught by the prior art” assumed when “level of skill is high”). Additionally, there is no question Dr. Gale qualifies as a POSITA under Patent Owner’s definition. *See, e.g.*, Ex. 1003 ¶¶6-16; Ex. 2021, 14:19-23:13.

Id.

While Patent Owner disputes Petitioner’s proposed skill level, Patent Owner does not identify a specific analytical difference that results from the use of Patent Owner’s proposed skill level. Nonetheless, we will adopt Patent Owner’s skill level as it is not inconsistent with the prior art and expert opinions. Ex. 1003 ¶ 65, Ex. 2006 ¶ 18. We therefore find the person of ordinary skill

would have had a working knowledge of the plural component meter mix dispenser arts pertinent to the ’578 patent. That person would have a bachelor’s degree in mechanical engineering, chemical engineering, or equivalent training, and approximately 5 years of experience working in the field of polymer science and application, particularly with plural component meter mix dispensers. Lack of work experience can be remedied by additional education, and vice versa.

PO Resp. 37.

VIII. CLAIM CONSTRUCTION

We interpret claim terms 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) (2020). Thus, claim terms “are generally given their ordinary and customary meaning” as understood by a person of ordinary skill in the art at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (citations omitted) (en banc).

Here, we construe only those claim terms in dispute. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe 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))); *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011)

(“[C]laim terms need only be construed ‘to the extent necessary to resolve the controversy’”).

If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). It is improper to add an extraneous limitation into a claim, i.e., one that is added wholly apart from any need for the addition to accord meaning to a claim term. *See, e.g., Hogan AB v. Dresser Indus., Inc.*, 9 F.3d 948, 950 (Fed. Cir. 1993). There is a presumption that a claim term carries its ordinary and customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002). To overcome this presumption, the patentee must “clearly set forth” and “clearly redefine” a claim term away from its ordinary meaning. *Bell Atlantic Network Servs., Inc. v. Covad Commc’ns Grp., Inc.*, 262 F.3d 1258, 1268 (Fed. Cir. 2001). The disavowal must be “unmistakable” and “unambiguous.” *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1322 (Fed. Cir. 2012).

The parties dispute the meaning of the term “at least two ramps” in claim 1. This term appears within a claim phrase reciting that “the other engagement parts cooperating with the guide grooves comprise at least two ramps.” Patent Owner argues that “at least two ramps” should be construed “to include ‘at least two webs having respective upper and lower inclined planes of substantially the same width along the webs’ lengths.”

PO Resp. 37. Petitioner responds that we should reject Patent Owner’s construction and give the term “its plain and ordinary meaning.”

Pet. Reply 19.

Patent Owner states the “original claim recited ‘engagement parts’ as a ‘guide placed at an incline’ without specifying a shape. During

prosecution, the Applicant narrowed independent claim 1 to include the recitation of ‘guide grooves’ and ‘at least two ramps.’” PO Resp. 36 (citing Ex. 1002, 334). Patent Owner contends that, based on statements made during prosecution that “the configuration ‘establishes a form fit in each phase of rotation along the increasingly mutually engaging longitudinal section[,]” a “POSITA would have understood from these actions that the ramps are likewise designed as webs with respective upper and lower inclined planes, of substantially the same width along the webs’ lengths, to correspond with the grooves’ inclined planes.” *Id.* (citing Ex. 2006 ¶¶ 31–33). Patent Owner contends “Petitioner’s insistence that the amendment ‘was never about specifying ramps of a particular cross-section,’ instead ‘specifying a form fit between engagement parts,’ is wrong. Pet. Reply, 21-22. It was because the Examiner interpreted the ‘*engagement parts*’ to encompass various cross section shapes that Applicant made the amendment and argument.” PO Sur-Reply 25 (referencing Ex. 1002, 340–41; PO Resp. 36).

Petitioner contends “Patent Owner attempts to improperly deviate from the ordinary meaning of ‘at least two ramps’ and construe this term as ‘at least two webs having respective upper and lower inclined planes of substantially the same width along the webs’ lengths.’” Pet. Reply 19 (citing PO Resp. 37). Petitioner contends

Patent Owner bases this overly narrow construction on how the ramps are depicted in certain ’578 patent figures. *See* POR 32-37. Such evidence is not enough to depart from a term’s ordinary meaning, which is only proper when there is disclaimer or lexicography. *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). The Board should reject Patent Owner’s construction and give “at least two ramps” its plain and ordinary meaning.

Id. Petitioner also contends that Patent Owner’s prosecution history arguments fail because the amendment to include “at least two ramps” “was never about specifying ramps of a particular cross-section. It was about specifying a form fit between the engagement parts.” *Id.* at 21. Petitioner explains that such a form fit can exist with a variety of ramp cross-sections and grooves including semi-circles and therefore does not support the much narrower construction now being proposed by Patent Owner. *Id.* at 21–22.

Patent Owner responds that “Petitioner’s assertion that the ramps do not need to have inclined planes of substantially the same width is also incorrect. Pet. Reply, 20.” PO Sur-Reply 25. Patent Owner contends that “Dr. Brown explained, per the specification, that the ramps have ‘substantially a constant width along their entire length’ corresponding to that of the grooves. Ex.2006, ¶26; Ex.1001, 7:1-4; POR, 32-33. Petitioner’s Reply conveniently ignores this part of the specification, though the omitted description is expressly about ‘ramps 8.’” *Id.* Patent Owner contends

The prosecution amendment narrowed the “*engagement parts ... placed at an incline*” to “*comprise at least two ramps*.” Petitioner’s insistence that the amendment “was never about specifying ramps of a particular cross-section,” instead “specifying a form fit between engagement parts,” is wrong. Pet. Reply, 21-22. It was because the Examiner interpreted the “*engagement parts*” to encompass various cross-section shapes that Applicant made the amendment and argument. *See* Ex.1002, 340-41; POR, 36. Following Petitioner’s theory, Applicant’s amendment adding “*ramps*” would not have done anything to “clarify the structure and effect” (versus Colin⁷ per the Office Action). Ex.1002, 338; POR, 36. In reality, Applicant’s amendment/argument overcame the use of Colin. Ex.1002, 353.

⁷ During prosecution, the Examiner used Colin, U.S. Patent No. 5,033,650 (“Colin”; Ex. 1010), to reject the claims. *See, e.g.,* Ex. 1002, 338. The ’578 patent discusses Colin. *See* Ex. 1001, 1:23–2:20.

Id. at 25–26.

We agree with Petitioner that the term “at least two ramps” should be construed using its plain and ordinary meaning. We recognize that the Specification and Figure 1 of the ’578 patent describe an embodiment where “the ramp 8 and the guide groove 25, 26 have substantially a constant width along their entire length.” Ex. 1001, 7:1–2, Figure 1 (emphasis omitted). But the Specification of the ’578 patent also explains the “engagement parts cooperating with the guide grooves preferably comprise at least two ramps, which are designed corresponding to the guide grooves. In particular, the thickness of the ramps in the longitudinal direction preferably corresponds substantially to the width of the guide groove.” Ex. 1001, 3:25–29.

The Specification further states a guide groove “is respectively provided which extends at an incline about the circumference and whose incline and *shape* correspond substantially to the ramps on the accessory part.” Ex. 1001, 6:14–17 (emphasis added). The use of the word “shape” by the Specification is reasonably understood to suggest that no particular shape is required and that the guide groove broadly encompasses any shape that would function for constrained lifting. That is, the Specification does not require a particular shape for the ramps with inclined planes of the same width.

And although Patent Owner’s argument that the “at least two ramps” require “inclined planes of substantially the same width” has a basis in the Specification and in the prosecution history, Patent Owner did not choose to amend the claim to include this limitation either before the Patent Examiner or during this *inter partes* review proceeding. “Even when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit

the claim scope using ‘words or expressions of manifest exclusion or restriction.’” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004). “[I]t is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.” *Id.*, 358 F.3d at 913. No such clear intention is present in either the Specification or claims of the ’578 patent.

In the prosecution history, the distinction being made by the amendment to ramps placed at an incline is to distinguish a prior art reference because “[t]here is nothing in Colin for either engagement parts to act against in order to lift the accessory part from the cartridge.” Ex. 1002, 341 (underlining omitted). The amendment to “ramps” had nothing to do with a requirement or need for the engagement parts to have “substantially the same width along the webs’ lengths” but rather simply to provide “the ability that when the connection is released, the accessory part is lifted from the cartridge in a positively guided manner.” Ex. 1002, 341. Patent Owner’s expert Dr. Brown has explained that “it was important to include ramps that were able to act against another surface ‘in order to lift the accessory part from the cartridge.’” Ex. 2006 ¶ 31 (citing Ex. 1002, 341). Dr. Brown explains that the “claimed ramps are likewise designed as webs with inclined planes corresponding to inclined planes of the guide grooves.” *Id.*

After this amendment, the Examiner continued to apply prior art and the Appellant’s response on Nov. 3, 2014 focused on the accessory part being “lifted from the cartridge in a positively guided manner to cause a constrained lifting.” Ex. 1002, 386. But in this amendment again, there was no argument requiring any particular shape of the ramps nor does the evidence show that ramps of other shapes would not provide lifting in a

positively guided manner to cause constrained lifting.⁸ Therefore, the prosecution history does not support Patent Owner’s argument that ramps necessarily have “substantially a constant width along their entire length” and does not provide a reason to incorporate this limitation from the Specification. “[T]he prosecution history of the . . . patent, to the extent it is in the record on appeal, does not clearly and unmistakably restrict the meaning of this claim term.” *ResQNet.com, Inc. v. Lansa, Inc.*, 346 F.3d 1374, 1384 (Fed. Cir. 2003).

For these reasons, we agree with Petitioner that the term “at least two ramps” should be construed using its plain and ordinary meaning. This understanding is consistent with that of Patent Owner’s expert, Dr. Brown, who explains ramps “as webs with inclined planes corresponding to inclined planes of the guide grooves” (Ex. 2006 ¶ 31). Dr. Brown’s understanding is consistent with the requirement of claim 1 of the ’578 patent to enable constrained lifting in a positively guided manner. We do not agree with Patent Owner and are not persuaded by Dr. Brown that inclined planes having “substantially the same width along the webs’ lengths” are required by the Specification or claim 1 of the ’578 patent or supported by the prosecution history, and do not read this limitation into a claim entirely lacking this language.

IX. ANALYSIS

A. Introduction

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is

⁸ For example, as discussed extensively below, Yu’s ramps cause constrained lifting in a positively guided manner while having a shape different than that argued by Appellant.

unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). 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).

The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness.⁹ *Graham*, 383 U.S. at 17–18. The obviousness inquiry also typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)). A petitioner cannot prove obviousness with “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Rather, a petitioner must articulate a sufficient reason why a person of ordinary skill in the art would have combined the prior art references. *In re NuVasive*, 842 F.3d 1376, 1382 (Fed. Cir. 2016).

We analyze the asserted grounds of unpatentability in accordance with these principles to determine whether Petitioner has met its burden to

⁹ The parties did not present arguments or evidence related to objective indicia of nonobviousness. Therefore, objective evidence of nonobviousness does not constitute part of our analysis in this Decision.

establish by a preponderance of evidence the unpatentability of claims 1–3, 9–13, 16, and 17 of the '578 patent.

B. Overview of the Asserted Prior Art

1. *Keller '574 (Ex. 1005)*

Keller '574¹⁰ is an issued US patent that describes a “a dispensing assembly having coded attachment of an accessory to a dispensing device, particularly attachment of a mixer to a multiple component cartridge.”

Ex. 1005, 1:21–24. Keller '574 explains that:

There exists a need to connect and attach a mixer or accessory to a multiple component cartridge or dispensing device in a predetermined orientation, such as when cartridge outlets or mixer inlets are of a different size for different relative mixing ratios or when special high ratio mixers are used for greater mixing efficiency and when mixers or accessories are refitted for reuse.

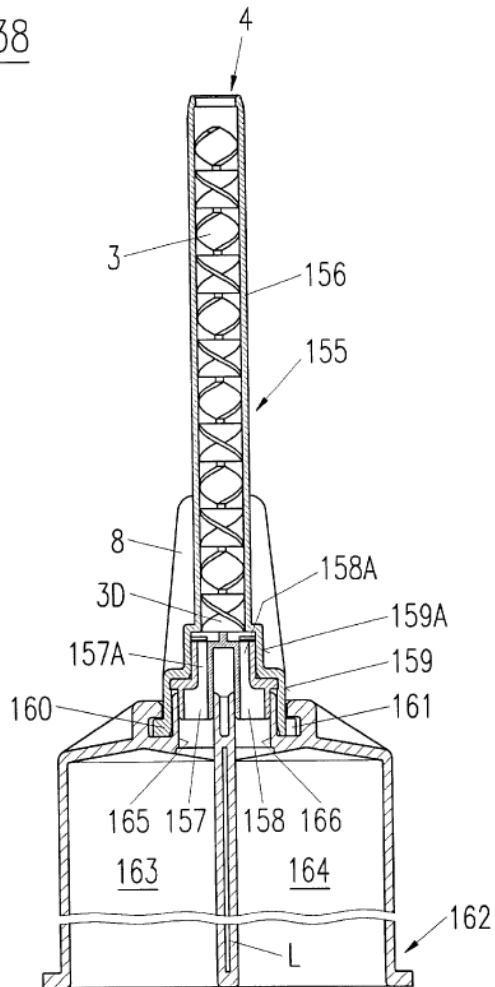
Ex. 1005, 1:46–53. Keller '574 teaches “a cartridge for a mixer having a plurality of inlets. The cartridge includes a plurality of chambers each having an outlet formed at a threaded flange for engagement with the inlets of the mixer, the threaded flange receiving a threaded coupling ring.”

Ex. 1005, 2:48–52.

Figure 38 of Keller '574, reproduced below, “shows a mixer-cartridge assembly with a mixer **155** with a mixer housing **156**, outlet **4** and integral internal mixer parts comprising two separate inlets **157** and **158** ending into a disc-shaped flange.” Ex. 1005, 11:45–48.

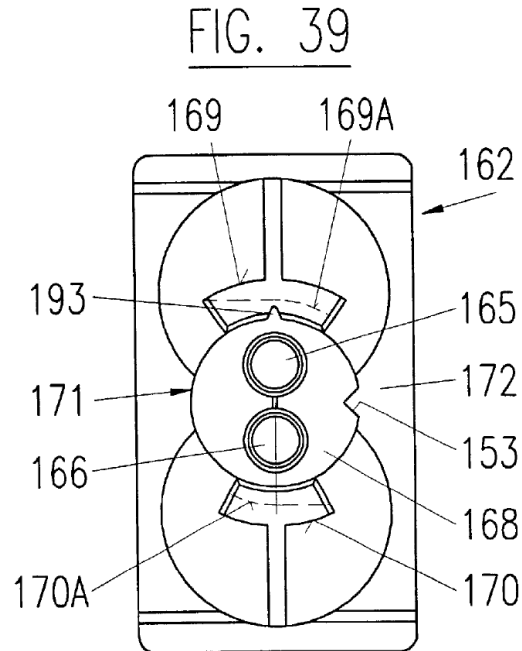
¹⁰ We cite to the Keller '574 column and line numbers, not the Exhibit page numbers.

FIG. 38



Keller '574 explains that the “mixer housing **156**” comprises “two lateral ends of which are formed as bayonet lugs **160** and **161**” that “have inclined parts, not shown, so as to enforce the locking and sealing ability by an axial force. Corresponding inclined parts, not shown, may also be located on the corresponding surface of the cartridge sector shaped bayonet sockets.” Ex. 1005, 11:56–12:12.

In Figure 39 of Keller '574, reproduced below, “the bayonet means at the cartridge comprises two diametrically opposed sector-shaped bayonet sockets **169** and **170** acting as bayonet prongs for the bayonet lugs of the mixer.” Ex. 1005, 12:18–21.



As shown in Figure 39, Keller '574 teaches “the passages of the bayonet sockets **169** and **170** commence as straight passages but become curved from the mid point onwards so as to achieve a greater strength against bayonet lug axial forces.” Ex. 1005, 12:26–29.

2. *Yu (Ex. 1006)*

Yu¹¹ is an issued Canadian patent that “relates to improvements in the mounting of a removable nozzle.” Ex. 1006, 1. Yu teaches “that the difficulties previously experienced in the mounting of the nozzle can be overcome by forming a coarse thread connection between the nipple and nozzle which will seat the nozzle on the nipple in response to a rotation of less than 90°.” Ex. 1006, 3.

¹¹ We cite to the Yu page numbers, not the Exhibit page numbers.

Figure 3 of Yu is reproduced below:

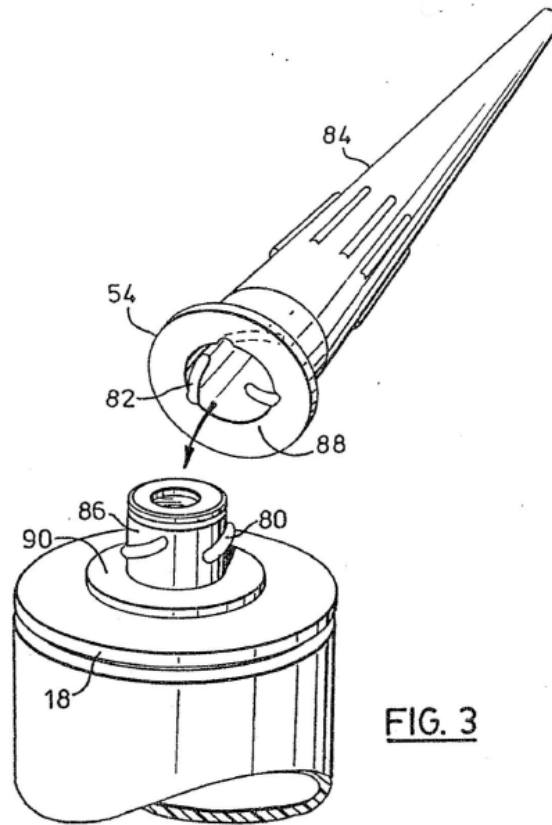


Figure 3 shows

coarse male thread elements 80 and female thread grooves 82 respectively. The threads 80 and grooves 82 have three starts which are spaced 120° from one another and extend through an arc of 60° . In use, the nozzle 84 can be positioned on the nipple 86 and by rotating the nozzle through 60° its [sic] free end 88 will be wedged against the shoulder 90 of the end wall 18.

Ex. 1006, 11. Yu explains that “that it is not necessary to provide an interlock between the nozzle and the nipple which is sufficient to resist the pressure within the cartri[d]ge in use because the flange 54 of the nozzle is engaged by the tangs of the caulking gun.” Ex. 1006, 9. Yu states the tangs of “the caulking gun serve[] to prevent the nozzle from becoming separated from the body during the caulking operation.” Ex. 1006, 9.

3. *Heusser*¹² (Ex. 1007)

Heusser is an issued US patent that describes “a mixing dispensing of a plurality of flowable components from a multiple chambered vessel and . . . uses of the apparatus.” Ex. 1007, 1:5–8. Figures 2 and 3 of Heusser are reproduced below:

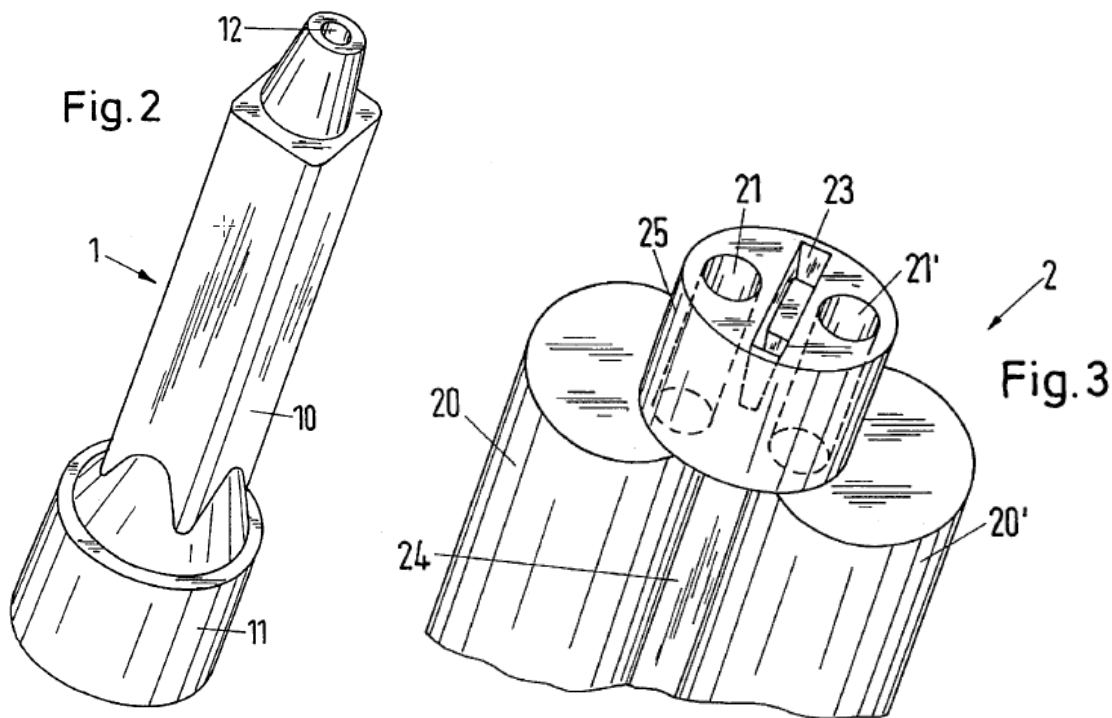


Figure 2 shows “a housing **1** which can be placed onto a vessel **2** with an outlet opening **12** at its tip for mixed components, with the housing **1** having a transition part **11** which can be coupled onto the vessel **2**.” Ex. 1007, 2:43–47. Figure 3 shows a cartridge that “comprises two chambers **20**, **20'** (partition wall **24**) for the Storage of two components to be mixed and a connection part **22** [not shown] with an inner screw thread **25** . . . which forms the counterpart to the outer screw thread **15'** of the coupling-on means **15**.” Ex. 1007, 2:57–62.

¹² We cite to the Heusser column and line numbers, not the Exhibit page numbers.

C. Ground 1: Obviousness Over Keller '574 and Yu

Petitioner contends that claims 1–3, 9–13, 16, and 17 would have been obvious over Keller '574 and Yu. Pet. 11–56. Petitioner provides a detailed analysis of independent claim 1 and then explains where the claim limitations of dependent claims 2, 3, 9–13, 16, and 17 are found within the prior art. *Id.* at 44–56.

We begin with Petitioner's contentions on claim 1, noting where we agree with and adopt any undisputed analysis by the Petitioner, and then move to our analysis, which addresses Patent Owner's counterarguments. Although Patent Owner challenges only certain portions of Petitioner's obviousness combination, in light of Petitioner's burden and for completeness we address each element of claim 1. We note that Patent Owner has not provided separate argument on the patentability of the challenged dependent claims.

1. *Claim 1*

a) *[1P]: "A discharge arrangement, comprising:"*

Petitioner asserts "Keller ['574] discloses 'a mixer-cartridge assembly' (discharge arrangement), including a mixer 155 and a cartridge 162. Ex. 1005, 11:45-12:17, Fig. 38; Ex. 1003, ¶92." Pet. 26.

Patent Owner does not dispute that Keller '574 teaches or suggests limitation [1P]. *See generally* PO Resp. We agree with and adopt Petitioner's undisputed analysis.

b) *[1A]: "an accessory part with at least two inlets;"*

Petitioner asserts that Keller '574 teaches that "mixer 155 includes 'two separate inlets 157 and 158' that are inlets to the accessory part. Ex. 1005, 11:45-51, Figs. 38, 40; Ex. 1003, ¶93." Pet. 26.

Patent Owner does not dispute that Keller '574 teaches or suggests limitation [1A]. *See generally* PO Resp. We agree with and adopt Petitioner's undisputed analysis.

c) [1B]: “a cartridge for at least two components,”

Petitioner asserts “Keller ['574] discloses a cartridge 162. . . . having ‘two cylindrical containers 163 and 164.’ Ex. 1005, 12:13-16, Fig. 38. Each container 163, 164 houses a separate chemical component (e.g., a chemical fluid material). Ex. 1005, 1:21-24, 5:34-37, 6:54-58, 17:40-50, 18:48-49; Ex. 1003, ¶94.” Pet. 27.

Patent Owner does not dispute that Keller '574 teaches or suggests limitation [1B]. *See generally* PO Resp. We agree with and adopt Petitioner's undisputed analysis.

d) [1C]: “wherein the cartridge has at least two chambers for in each case one of the components and has at least two outlets, complementary to the inlets, for the components,”

Petitioner asserts “Keller ['574]'s ‘cartridge 162 has two cylindrical containers 163 and 164,’ or chambers, that contain the chemical components described for [1B]. *Supra* § IV.A.4.c; Ex. 1005, 12:13-16, 17:40-50; Ex. 1003, ¶95.” Pet. 28. Petitioner asserts that “[e]ach of these container chambers also has an outlet associated with it (i.e., female outlets 165 and 166). Ex. 1005, 12:13-16; Ex. 1003, ¶95.” Pet. 28. Petitioner asserts “[t]hese outlets are complementary to the inlets on the accessory part—they ‘receiv[e] and seal[] over the separate male inlets 157 and 158.’ Ex. 1005, 12:13-16, Figs. 38.” Pet. 29.

Patent Owner does not dispute that Keller '574 teaches or suggests limitation [1C]. *See generally* PO Resp. We agree with and adopt Petitioner's undisputed analysis.

- e) [1D]: “wherein each of the outlets is adapted to be plugged into one of the inlets, or vice versa; and”

Petitioner asserts “[e]ach of Keller [’574]’s male inlets 157, 158 is adapted to be plugged into one of female outlets 165, 166 . . . Ex. 1005, 12:13-16, 5:55-64, Fig. 38; Ex. 1003, ¶96.” Pet. 30.

Patent Owner does not dispute that Keller ’574 teaches or suggests limitation [1D]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

- f) [1E]: “a connecting device with a first connecting component, which is arranged on the accessory part, and a second connecting component, which is complementary to the first connecting component and is arranged on the cartridge,”

Petitioner asserts “Keller [’574] discloses a mixer 155 with a larger diameter 159 and two bayonet lugs 160, 161, as well as a cartridge 162 with two bayonet sockets 169, 170. Ex. 1005, 11:56-60, 12:18-22, Figs. 38-40; Ex. 1003, ¶97.” Pet. 31. Petitioner asserts

it would have been obvious to modify Keller [’574] by applying Yu’s male-thread-element design to Keller [’574]’s two bayonet lugs and by applying Yu’s female-thread-groove design to the corresponding passages in Keller [’574]’s two bayonet sockets. Ex. 1003, ¶97. Under this combination, the mixer 155 would still have the larger diameter 159 component, but the two bayonet lugs would be replaced with two protruding male threads positioned at an inclined angle, and the passages in these thread-groove sockets would be angled such that they complement and receive the male threads. Ex. 1003, ¶97. The male threads and larger diameter component 159 combine to form a “first connecting component” on the mixer 155 (accessory part), and the cartridge’s thread-groove sockets and angled passages inside them combine to form a “second connecting component.” Ex.

1003, ¶97. The first and second connecting components, together, form a “connecting device.” Ex. 1003, ¶97.

Pet. 31.

Patent Owner does not dispute that Keller ’574 teaches or suggests limitation [1E]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

g) [1F]: “wherein one of the connecting components comprises a socket and the other connecting component comprises a connector part that is adapted to be inserted into the socket along a longitudinal direction,”

Petitioner asserts that Keller ’574 discloses “one connecting component with two thread-groove sockets 169, 170 that form a socket for larger diameter 159, which is a connector part on the other connecting component. Ex. 1005, 11:51-53, 12:18-32, Figs. 38-40; Ex. 1003, ¶99.” Pet. 31–32. Petitioner asserts a “POSITA would have understood that larger diameter 159 is adapted to be inserted into the socket formed by thread-groove sockets 169, 170 along a longitudinal direction in the Keller [’574]/Yu apparatus.” Pet. 33–34 (citing Ex. 1003 ¶ 100).

Patent Owner does not dispute that Keller ’574 teaches or suggests limitation [1F]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

h) [1G]: “wherein first engagement parts of a rotational guide placed at an incline to the longitudinal direction are provided on an outer circumference of the connector part, and”

Petitioner asserts that

Keller [’574]’s two bayonet lugs 160, 161 are provided on an outer circumference of larger diameter 159. Ex. 1005, 11:56-60, 12:8-12, 12:18-25, Figs. 38, 40; Ex. 1003, ¶102. Yu’s male

thread elements 80 are first engagement parts of a rotational guide placed at an incline to the longitudinal direction and are provided on an outer circumference of the nipple 86. Ex. 1006, 4, 12, 16 (disclosing that male thread elements 80 “extend through an arc of 60°” and are one part of a coarse thread connection that “will seat the nozzle on the nipple in response to a rotation”), Fig. 3; Ex. 1003, ¶102.

Pet. 35. Petitioner asserts the combination of Keller ’574 and Yu suggests that “the inclined male thread elements are similarly provided on an outer circumference of larger diameter 159 and disclose first engagement parts of a rotational guide placed at an incline to the longitudinal direction, rendering [1G] obvious. Ex. 1003, ¶103.” Pet. 36.

Patent Owner does not dispute that Yu teaches or suggests limitation [1G]. *See generally* PO Resp. Patent Owner does dispute whether there would have been a reason to combine the device of Keller ’574 and Yu. PO Resp. 40. We will address this argument below as argued by Patent Owner. *Id.* at 41.

- i) [1H]: “corresponding second engagement parts of the rotational guide are provided on the inner circumference of the socket,”

Petitioner asserts “Keller [’574]’s bayonet sockets 169, 170 include passages, into which bayonet lugs 160, 161 are rotated. Ex. 1005, 11:51-53, 12:18-32, Figs. 38-40; Ex. 1003, ¶104.” Pet. 37. Petitioner further asserts that “Yu discloses female thread grooves 82 on the inner circumference of the socket, which ‘is proportioned to receive said discharge nipple,’ as depicted in Figure 3, and amounts to a thread-groove socket with a coarse thread connection that ‘will seat the nozzle on the nipple in response to a rotation.’ Ex. 1006, 4, 6, 16, Fig. 3; Ex. 1003, ¶104.” Pet. 37.

Patent Owner does not dispute that Yu teaches or suggests limitation [1H]. *See generally* PO Resp. Patent Owner does dispute whether there would have been a reason to combine the device of Keller '574 and Yu. PO Resp. 40. We will address this argument below as argued by Patent Owner. *Id.* at 41.

- j) [1I]: “wherein the connecting components are adapted to be rotated into each other over an effective connecting section along the rotational guide after the connector part has been plugged into the socket,”

Petitioner asserts “Keller [’574] discloses that bayonet lugs 160, 161 of larger diameter 159 are adapted to be rotated into the passages in bayonet sockets 169, 170 after larger diameter 159 has been plugged into the socket formed by bayonet sockets 169, 170.” Pet. 39. Petitioner asserts

Yu discloses that, to attach the nozzle to the cartridge, the nozzle is first “positioned on the nipple 86” and then rotated 60° such that nipple 86 is rotated into the socket over an effective connecting section along the rotational guide formed by male thread elements 80 and female thread grooves 82 after the top portion of nipple 86 (where the nipple lacks male thread elements) has been plugged into the socket. Ex. 1006, 12, Fig. 3; Ex. 1003, ¶107.

Pet. 39–40.

Patent Owner does not dispute that Yu teaches or suggests limitation [1I]. *See generally* PO Resp. Patent Owner does dispute whether there would have been a reason to combine the device of Keller '574 and Yu. PO Resp. 40. We will address this argument as argued by Patent Owner. *Id.* at 41.

- k) [1J]: “wherein one of the engagement parts comprises guide grooves and the other engagement parts cooperating with the guide grooves comprise at least two ramps, which are

*designed corresponding to the guide grooves,
and”*

Petitioner asserts “in the combined Keller [’574]/Yu apparatus, the female thread grooves comprise guide grooves, and the male thread elements constitute multiple ramps that rotate into and cooperate with the female thread grooves (i.e., the male thread elements are designed corresponding to the thread grooves). Ex. 1006, 16.” Pet. 41.

Patent Owner does not dispute that Yu’s engagement parts cooperate regarding limitation [1J], but Patent Owner does dispute what the term “at least two ramps” means as discussed in detail in the claim interpretation section. *See generally* PO Resp., especially PO Resp. 31–37. Patent Owner also disputes whether there would have been a reason to combine the device of Keller ’574 and Yu. PO Resp. 40. We will address this argument below as argued by Patent Owner. *Id.* at 41.

- l) [1K]: *“wherein the guide grooves and the at least two ramps are adapted to be brought increasingly into engagement with each other while being guided in the axial direction and to be disengaged from each other while being guided over an effective connecting section in the axial direction, such that, when the connection is established, the accessory part is positively guided towards the cartridge in a constrained manner, and such that, when the connection is released, the accessory part is lifted from the cartridge in a positively guided manner to cause a constrained lifting.”*

Petitioner asserts

Keller [’574]’s bayonet lugs 160, 161 and bayonet sockets 169, 170 can be brought increasingly into engagement with each other while being guided in the axial direction such that, when the connection is established, mixer 155 is positively guided towards cartridge 162 in a constrained manner. Ex. 1005, 12:8-12, 12:18-

29; Ex. 1003, ¶110. A POSITA would have also understood that mixer 155 is removed from cartridge 162 by reversing the attachment steps, which involves counter-rotating bayonet lugs 160, 161 out of bayonet sockets 169, 170. Ex. 1003, ¶110.

Pet. 42. Petitioner asserts “Yu’s ‘female thread grooves 82’ and ‘coarse male thread elements 80’ are adapted to be brought increasingly into engagement with each other—Yu discloses that the female thread grooves are ‘adapted to threadably engage the male thread elements’ upon ‘rotating the nozzle through 60.’ Ex. 1006, 12, 16.” Pet. 42. Petitioner asserts “Yu also discloses that removing the nozzle merely requires ‘rotat[ing] the nozzle through 60° in the opposite direction,’ which disengages the guide grooves and the ramps from each other. Ex. 1006, 12; Ex. 1003, ¶112.” Pet. 43.

Patent Owner does dispute that Yu teaches or suggests the constrained lifting requirement limitation [1K]. *See* PO Resp. 75–81. Patent Owner also disputes whether there would have been a reason to combine the device of Keller ’574 and Yu. PO Resp. 40. We will address these arguments below as argued by Patent Owner. *Id.* at 41.

m) Reason to combine

Petitioner asserts “applying Yu’s coarse thread design to Keller [’574] adds a mechanical advantage that applies *both* when the mixer is being attached and removed from the cartridge. Ex. 1003, ¶85.” Pet. 21.

Specifically, Petitioner asserts:

Keller [’574] uses inclined surfaces to help guide the mixer toward the cartridge during attachment. Ex. 1005, 12:8-12. And Keller ’196 uses inclined surfaces to help guide the mixer away from the cartridge during removal. Ex. 1009 (Keller ’196), 8:30-33. But Yu provides this benefit *during both attachment and removal*, which would have motivated a POSITA to use this design. Ex. 1003, ¶89. Indeed, it was standard in the art to use multi-start threads on cartridges to allow an accessory part to be

attached and detached through rotation. *See* Ex. 1017 (using Luer locks to achieve this functionality for syringes); Ex. 1003, ¶89.

Pet. 23–24. Petitioner asserts “a POSITA would have known that Yu’s design would also accommodate the types of materials discharged by the Keller [’574] apparatus (i.e., there would be an expectation of success in the combination in terms of the material being discharged). Ex. 1003, ¶91.”

Pet. 25. Petitioner asserts “for reinforcement, Yu discloses ‘tang’s on the dispenser that engage the nozzle during dispensing ‘to prevent the nozzle from becoming separated from the body during the caulking operation.’ Ex. 1006, 10. If desiring such reinforcement, a POSITA would have been motivated to use these tangs on the Keller [’574] apparatus. Ex. 1003, ¶91.”

Pet. 25. Lastly, Petitioner asserts a “POSITA would have considered the Yu modification predictable and reasonably expected its success because threads were straightforward to implement and commonly understood to provide a mechanical advantage when moving two components relative to each other axially. Ex. 1003, ¶90.” Pet. 24.

Patent Owner disputes Petitioner’s motivation to combine arguments. *See* PO Resp. 40–41. As further discussed below, considering all of the arguments and cited evidence of record, we find that Petitioner has met its burden to demonstrate unpatentability of the claims based on the combination of Keller ’574 and Yu.

2. *Analysis*

a) *Particularity and Yu’s tangs*

(1) *Patent Owner’s position*

Patent Owner contends that the “the Board’s conclusion that Keller ’574’s description of locking and sealing locations at the bayonet interface

would have been sufficient for selecting tang locations constitutes an invalidity argument that was ‘never presented by the petitioner and not supported by record evidence.’ *In re Magnum Oil Tools Int’l*, 829 F.3d 1364, 1381 (Fed. Cir. 2016).” PO Resp. 39. Patent Owner contends that “the Board assumed, without deciding, that the nebulous use of Yu’s tangs ‘on’ the cartridge was correct, and required PO to prove that it would *not* have been obvious. This constitutes the very type of improper burden shifting that the Federal Circuit warned against. *See In re Magnum Oil Tools Int’l*, 829 F.3d at 1378-79.” *Id.* at 40.

Patent Owner also contends that a “POSITA would not have known from the Petition how the tangs would be combined with Keller ’574 or Heusser, particularly considering the ‘hundreds of different designs’ that a POSITA could implement with or without tangs, and ‘dozens of varieties of tangs that could be implemented.’” PO Resp. 67 (citing Ex. 2021, 94:5–95:20; 97:15–98:2). Patent Owner contends that “[t]his is particularly relevant where even Dr. Gale did not have knowledge of the rear-mounted dispenser systems utilized with the Keller ’574 and Heusser cartridges.” *Id.* (citing Ex. 2021, 56:10–57:3, 65:3–11, 81:5–84:9).

Patent Owner contends that a “POSITA would understand from the entirety of Yu’s disclosure that tangs are relied upon for operation in use in cooperation with a corresponding enlarged flange on the detachable nozzle. This is a further reason why any ground that omits tangs must fail.” PO Resp. 67–68 (citing Ex. 2006 ¶¶ 174–75). Patent Owner contends that, “[w]ithout the flange-nozzle interaction, Yu’s nozzle (with coarse threading to seat onto the cartridge’s nipple for mounting into the caulk gun) would backdrive from the cartridge during use from the pressure present.” *Id.* (citing Ex. 2006 ¶ 177). Patent Owner contends that “Petitioner **does not**

ever even mention, or acknowledge, the fundamental necessity of the enlarged flange on the nozzle to engage the tangs of the magazine-mount caulk gun. Therefore, the combinations would not work as proposed.” *Id.* at 69 (citing Ex. 2006 ¶¶ 178–79). Patent Owner that contends “nothing in the Petition that indicates a POSITA would have had a reasonable expectation of success in applying Yu’s tangs ‘on’ either Keller ’574’s or Heusser’s apparatus, particularly without the required enlarged flange on the nozzle.” *Id.* at 72 (citing Ex. 2006 ¶¶ 187, 189–90). Patent Owner contends that “Petitioner’s theory places Yu’s tangs on Keller ’574’s cartridge, and on Heusser’s cartridge. But Yu itself never teaches or suggests placing tangs on a cartridge itself.” *Id.* at 70 (citing Ex. 2006 ¶¶ 182–83; *cf.* PO Sur-Reply 6–7).

Patent Owner also contends

Yu certainly does not suggest a desirability to “make the interference fit as tight as needed,” or that such a tight fit would “still allow[] for easy attachment/removal of the mixer.” Pet. Reply, 12-13. Petitioner’s argument is “meaningfully distinct” from Petitioner’s original position, which sought to solve the problem of tight interference fits with Yu’s coarse threading “in place of” Keller ’574’s/Heusser’s pre-existing interlocks. *See Ariosa Diagnostics*, 805 F.3d at 1367. This is the very type of new argument that is impermissible in reply. *Id.*

PO Sur-Reply 15–16.

(2) *Petitioner’s position*

Citing the original Petition, Petitioner contends

Petitioner described how Yu teaches using tangs for reinforcement “to prevent the nozzle from becoming separated from the body during the caulking operation.” Paper 2 (“Pet.”) at 25, 62; Ex. 1006, 10. Based on this teaching, Petitioner explained how, “[i]f desiring such reinforcement, a POSITA would have been motivated to use these tangs on the” Keller

'574 and Heusser apparatuses. Pet. 25, 62 (citing Ex. 1003 ¶¶91, 139).

Pet. Reply 1. Petitioner contends that “[e]ven Patent Owner recognized that Petitioner raised tang-based arguments, mentioning Yu’s tangs *over 60 times* in its Preliminary Response.” *Id.* at 2. Petitioner contends that “Patent Owner’s arguments attempt to apply a standard requiring Petitioner to explain how one would have bodily incorporated Yu’s tangs into the Keller ’574 and Heusser designs.” *Id.* Petitioner contends that Dr. Gale explained “tangs like Yu’s were so common and well known to a POSITA that additional specific examples were not required. *See* Ex. 2021, 97:8-103:16.1 ‘[T]here’s literature going back decades on how to implement tangs.’ *Id.*, 102:18-19.” *Id.* at 2–3.

In the original Petition, Petitioner noted that Keller ’574 “explains that the mixer’s inlets and the cartridge’s outlets must have ‘tightly sealed connections.’” Pet. 22 (citing Ex. 1005, 5:55–64; Ex. 1003 ¶ 86). Petitioner contends that a “POSITA would have wanted this tight fit because it prevents leaking.” Pet. 22. Petitioner contends

Yu identifies similar problems. It explains that prior-art nozzles were routinely connected to cartridges through “interference fit[s],” but that this design was problematic because, for loose fits, the cartridge and nozzle could become unintentionally separated, and for tight fits, the user might encounter “considerabl[e] difficulty” in removing the nozzle. Ex. 1006, 2; Ex. 1003, ¶87. Yu further explains that it was known to attach and detach nozzles to cartridges with “a conventional single start thread.” Ex. 1006, 2. But this design was also problematic because it took several rotations to disengage the

threads and remove the nozzle from the cartridge. Ex. 1006, 2-3; Ex. 1003, ¶87.

Yu's coarse thread design solves the problems described above.

Pet. 22–23.

(3) *Analysis*

While we agree with Patent Owner that it is Petitioner's burden to show by a preponderance of the evidence that the claims of the '578 patent at issue are unpatentable, we find that Petitioner has satisfied this burden based on a combination of Keller '574 and Yu, either with or without the use of tangs. Petitioner provided a specific use of tangs in the Petition, stating

for reinforcement, Yu discloses “tangs” on the dispenser that engage the nozzle during dispensing “to prevent the nozzle from becoming separated from the body during the caulking operation.” Ex. 1006, 10. If desiring such reinforcement, a POSITA would have been motivated to use these tangs on the Keller apparatus. Ex. 1003, ¶91.

Pet. 25. Patent Owner's expert Dr. Brown acknowledges that in Yu, “[e]ngagement between the nozzle flange and the tangs of the caulk gun would prevent the threaded nozzle from unthreading from the nipple during use in a caulking operation.” Ex. 2001 ¶ 61; Ex. 2006 ¶ 94. And, while Dr. Brown asserts that “Petitioner does not apply the caulking gun tangs and flanged nozzles of Yu to Keller '574's structure” (Ex. 2001 ¶ 78), the Petition and Dr. Gale both directly state that Yu's tangs may be used for reinforcement with Keller '574. *See* Pet. 25; Ex. 1003 ¶ 91.

As to the specific location of tangs, Petitioner's expert Dr. Gale states “a POSITA would recognize that tangs can be implemented in multiple different ways.” Ex. 2021, 34:21–22. Dr. Gale further states

if you want some reinforcement or, you know, want to make sure that it's not going to come off for any reason, maybe a factor of

safety, you could certainly put tangs on to this device and that would be obvious to a person of ordinary skill in the art on how to do that.

Ex. 2021, 95:15–20. Dr. Brown responds: “it is my opinion that a POSITA would not have known where to place the tangs mentioned in Yu on either Keller ’574 or Heusser according to the Petition’s (and Dr. Gale’s) sparse disclosure.” Ex. 2006 ¶ 173.

We agree with Petitioner that Patent Owner’s argument requiring Petitioner to show specific tang locations is improper bodily incorporation, as “[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference,’ but rather whether ‘a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention.’” *Erecting & Dismantling Co. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) (*quoting In re Keller*, 642 F.2d 413, 425 (CCPA 1981), and *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007)). In other words, the correct test is whether there would have been reason to combine Yu’s tangs and threading on nozzles on the dual chamber delivery device of Keller ’574 with a reasonable expectation of success. We address the reasonable expectation of success *infra*. Here, we agree with Petitioner that the ordinary artisan would have had reason to use Yu’s tangs and nozzle threading on the dual chamber delivery device of Keller ’574 because “applying Yu’s coarse thread design to Keller adds a mechanical advantage that applies *both* when the mixer is being attached and removed from the cartridge. Ex. 1003, ¶85.” Pet. 21.

We also are not persuaded by Patent Owner that Petitioner’s Reply impermissibly relies upon a new argument when pointing out that both

Keller and Yu suggest interference fits would address and satisfy any implicit requirement in claim 1 of the '578 patent that the nozzle and cartridge engage in a sealing manner.¹³ PO Sur-Reply 15–16. The Petition specifically suggests that Keller '574 required “tightly sealed connections” because this “prevents leaking” and then further suggests that when tightly sealed, axial force to remove the nozzle mixer would be difficult. Pet. 22 (citing Ex. 1005, 5:55–64; Ex. 1003 ¶ 86). The Petition then points out that Yu also recognized prior art interference fit connections between nozzles and cartridges that could be difficult to remove for tight fits. *See* Pet. 22 (citing Ex. 1003 ¶ 87). The Petition expressly recognizes that one reason to combine Keller '574 and Yu would have been to provide “the mechanical advantage that results from the engagement of corresponding inclined surfaces, and this mechanical advantage would exist both during attachment and removal (thus solving the [tight interference fit] problems identified in Keller and Yu).” Pet. 23 (citing Ex. 1003 ¶ 88; Ex. 1005, 12:8–12).

Petitioner provides substantial reasons for the use of tangs in the combination of Yu and Keller '574. *See* Pet. 25; Ex. 1003 ¶ 91; Ex. 2021, 95:15–20.

b) Reason to Combine

(1) Patent Owner's position

Patent Owner contends

Yu's intent was not to change how a detachable nozzle was locked and sealed during dispensing, but rather how to improve loading into/removal from the caulking gun's magazine. *See supra* VIII.D; Ex.1006, 2-3, 3-4. Yu's coarse threading makes nozzle seating before placement in the magazine and

¹³ We note that there is no “sealingly” limitation expressly recited in claim 1 of the '578 patent.

removal after exiting the magazine easier relative to the cartridge itself with just a 60° turn. Ex.1006, 3; 12. But these short-turn threads have larger helix (lead) angles and do not achieve interlock by themselves, lacking much of the surface area that prior multiple-turn threading has.

PO Resp. 47 (citing Ex. 2014, 74; Ex. 2016, 7; Ex. 2006 ¶¶ 114–16). Patent Owner contends that, absent “hindsight, a POSITA would not have looked to Yu’s coarse threads (which do not interlock for use) as a replacement for Keller’s and Heusser’s existing, interlocking designs.” *Id.* at 48.

Dr. Brown states that “the benefits of Yu’s ‘coarse thread design’ are not relevant to the main issue that Dr. Gale, and the Petition, merely skirt in passing – ensuring that any attached mixing nozzle is securely connected via interlock to resist ‘high backpressures’ when dispensing and mixing.”

Ex. 2006 ¶ 106. Dr. Brown states that “Yu’s 1/6 turn short coarse thread elements lack an interlock function and would result in backdriving (self-loosening under axial loading) during use.” *Id.* ¶ 109. Dr. Brown states that “a POSITA would not have had a reason to turn to Yu’s 1/6 turn, short coarse threading alone, when doing so would replace the very lock and seal mechanisms that protect against leakage that would result from the high backpressures present during dispensing.” *Id.* ¶ 112. Dr. Brown also states that “Yu explained that detachable nozzles relied upon engagement of a nozzle flange with tangs of the caulking gun The multi-start coarse threading that Yu proposes for easier seating and removal of the nozzle with respect to the cartridge nipple reduces even further the gripping ability of the threading.” Ex. 2006 ¶¶ 115–116. Patent Owner contends that “Petitioner’s Reply illuminates how Petitioner has consistently used the Challenged Claims as the blueprint for picking and choosing the prior art, changing its combination theories when confronted with the Petition’s combination

failures. This is the very type of ‘moving target’ that the Federal Circuit cautions against.” PO Sur-Reply 2.

(2) *Petitioner’s position*

Petitioner contends that “a POSITA would have been motivated to make the proposed combinations, and would have had a reasonable expectation of success, at least because the threaded connection would have made attachment and removal easier.” Pet. Reply 13 (citing Pet. 21–23, 60–61; Ex. 1006, 2; Ex. 1003 ¶¶ 85–90, 136–138). Petitioner asserts:

Keller [’574] uses inclined surfaces to help guide the mixer toward the cartridge during attachment. Ex. 1005, 12:8-12. And Keller ’196 uses inclined surfaces to help guide the mixer away from the cartridge during removal. Ex. 1009 (Keller ’196), 8:30-33. But Yu provides this benefit *during both attachment and removal*, which would have motivated a POSITA to use this design. Ex. 1003, ¶89. Indeed, it was standard in the art to use multi-start threads on cartridges to allow an accessory part to be attached and detached through rotation. *See* Ex. 1017 (using Luer locks to achieve this functionality for syringes); Ex. 1003, ¶89.

Pet. 23–24.

Dr. Gale and the Petition point to Yu’s recognition of a problem when a nozzle is connected to a cartridge:

[i]f the interference fit is a very tight fit, considerably difficulty can be experienced in attempting to remove the nozzle. This problem is further complicated in practice by reason of the fact that the nozzle and cartridge frequently become smeared with the caulking compound which makes it difficult for the user to firmly engage the nozzle to remove it from the cartridge.

Ex. 1006, 1; Pet. 22; Ex. 1003 ¶ 87. Dr. Gale and the Petition then rely on Yu’s teaching “that the difficulties previously experienced in the mounting of the nozzle can be overcome by forming a coarse thread connection between the nipple and nozzle which will seat the nozzle on the nipple in response to a rotation of less than 90°.” Ex. 1006, 3; Pet. 23; Ex. 1003 ¶ 88.

Dr. Gale concludes that

Yu's male thread elements and female thread grooves in place of Keller's bayonet lugs and corresponding passages in the bayonet sockets, respectively, would have improved Keller's device by providing a coarse thread connection that guides the mixer towards and lifts the mixer from the cartridge in response to rotations of less than 90°. Ex. 1006, 4, 12. Under this design, the modified discharge apparatus would now have the mechanical advantage that results from the engagement of corresponding inclined surfaces, and this mechanical advantage would exist both during attachment and removal, which solves the problems identified in Keller and Yu. Ex. 1005, 12:8-12.

Ex. 1003 ¶ 88.

(3) *Analysis*

As we consider all of the evidence, we first note that Petitioner provides a specific and persuasive reason in the Petition to combine Yu's nozzle with a thread design for the attachment of the Keller '574 nozzle with the dual delivery cartridge where

applying Yu's coarse thread design to Keller adds a mechanical advantage that applies *both* when the mixer is being attached and removed from the cartridge. Ex. 1003, ¶85. . . . A POSITA would have further recognized that, without a mechanical advantage (e.g., the interaction between ramps and grooves), users may have difficulty providing the axial force necessary to attain the desired tight seal described in Keller during attachment, and to remove the mixer from the cartridge.

Pet. 21–22 (citing Ex. 1003 ¶ 86; Ex. 1016 ¶¶ 72, 78). This mechanical advantage benefit has been the basis of Petitioner's reason to combine throughout this proceeding, and a preponderance of the evidence of record does not support Patent Owner's argument that Petitioner relies on hindsight. The requirement of a reason to combine is a safeguard against hindsight bias, which is characterized by the "temptation to read into the prior art the teachings of the invention in issue." *KSR*, 550 U.S. at 421.

We are not persuaded by Dr. Brown’s concerns about high backpressures as it relates to the reason to combine because the claims of the ’578 patent do not include any specific pressure requirements or materials, e.g., those having high viscosity. Dr. Brown acknowledges that Yu provides a reason to modify Keller ’574 with the use of coarse threading “for easier seating and removal of the nozzle.” Ex. 2006 ¶ 116. We find Dr. Brown’s leakage criticisms of this express reason to combine Yu and Keller ’574 unpersuasive because there is no claim limitation addressing leakage and because Dr. Gale explains that the ordinary artisan would friction fit the nozzle to the cartridge to avoid leakage (*see* Ex. 1023 ¶¶ 26, 31). Moreover, Dr. Gale explains that the use of tangs in the combination as taught by Yu would also address Dr. Brown’s concern regarding leakage. Ex. 1003, 91; Ex. 2021, 34:21–35:3, 42:14.

We therefore find that a preponderance of the evidence of record supports Petitioner’s reasoning that an ordinary artisan would have had reason to use Yu’s inclined surface to make nozzle attachment and removal to and from a dispensing cartridge easier by creating mechanical advantage.

c) Reasonable expectation of success

(1) Patent Owner’s position

Patent Owner contends that “[m]odifying Keller ’574 and Heusser’s already-existing interlocks with Yu’s noninterlocking coarse threading would not lead to a reasonable expectation of success. Ex. 2006, ¶112.” PO Resp. 42. Patent Owner contends that “Keller ’574’s interface between the mixer’s inlets and the cartridge’s outlets needs to be ‘tightly sealed.’ Ex.1003, ¶86; Ex.2006, ¶106. A POSITA would have expected the interface

between Heusser's mixer and cartridge to be tightly sealed during use as well. Ex. 2006, ¶110." *Id.*

Patent Owner contends

Yu's short coarse threads alone would not be adequate for the locking and sealing necessary for avoiding leakage during dispensing. Ex.2006, ¶108. Yu's coarse threads have several starts, meaning that each respective thread would have a higher helix (lead) angle that would be known to lead to backdriving under pressure during dispensing, and thus leakage. Ex. 2006, ¶109; Ex. 2016, 7.

PO Resp. 44–45. Patent Owner contends

These problems with Petitioner's combinations are understandable, since Petitioner did not appear to appreciate what type of dispensing gun each reference was designed to operate with (Keller '574 and Heusser with a rear-mount dispensing gun, and Yu with a frame-mount dispensing gun). *See* Ex.2021, 86:14-22 (the type of dispensing gun "totally irrelevant" to the design of the mixing tip used); 89:1-10 (Heusser allegedly focused on tips, not gun); 87:19-88:13 (similar). But the type of gun is directly relevant to how the mixing tip/nozzle is designed, with prime examples in Keller '574, Heusser, and Yu. Keller '574 and Heusser designed the mixing tips to be interlocking without external support. Ex.2006, ¶52. Yu, meanwhile, designed its nozzle to rely upon the external interlock of the tangs engaging the nozzle's flange. Without considering how a POSITA would have expected dispensing to occur, each of Petitioner's combinations cannot have a reasonable expectation of success.

Id. at 45–46.

Patent Owner contends that "Maziarz [Ex. 1020] demonstrates that there are substantial differences between single and multi-component cartridges, that tangs still would not retain the nozzle for a multi-component cartridge, and that considerable changes must be made to even make a rear-mount, multi-component cartridge fit within a magazine for a single-

component cartridge.” PO Sur-Reply 8. Patent Owner contends that “Maziarz’s tangs don’t engage the nozzle at all. The ‘outlet 16’ (part of the cartridge, Ex.1020, 2:18-22) extends beyond the tangs at the magazine’s discharge end.” *Id.* at 9.

Patent Owner contends that Petitioner’s prior art “combinations would fail due to backdriving.” PO Sur-Reply 12. Patent Owner contends that the “Board should determine that Petitioner’s evidence in support of its combination is insufficient, since the evidence fails to address the problems with Petitioner’s actual combinations.” *Id.* at 13. Patent Owner contends

Petitioner’s new arguments about the applicability of lower viscosity components ring hollow. Petitioner acknowledged that “**both Keller and Yu are designed to discharge thick materials** capable of clogging the discharge outlets.” Pet., 25; 62 (similar for Heusser). Dr. Gale and Dr. Brown agreed about the viscosities at issue in Keller ’574, Heusser, and Yu. Ex.1003, ¶¶91, 139; Ex.2006, ¶¶48-49; Ex.2003, 4:62-65; POR, 10. A different viscosity of material was not part of Petitioner’s original combination theory, and Petitioner’s attorney-argument attempt to backtrack here should be given little, if any, weight.

PO Sur-Reply 14. Patent Owner also contends that “Yu certainly does not suggest a desirability to ‘make the interference fit as tight as needed,’ or that such a tight fit would ‘still allow[] for easy attachment/removal of the mixer.’ Pet. Reply, 12-13.” *Id.* at 15.

(2) *Petitioner’s position*

Petitioner contends

Patent Owner suggests that the connection between the accessory part and cartridge in the proposed combinations lacks an interlock that could resist backdriving during use without the aid of tangs. *See* POR 42-58, 78-82. Nothing in the patent—claims or otherwise—requires the interlocking that Patent Owner demands. Instead, the patent simply requires that a “connecting

device” connect an “accessory part” (e.g., mixer) to a “cartridge or syringe.” Ex. 1001, 1:17-21, 5:10-12.

Pet. Reply 9. Petitioner contends that the ’578 “patent *does not require* the connection to withstand all backpressures that might occur during use—it mentions nothing about this at all.” *Id.* Petitioner also contends that “both parties’ experts agreed that materials with viscosities lower than caulk, for example, are commonly used with multicomponent cartridges. . . . Such relatively low-viscosity materials include medical adhesives and epoxies.” Pet. Reply 17–18 (citing Ex. 1022, 22:12–23:16, 27:2–28:16; Ex. 2021, 21:18–16, 23:14–22; Ex. 2021, 21:18–16, 23:14–22).

Petitioner contends that “known designs existed for dispensing from a two-component cartridge *without* a rear-mounted gun and a so-called interlock, including the Maziarz design The ’578 patent precludes none of these dispensing design options.” Pet. Reply 10 (citing Ex. 1016 ¶ 79; Ex. 2021, 68:7–21). Petitioner contends that “even Dr. Brown could not confirm that the thread-angle designs in the claims would result in interlocking. Claim 7 recites ramps inclined at 20°. Ex. 1001, claim 7; *see also id.* 3:33-37. Dr. Brown could not say whether this angle was low enough to resist backdriving.” *Id.* Petitioner contends that the “uncertainty Dr. Brown describes shows the problems with relying on unclaimed features. Assumptions can be made that can give the patent more credit than it deserves. The law protects against this—Petitioner’s obviousness arguments need only be commensurate with the specificity provided in the patent.” *Id.* at 11.

Petitioner contends that the “’578 patent states that ‘a good seal’ results from the mixer inlets and cartridge outlets plugging into each other, ‘*as is known per se.*’” Pet. Reply 11 (citing Ex. 1001, 5:52–54). Petitioner

contends that “[b]ecause Yu’s threads provide a mechanical advantage during attachment/ removal, a POSITA can make the interference fit as tight as needed while still allowing for easy attachment/removal of the mixer.” *Id.* at 12–13 (citing Ex. 1003 ¶¶85-88, 136-137). Petitioner contends that “[i]n arguing that the mixers in Petitioner’s proposed combinations would fall off in response to backpressure, Dr. Brown admittedly failed to account for the impact of the interference fit during use—a major oversight.” *Id.* at 14 (citing Ex. 1022, 73:2–13, 98:24–100:2, 132:1–14; Ex. 1023 ¶¶ 6–10).

Petitioner contends

Dr. Brown applied “a general heuristic” in which he concluded that “backdriving would be expected to occur” if the screw lead “is equal to or greater than one-third the value of the lead screw diameter.” Ex. 2006 ¶65 (citing Ex. 2018, 1). But aside from not factoring in interference fits . . . this analysis includes several fundamental errors: (1) it misapplies the general rule from the literature, (2) it miscalculated multiple variables on which the heuristic relies, (3) it improperly relies on concocted, result-oriented values and dimensions from a single depicted embodiment in Yu, and (4) ignores the simple formula for self-locking threads. Ex. 1023 ¶¶6-32.

Pet. Reply 14.

(3) *Analysis*¹⁴

We find Patent Owner’s arguments address concerns that are not required or recited in the challenged claims. But “the name of the game is

¹⁴ Both parties discuss Maziarz (Ex. 1020). *See* Pet. Reply 5–8; PO Sur-Reply 7–10. We note that Maziarz was not included in Petitioner’s grounds. The element in Maziarz identified by the parties as “tangs” represents a front stop plate 43 as shown in the annotated figure 2 in PO Sur-Reply 9. Ex. 1020, 2:34–35. We do not further address this reference, which only shows the state of the prior art, including knowledge that a stop plate may be used in a dispensing device.

the claim.” *In re Hiniker Co.*, 150 F.3d 1362, 1369 (Fed. Cir. 1998).

“The reasonable expectation of success requirement refers to the likelihood of success in combining references to meet the limitations of the claimed invention.” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016). “[F]ailure to consider the appropriate scope of the . . . patent’s claimed invention in evaluating the reasonable expectation of success . . . constitutes a legal error.” *Allergan, Inc. v. Apotex Inc.*, 754 F.3d 952, 966 (Fed. Cir. 2014). In *Intelligent*, the court found

The Board seemed to believe that the “reasonable expectation of success” inquiry looked to whether one would reasonably expect the prior art references to operate as those references intended once combined. That is not the correct inquiry—one must have a motivation to combine accompanied by a reasonable expectation of achieving *what is claimed* in the patent-at-issue. *Intelligent*, 821 F.3d at 1367 (emphasis added).

We find that Petitioner’s combination of Yu and Keller ’574 provides a reasonable expectation of success in creating a discharge arrangement as recited in claim 1 of the ’578 patent. We note that neither the Specification nor claim 1 of the ’578 patent limits the materials for which the discharge arrangement may be used. That is, there is no disclosure regarding the viscosity or other characteristics of materials being discharged from the two component cartridge recited in the ’578 patent Specification and claims.

As applied to the instant facts, there is a reasonable expectation of success in modifying the device of Keller ’574 to use the threads of Yu in order to form a dispensing device. As Dr. Gale states, “a POSITA would have considered this design modification to Keller in view of Yu predictable because it simply requires a substitution of one known prior art element for another and yields predictable results.” Ex. 1003 ¶ 85. Dr. Gale further states

a “a person of ordinary skill in the art would have known how to manipulate the coefficient of friction (by selecting certain materials) and/or the lead angle to make sure Yu’s design was self-locking if a self-locking design was desired.” Ex. 1023 ¶ 26. Dr. Gale also notes “a person of ordinary skill in the art would have understood that according to this heuristic a larger diameter would have allowed for a lower angle of inclination for the same amount of axial movement upon rotation, making it easier to design a self-locking connection.” Ex. 1023 ¶ 31 (citing Ex. 2018, 1).

Therefore, using the correct inquiry as explained by *Intelligent*, a preponderance of the evidence shows that there would have been a reasonable expectation of achieving what is claimed in the claims of the ’574 patent.

Even when we focus on the issues argued by Patent Owner, including backdriving and mounting to use tangs (or not), we are not persuaded that a preponderance of the evidence supports the concern that the device of claim 1 of the ’578 patent, as rendered obvious by Keller ’574 and Yu, would have lacked a reasonable expectation of success in functioning.

As to tangs, Dr. Brown states

a POSITA would recognize that Keller ’574’s mixing nozzle (with just Yu’s coarse thread elements that do not provide interlock, and without the tangs that Dr. Gale asserts are “back up,” let alone the flange necessary to interact with the tangs that Petitioner never mentions) would no longer be able to resist the “high backpressures” generated during dispensing.

Ex. 2006 ¶ 126. Dr. Gale states “a POSITA would recognize that tangs can be implemented in multiple different ways. They could be part of the caulking gun. They could be, you know, easily put on a cartridge itself.” Ex. 2021, 34:21–35:3. We find that a preponderance of the evidence supports the

finding that an ordinary artisan would have known how to incorporate tangs into a device based on the combination of Yu and Keller '574.

As to backdriving, Dr. Brown, when answering a question about claim 1 of the '578 patent, “[s]o you think all of those limitations relate to how a mixing element is attached to a dispenser and to orientate it so that it can provide communication between the inlet and the outlet in the mixing?,” responded with: “I’d say that that in relation to this patent, yes.” Ex. 1022, 40:12–18 (emphasis omitted). That is, Dr. Brown acknowledged that the claim limitations relate to a device. Dr. Brown further acknowledged that the concern regarding backdriving, to which no limitation is present in the claims of the '578 patent, depends on forces and materials, stating “there’s different materials and different forces applied to these. You have to tell me how much force is going to be used there. It’s not a universal black-and-white line.” Ex. 1022, 66:17–21 (emphasis omitted).

And Dr. Gale rebutted Dr. Brown’s statement that the “tendency towards backdriving for helix (lead) angles at or above a certain value has also been described by a general heuristic that ‘when the screw lead is less than 1/3 the diameter, backdriving will not occur.’” Ex. 2006 ¶ 65 (citing Ex. 2018, 1; Ex. 2023). Dr. Gale persuasively explains that the “guideline that Dr. Brown uses as a heuristic is not particularly relevant to the patents and devices being discussed as part of this proceeding because it assumes a friction coefficient much lower than the friction coefficient for materials commonly used when constructing two-component cartridges and mixers.” Ex. 1023 ¶ 11. Dr. Gale reasons that “[i]f Dr. Brown’s assumptions and calculations are correct, then every single preferred embodiment of the '578 patent would result in backdriving.” *Id.* ¶ 12. Dr. Gale states “[e]ven factoring in Dr. Brown’s changes to his declaration from his deposition, his

miscalculations begin by mixing up Pitch and Lead.” *Id.* ¶ 19.

We find that a preponderance of the evidence of record, even considering the backdriving and tang concerns, also demonstrates that there would have been a reasonable expectation of success for a person having ordinary skill in the art to combine Yu’s thread design for nozzles with the double chamber device of Keller ’574 using routine skill in the art into a device that dispenses fluid mixtures without backdriving, whether with or without the use of tangs.

d) Inoperable for intended purpose

(1) Patent Owner’s position

Patent Owner contends that a “POSITA would further not have had a reason to make Petitioner’s proposed replacement of Keller ’574’s existing interlock with Yu’s coarse threading, with no tangs-flange interface, because it would change Keller ’574’s principle of operation and render it inoperable.” PO Resp. 48 (citing Pet. 20; Ex. 2006 ¶¶ 118–19). Patent Owner contends that “Keller ’574 is entirely directed to avoiding leakage due to high backpressure during dispensing by providing a coded attachment of a mixer to a multiple component cartridge. Ex.1005, 2:23-55. For example, Keller ’574 provides larger bayonet lugs/sockets to cope with the backpressures during dispensing.” *Id.* at 48–49 (citing Ex. 1005, 2:13–17). Patent Owner contends that after substituting Yu’s threads in the place of Keller ’574’s bayonets,

Keller ’574’s thus-modified mixer-cartridge configuration would no longer be able to resist the backpressures during dispensing, because the proposed modification replaces Keller ’574’s interlocking mechanism with Yu’s coarse threads that would not sealingly maintain the connection during dispensing (per Yu’s own description, *see* Ex. 1006, 10, 12 (needing an interlock between the nozzle and nipple beyond snap fit or coarse

threading to resist pressure during use)). Nor would the coarse threads, with just 60° of travel for attaching/detaching, have the predictable result of a functioning combination.

Id. at 50 (citing Ex. 2006 ¶¶ 125–27). Patent Owner contends that, “[w]ith the typical one-inch socket size for Keller ’574, applying Yu’s large helix (lead) angle, low TPI [threads per inch], and multiple starts results in an approximately over 6:1 relationship between the screw lead and socket diameter.” *Id.* at 51. Patent Owner contends that a “POSITA would have therefore expected Keller ’574’s mixer modified with coarse threading to backdrive under the expected axial load.” *Id.* (citing Ex. 2006 ¶¶ 133–36).

(2) *Petitioner’s position*

Petitioner contends

the ’578 patent *never discloses*—in the claims or otherwise—what components/materials are stored in the cartridge. The claims, for example, simply recite “a cartridge for at least two components.” Ex. 1001, 9:50. Keller ’574 and Heusser likewise disclose generic discharge arrangements without limitation on the types of materials to be discharged. *See, e.g.*, Ex. 1005, Title, 1:21-2:33; Ex. 1007, Title, 1:5-65; Ex. 1003 ¶91.

Pet. Reply 17. Petitioner contends that “the ’578 patent expressly relies on U.S. Patent No. 5,033,650 (‘Colin’; Ex. 1010). Ex. 1001, 1:23-2:20.” *Id.* at 18. Petitioner contends that, “[a]ccording to Colin, if ‘the materials stored in the syringe are of relatively low viscosity so as to require minimal force to feed the materials through the common mixing element in the nozzle assembly, the particular coupling arrangement is of no consequence.’” *Id.* (citing Ex. 1010, 1:24–31). Petitioner contends that, “[g]iven these disclosures in Colin, a POSITA would have had no concerns with applying Yu’s threaded connection design to Keller ’574 and Heusser for at least materials with relatively low viscosity.” *Id.* (citing Ex. 1010, 1:24–31; Ex. 1003 ¶ 91).

(3) *Analysis*

We begin our analysis by noting that claim 1 of the '578 patent does not recite any intended purpose, with the preamble of claim 1 simply reciting a “discharge arrangement.” Ex. 1001, 9:48. And the '578 patent states that the “present invention relates to a discharge arrangement comprising a cartridge or syringe for at least two components and comprising an accessory part.” *Id.*, 1:17–19. The '578 patent's intended purpose is therefore to simply form a discharge arrangement without any specific requirements regarding the materials being discharged. Keller '574 identifies

a need to connect and attach a mixer or accessory to a multiple component cartridge or dispensing device in a predetermined orientation, such as when cartridge outlets or mixer inlets are of a different size for different relative mixing ratios or when special high ratio mixers are used for greater mixing efficiency and when mixers or accessories are refitted for reuse.

Ex. 1005, 1:46–53. Keller '574 does recognize a concern with “leakage at the mixer to cartridge sealing interface.” Ex. 1005, 2:15–16. Yu states that the “difficulties previously experienced in the mounting of the nozzle can be overcome by forming a coarse thread connection between the nipple and nozzle which will seat the nozzle on the nipple in response to a rotation of less than 90°.” Ex. 1006, 3. Yu discusses the use of a caulking gun. Ex. 1006, 12.

Dr. Brown states that “[c]hanging Keller '574's mixing nozzle bayonet lugs by actually applying Yu's coarse threading in their place would change the principle of operation of Keller '574's device as well as render it inoperable for its intended purpose.” Ex. 2006 ¶ 118. Dr. Brown states that the “tendency towards backdriving for helix (lead) angles at or above a certain value has also been described by a general heuristic that ‘when the

screw lead is less than $\frac{1}{3}$ the diameter, backdriving will not occur.’ Ex. 2018.” *Id.* ¶ 65. Dr. Brown states

Yu expressly expects the external tangs of a caulking gun “to resist the pressure within the cartridge in use” by engaging “the flange 54 of the nozzle ... during the caulking operation.” Ex. 1006, 10. A POSITA would therefore recognize that Yu’s coarse threading alone is unable to resist the backpressures during use without the external interlock provided by the tangs-flange interaction.

Id. ¶ 147.

Dr. Gale states that “a person of ordinary skill in the art would have known how to manipulate the coefficient of friction (by selecting certain materials) and/or the lead angle to make sure Yu’s design was self-locking if a self-locking design was desired. *See* Ex. 2023, 1.” Ex. 1023 ¶ 26. Dr. Gale states that “[i]f a person of ordinary skill in the art wanted to design a self-locking connection using polyethylene while maintaining the 0.72-inch Lead from Yu’s Figure 3, one would have only needed to increase the diameter from 1 inch to 1.15 inches.” *Id.* ¶ 27. As to viscosity, Dr. Gale stated that for “two-part epoxies, there’s a pretty wide range of viscosities. I’ve seen everything from pretty thin to pretty thick. But I’m -- you know, one that you can do with your thumb probably is limited to about, you know, 5 bar or something like that.” Ex. 2021, 23:6–11.

Both experts have demonstrated that the ordinary artisan, interested in ensuring dispensing without a nozzle separating from the cartridge, would have known the necessary parameters to ensure this result, including selecting helix lead angles to avoid backdriving (Ex. 2006 ¶ 65), selecting viscosity of the material being dispensed (Ex. 2021, 23:6–11), and selecting parameters such as the coefficient of friction of the materials. Ex. 1023 ¶ 26.

We find that a preponderance of the evidence of record supports the position that the combination of Keller '574 and Yu as proposed by Petitioner would result in a device operable to discharge materials as required by claim 1 of the '578 patent. “[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 550 U.S. at 417. We find the evidence supports Petitioner’s position that forming an operable device using Yu’s easier to attach and remove thread elements, whether or not incorporating a tang to further prevent thread separation from the cartridge if desired in the device of Keller '574, would have been obvious because “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

e) Analogous art

(1) Patent Owner’s position

Patent Owner contends “Yu is non-analogous art to the '578 patent because Yu relates to single component cartridge systems – not multiple-component systems. Petitioner argues that the '578 patent and Yu ‘disclose techniques for attaching an accessory part to a cartridge in a discharge arrangement.’” PO Resp. 59 (citing Pet. 16, 59). Patent Owner contends that the “'578 patent relates ‘to a discharge arrangement comprising a cartridge ... **for at least two components** ... with one connecting component of a connecting device being arranged on the syringe or cartridge and another on the accessory part.” *Id.* at 60 (citing Ex. 1001, 1:17–21). Patent Owner contends that Keller '574 and Heusser also relate to multiple component cartridges while “Yu’s problem and solution are in the context of a single-component cartridge tube maintaining connection with a detachable nozzle

while loading into a caulking gun's magazine.” *Id.* (citing Ex. 2006 ¶ 162; Ex. 1006, FIGs. 1–4.) Patent Owner asserts that the “Petition does not explain how Yu’s magazine-mount single-component cartridge is in the same field of endeavor as the ’578 patent’s multiple-component cartridge for at least two components (likewise Keller ’574 and Heusser) that are mixed as they are dispensed using very different interlock mechanisms.” PO Resp. 61.

Patent Owner also contends that “Yu is not reasonably pertinent to the particular problem with which the ’578 patent is involved.” PO Resp. 63. Patent Owner contends a “POSITA considering Yu’s description would not have understood the nozzle as being interlocked on the cartridge for dispensing after a rotation of less than 90°.” *Id.* at 63–64. Patent Owner contends

The formulation of Yu’s problem-solution in the Petition and Institution Decision misses these necessary aspects. The Institution Decision noted the difficulty of Yu prior interference fits, but left off the issues that Yu also expressed regarding the difficulties of removing nozzles that have been smeared with caulking compound with heavy clothes that make grasping difficult.

Id. at 64 (citing Paper 7 at 29–30; Ex. 1006, 3; Ex. 2006 ¶ 169). Patent Owner contends that “the language the Board cites from Yu’s page 2 about the difficulty of removing the nozzle when the interference fit is too tight was actually describing how prior approaches sought to resolve the problem of keeping a detachable nozzle on when loading into a caulking gun.” *Id.* (citing Ex. 1006, 2). Patent Owner also contends that the Institution Decision omitted the sealing need and that “[o]mitting this sealing requirement in summarizing the problem the ’578 patent addresses blurs the real differences

between the '578 patent's solution and Yu's solution." *Id.* at 65–66 (citing Ex. 2006 ¶ 171).

(2) *Petitioner's position*

Petitioner contends

Patent Owner characterizes Yu as providing a “coarse threading solution for easier attaching/detaching” and “an easy on-off solution with sufficient connection to hold the nozzle on the nipple while loading into a caulking gun.” POR 63 (citing Ex. 1006, 3-5, 12). Thus, by Patent Owner's own admission, Yu is reasonably pertinent to the problem the '578 patent intended to solve. *See* Ex. 1003 ¶79.

Pet. Reply 23. Petitioner further contends that “Yu is also analogous art because it is in the same field of endeavor as the '578 patent.” *Id.* (citing Ex. 1003 ¶ 78). Petitioner contends

Given its focus on the connection between nozzles and cartridges generally and its applicability to cartridges other than caulk, it would be improper to limit its field to only single-component cartridges. Ex. 1006, 2 Moreover, the broad applicability of Yu's caulking gun design is confirmed by Maziarz, which discloses a similar caulking gun design for dispensing materials from dual-barrel cartridges. Ex. 1020, Abstract.

Id. at 24.

(3) *Analysis*

We remain persuaded that Yu is analogous art to the claims of the '578 patent and to Keller '574. “Prior art is analogous if it is from the same field of endeavor or if it is reasonably pertinent to the particular problem the inventor is trying to solve.” *Circuit Check Inc. v. QXQ Inc.*, 795 F.3d 1331, 1335 (Fed. Cir. 2015).

As to the field of endeavor, *Bigio* requires us “to determine the appropriate field of endeavor by reference to explanations of the invention's subject matter in the patent application, including the embodiments,

function, and structure of the claimed invention.” *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004).

The ’578 patent teaches that the “present invention relates to a discharge arrangement comprising a cartridge or syringe for at least two components and comprising an accessory part.” Ex. 1001, 1:17–19. The ’578 patent specifically identifies that “a first object is to produce a reliable and rapid connection between the cartridge and the accessory part in such a way that, with little force being applied, the accessory part can be secured sealingly on the cartridge and can also be lifted from the cartridge.” Ex. 1001, 2:15–20.

Therefore the field of endeavor is rapid and reliable connections between a cartridge and an outlet nozzle. Ex. 1003 ¶¶ 33–36. We find this even if we agree with Patent Owner that this connection must also secure the nozzle to the cartridge “sealingly” despite the absence of the term “sealingly” or an analogous term being recited in claim 1 of the ’578 patent. As to whether Yu would function in a “sealingly” manner or whether it would have been obvious to modify Yu to do so, we rely on our discussion above relying on Dr. Gale and the Petition that point to Yu’s recognition of a problem when a nozzle is connected to a cartridge

[i]f the interference fit is a very tight fit, considerably difficulty can be experienced in attempting to remove the nozzle. This problem is further complicated in practice by reason of the fact that the nozzle and cartridge frequently become smeared with the caulking compound which makes it difficult for the user to firmly engage the nozzle to remove it from the cartridge.

Ex. 1006, 1; Pet. 22; Ex. 1003 ¶ 87. That there would have been a concern for a very tight fit reasonably supports a conclusion that Yu’s nozzle would connect in a sealing manner to the cartridge. Further, Dr. Gale states that,

“[i]f a person of ordinary skill in the art wanted to design a self-locking connection using polyethylene while maintaining the 0.72-inch Lead from Yu’s Figure 3, one would have only needed to increase the diameter from 1 inch to 1.15 inches.” Ex. 1023 ¶ 27.

Our determination that Yu is in the same field of endeavor as the ’578 patent claims is also supported by Patent Owner’s declarant, Dr. Brown, who states that “the ’578 patent discloses ‘improvements to a discharge arrangement ... in order to further increase its user friendliness.’ Ex. 1001, 2:12–15.” Ex. 2001 ¶ 39. Despite Dr. Brown’s statement that “Yu relates to a single component cartridge, not simply a ‘discharge arrangement’ generally” (Ex. 2001 ¶ 101), Dr. Brown also states: “I agree with Dr. Gale, who states that Keller ’574, Yu and Heusser are all ‘designed to discharge materials that are thick and capable of clogging the discharge outlets.’ Ex. 1003, ¶¶91 and 139.” Ex. 2001 ¶ 29.

We find unpersuasive Patent Owner’s attempt to distinguish, as different fields of endeavor, a first field of discharge of a cartridge with two components and a nozzle for the ’578 patent and Keller ’574 from a second field of discharge of a cartridge with one component and a nozzle as in Yu. The ’578 patent, Keller ’574, and Yu are all designed to discharge materials from cartridges secured to nozzles. Therefore, we find that Yu is in the same field of endeavor as the ’578 patent.

However, even if Yu were not in the same field of endeavor, we find that Yu would have been reasonably pertinent to the issue of attaching a nozzle to a cartridge with two components. For the ’578 patent, the “first object is to produce a reliable and rapid connection between the cartridge and the accessory part in such a way that, with little force being applied, the accessory part can be secured sealingly on the cartridge and can also be

lifted from the cartridge.” Ex. 1001, 2:15–20. Thus, at least part of the problem being addressed by the ’578 patent is how a nozzle can, with little force, be connected to a cartridge. *See id.* And Yu “relates to improvements in the mounting of a removable nozzle” where when “the interference fit is a very tight fit, considerably difficulty can be experienced in attempting to remove the nozzle.” Ex. 1006, 1, 2. Yu explains that “difficulties previously experienced in the mounting of the nozzle can be overcome by forming a coarse thread connection between the nipple and nozzle which will seat the nozzle on the nipple in response to a rotation of less than 90°.” Ex. 1006, 3.

We find that Yu’s concerns for ease of nozzle attachment and removal are reasonably pertinent to the object stated in the ’578 patent of securing a nozzle with a rapid connection with little force being applied. We are not persuaded by Patent Owner’s arguments attempting to narrow the issue to require “sealingly” for two reasons. First, as to the analogous arts test, the “‘problem’ being examined must not be defined so narrowly as to collapse these inquiries and only consider art within the inventor’s field of endeavor.” *Sanofi-Aventis Deutschland GmbH v. Mylan Pharms. Inc.*, 66 F.4th 1373, 1377 (Fed. Cir. 2023). Second, as already noted, the term “sealingly” is not included in claim 1 of the ’578 patent and therefore is not a requirement of the claims.

Accordingly, we find a preponderance of the evidence shows that Yu is within the field of endeavor of the ’578 patent and that Yu is pertinent to the concerns of attaching a removable nozzle to a cartridge.

f) Ramps limitation

(1) Patent Owner’s position

Patent Owner contends “Yu’s coarse threads do not render obvious ‘at least two ramps,’ properly understood as ‘webs having respective upper and

lower inclined planes of substantially the same width along the webs' lengths,' combined with either Keller '574 or Heusser." PO Resp. 74 (citing Ex. 2006 ¶ 199). Patent Owner contends a "POSITA would have expected Yu's coarse threads, with the same general shape as the locking ridge, to also be rounded and deformable since Yu does not teach that the embodiments have different material properties." *Id.* at 76.

(2) *Petitioner's position*

Petitioner contends

The plain language of the claims requires no particular shape for the ramps, aside from being "designed corresponding to the guide grooves" such that their engagement/disengagement performs the claimed functionality. The cross-sections of each ramp and corresponding groove could have any number of shapes (e.g., a semi-circle) and still meet these requirements.

Pet. Reply 19. Petitioner further contends that "[e]ven under Patent Owner's proposed construction of 'at least two ramps,' the claims are still obvious." *Id.* at 22. Petitioner contends that as "the Petition states, it would have been obvious to convert these lugs 'into two male threads positioned at an inclined angle, and then to angle the passages in the bayonet sockets to form thread-groove sockets' accordingly." *Id.* (citing Pet. 20–21). Petitioner contends that by "modifying the bayonet lugs into two male threads positioned at an inclined angle, they become two webs having respective upper and lower inclined planes of substantially the same width along the webs' lengths." *Id.* at 23 (citing Ex. 1003 ¶¶ 84, 88–90).

(3) *Analysis*

Consistent with our claim interpretation discussed above, we find that Yu reasonably teaches the "at least two ramps" requirement in claim 1 of the '578 patent for the reasons given in the Petition. We do not agree with Patent

Owner’s proposed construction, which seeks to add a requirement for “webs having respective upper and lower inclined planes of substantially the same width along the webs’ lengths.”

However, even if Patent Owner’s claim construction were adopted, we find Patent Owner’s expert, Dr. Brown, unpersuasive on this issue. When asked “[i]s it your opinion that the Yu reference[’]s male thread elements are not ‘at least two ramps’ because Figure 3 of the Yu reference depicts them as rounded?”, Dr. Brown answered: “I can’t make that, you know, broad, general statement. It says ‘at least two ramps to include at least two webs having upper and lower inclined planes of substantially the same width along the webs’ length.” Ex. 1022, 111:25–112:10. We therefore note that Dr. Brown does not clearly assert in the deposition that Yu’s rounded ramps fail to satisfy even the narrow construction proposed by Patent Owner of “webs having respective upper and lower inclined planes of substantially the same width along the webs’ lengths.”

We note again that claim 1 of the ’578 patent never states the ramps “include at least two webs having upper and lower inclined planes of substantially the same width along the webs’ length.”

We find Petitioner’s expert, Dr. Gale, persuasive when suggesting that a POSITA viewing Yu would have been motivated to convert the two Keller bayonet lugs into two male threads positioned at an inclined angle, and then to angle the passages in the bayonet sockets to form thread-groove sockets (as opposed to bayonet sockets), where the sockets complement and receive larger diameter 159, and the inclined passages become thread grooves on the inner circumference of each socket that complement and receive the male thread elements.

Ex. 1003 ¶ 84. Dr. Gale explains that “[u]nder this design, the modified discharge apparatus would now have the mechanical advantage that results

from the engagement of corresponding inclined surfaces, and this mechanical advantage would exist both during attachment and removal, which solves the problems identified in Keller and Yu.” *Id.* ¶ 88.

g) *Positively guided manner to cause a constrained lifting limitation*

(1) *Patent Owner’s position*

Patent Owner contends that “[b]oth the Keller ’574-Yu and Heusser-Yu combinations fail to render obvious independent claim 1’s ‘*discharge arrangement*’ including [1K]’s ‘*when the connection is released, the accessory part is lifted from the cartridge in a positively guided manner to cause a constrained lifting.*’” PO Resp. 78 (citing Ex. 2006 ¶ 210). Patent Owner contends that “Yu describes its coarse threading as only useful for seating the nozzle on the cartridge before use.” *Id.* at 79 (citing Ex. 1006, 4). Patent Owner contends that “[w]ithout the additional interlock, combining Yu’s coarse threads with Keller ’574’s apparatus would result in the mixer tip **unconstrainedly** dislodging from the cartridge during dispensing.” *Id.* at 80 (citing Ex.2006 ¶ 220). Patent Owner contends that “[b]ackdriving is an **unconstrained** lifting of the mixer during use, necessarily resulting in leakage at the exact time a POSITA would expect the mixer to remain secured sealingly to the multiple-component cartridge.” *Id.* at 81 (citing Ex. 2006 ¶ 221).

Patent Owner further contends that “[a]pplying Yu’s tangs ‘on’ Keller ’574’s or Heusser’s cartridge does not cure the failure of either combination to render obvious the ‘*constrained lifting*’ of the mixer. Ex.2006, ¶¶230. Instead, including the tangs simply changes why each combination fails to render [1K] obvious.” PO Resp. 82. Patent Owner, relying on Dr. Brown’s statements, contends

Following the Petition’s framework would result in Yu’s caulking gun tangs being fixed on the cartridge and, therefore, blocking a mixer (without a corresponding flange on the mixer tip) from “*lifting*” “*from the cartridge*” at all. Yu’s tangs “prevent the nozzle from becoming separated” from the cartridge, such that in combination they would prevent Keller ’574’s or Heusser’s mixer tip from separating from the rear-mount configured cartridge. *See* Ex. 1006, 10. Yu’s stationary tangs would prevent the very axial movement in claim element [1K], let alone “*in a positively guided manner.*” Ex. 2006, ¶233.

Id. at 83.

(2) *Petitioner’s position*

Petitioner contends that “the claimed requirements about the guide grooves, ramps, and ‘constrained lifting’ relate only to mounting and removing the accessory part— there is no interlock requirement during dispensing. As the Petition describes, these claimed features are obvious.” Pet. Reply 11 (citing Pet. 16–25, 41–44, 58–62, 78–82).

In the Petition, Petitioner contends

The design of Yu’s male thread elements and female thread grooves allows the nozzle to be longitudinally moved towards, and releaseably locked on, the cartridge via a guided, constrained nozzle rotation of less than 90°, and then longitudinally moved away from the cartridge via the same guided, constrained rotation in the opposite direction.

Pet. 16 (citing Ex. 1003 ¶¶ 52–53). Petitioner contends that “applying Yu’s coarse thread design to Keller adds a mechanical advantage that applies *both* when the mixer is being attached and removed from the cartridge.” Pet. 21 (citing Ex. 1003 ¶ 85). Dr. Gale states that

A POSITA would have understood that the nozzle is lifted from the cartridge in a positively guided manner to cause a constrained lifting when the connection is released because Yu discloses that “forming a coarse thread connection between the nipple and nozzle” overcomes the previous difficulties of removing the

nozzle from the nipple because the nozzle can be removed “in response to a rotation of less than 90°.” Ex. 1006, 3-4, 12.
Ex. 1003 ¶ 112.

(3) *Analysis*

We remain unpersuaded by Patent Owner’s arguments that rely on unclaimed elements related to backdriving. As we have already noted above, there would have been a reasonable expectation of success for a person having ordinary skill in the art to combine Yu’s thread design for nozzles with the double chamber device of Keller ’574 using routine skill in the art into a device that dispenses fluid mixtures without backdriving whether with or without the use of tangs. Above, we have already rejected Patent Owner’s argument that backdriving would necessarily occur in the obvious combination of Keller ’574 and Yu. As already stated, both experts have demonstrated that the ordinary artisan, interested in ensuring dispensing without backdriving a nozzle to separate from the cartridge, would have known the necessary parameters to ensure this result, including selecting helix lead angles to avoid backdriving (Ex. 2006 ¶ 65), selecting viscosity of the material being dispensed (Ex. 2021, 23:6–11), and selecting parameters such as the coefficient of friction of the materials. Ex. 1023 ¶ 26.

As to Patent Owner’s arguments that tangs would prevent even the “constrained lifting” required by claim 1 of the ’578 patent, we find this unpersuasive as an unclaimed timing limitation. That is, Yu teaches that while the nozzle/cartridge is constrained with tangs, the nozzle remains attached “because the flange 54 of the nozzle is engaged by the tangs of the caulking gun and thus the caulking gun serves to prevent the nozzle from becoming separated from the body during the caulking operation.” Ex. 1006, 9; *cf.* Pet. 25. But Yu also teaches that “[t]o remove this nozzle, it is merely

necessary to rotate the nozzle through 60° in the opposite direction.”

Ex. 1006, 11; *cf.* Pet. 19. Yu teaches “the present invention provides a simple and inexpensive cartridge for a caulking gun in which the nozzle and/or closure plug can be mounted and removed with ease.” Ex. 1006, 12; *cf.* Pet. 43. Thus, the obvious combination of Keller ’574 and Yu reasonably suggests a nozzle that may be removed in a “[p]ositively guided manner to cause a constrained lifting” whether or not tangs were present.

h) Conclusion

Therefore, overall, we find that a preponderance of the evidence shows the claims 1–3, 9–13, 16, 17 of the ’578 patent would have been obvious over the teachings of Keller ’574 and Yu.

D. Ground 2: Obviousness Over Heusser and Yu

Petitioner contends that claims 1–3 and 16 would have been obvious over Heusser and Yu. Pet. 56–82. Petitioner provides a detailed analysis of independent claim 1 and then explains where the limitations of dependent claims 2, 3, and 16 are found within the prior art. *Id.* at 82–83.

We begin with Petitioner’s contentions on claim 1, noting where we agree with and adopt any undisputed analysis by the Petitioner, and then move to our analysis, which addresses Patent Owner’s counterarguments. We note that many of the issues regarding Heusser and Yu have already been discussed above in the analysis of Keller ’574 and Yu and we incorporate that reasoning into our analysis of Heusser and Yu. We also note that Patent Owner has not provided separate argument on the patentability of the challenged dependent claims.

1. *Claim 1*

a) *[1P]: “A discharge arrangement, comprising:”*

Petitioner asserts “Heusser discloses an ‘apparatus for carrying out a mixing dispensing of a plurality of flowable components from a multiple chambered vessel.’ Ex. 1007, 1:5-8.” Pet. 62.

Patent Owner does not dispute that Heusser teaches or suggests limitation [1P]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

b) *[1A]: “an accessory part with at least two inlets;”*

Petitioner asserts that “Heusser discloses a transition piece 3 ‘rotatably arranged in the transition part 11, which produces separate supply passages 31, 31’ from outlet openings 21, 21’ of the vessel 2 to the mixer structure 4 and which permits a flowing of the components only through these supply passages 31, 31’.’ Ex. 1007, 2:42-56.” Pet. 64.

Patent Owner does not dispute that Heusser teaches or suggests limitation [1A]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

c) *[1B]: “a cartridge for at least two components,”*

Petitioner asserts “Heusser’s vessel 2 ‘is a cartridge’ with ‘two chambers 20, 20’ that store the ‘two components to be mixed’ (e.g., ‘a discrete flowable component in each chamber of the multiple chambered vessel’). Ex. 1007, 2:56-62, 4:27-31; Ex. 1003, ¶143.” Pet. 65.

Patent Owner does not dispute that Heusser teaches or suggests limitation [1B]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

d) *[1C]: “wherein the cartridge has at least two chambers for in each case one of the components*

and has at least two outlets, complementary to the inlets, for the components,”

Petitioner asserts

Heusser’s vessel 2 “comprises two chambers 20, 20” that store the “two components to be mixed.” Ex. 1007, 2:56-62. Each chamber houses “a discrete flowable component” and also has an “outlet opening[] 21, 21” associated with it that is complementary to the two sleeve-shaped positioning means 33 that form the inlets on the accessory part. Ex. 1007, 2:42-62, 3:30-39, 4:27-31, Figs. 3, 5; Ex. 1003, ¶144.

Pet. 65.

Patent Owner does not dispute that Heusser teaches or suggests limitation [1C]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

e) [1D]: “wherein each of the outlets is adapted to be plugged into one of the inlets, or vice versa; and”

Petitioner asserts “Heusser discloses two sleeve-shaped positioning means 33 that are the inlets to the accessory part and are adapted to be plugged into one of the outlet openings 21, 21’ on the cartridge, as depicted in Figure 5. Ex. 1007, 3:30-39; Ex. 1003, ¶145.” Pet. 66.

Patent Owner does not dispute that Heusser teaches or suggests limitation [1D]. *See generally* PO Resp. We agree with and adopt Petitioner’s undisputed analysis.

f) [1E]: “a connecting device with a first connecting component, which is arranged on the accessory part, and a second connecting component, which is complementary to the first connecting component and is arranged on the cartridge,”

Petitioner asserts

Heusser discloses a transition part 11 (on housing 1) that has an outer screw thread 15’, and a connection part 22 (on vessel 2)

that has an inner screw thread 25. Ex. 1007, 2:42-62, Fig. 5; Ex. 1003, ¶146. The transition part 11 and connection part 22 can be coupled together via these screw threads. Ex. 1007, 2:42-62.

Pet. 67. Petitioner further asserts

it would have been obvious to modify Heusser by using Yu's male thread elements in place of the inner screw thread 25 on connection part 22, and by using Yu's female thread grooves in place of the outer screw thread 15' on transition part 11. Ex. 1003, ¶147. On the resulting Heusser/Yu apparatus, the female thread grooves and transition part 11 combine to form a "first connecting component" on housing 1 (accessory part), and the male thread elements and connection part 22 combine to form a "second connecting component" on vessel 2 (cartridge). Ex. 1003, ¶147. The first and second connecting components, together, form a "connecting device." Ex. 1003, ¶147.

Pet. 67–68. Petitioner asserts "the modified inclined thread-and-groove arrangement described in the previous paragraph makes the first and second connecting components 'complementary.' Ex. 1003, ¶148." Pet. 68.

Patent Owner does not dispute that Heusser and Yu teach or suggest limitation [1E]. *See generally* PO Resp. We agree with and adopt Petitioner's undisputed analysis.

g) [1F]: *"wherein one of the connecting components comprises a socket and the other connecting component comprises a connector part that is adapted to be inserted into the socket along a longitudinal direction,"*

Petitioner asserts that Heusser combined with Yu "discloses a connecting component made of the female-grooved transition part 11 that forms a socket for connection part 22, which is a connector part on the other connecting component that is adapted to be inserted into the transition part 11 (socket) along a longitudinal direction." Pet. 69 (citing Ex. 1003 ¶ 149; Ex. 1007, Fig. 5).

Patent Owner does not dispute that Heusser and Yu teach or suggest limitation [1F]. *See generally* PO Resp. We agree with and adopt Petitioner's undisputed analysis.

- h) [1G]: “wherein first engagement parts of a rotational guide placed at an incline to the longitudinal direction are provided on an outer circumference of the connector part, and”

Petitioner asserts that:

As depicted in Figure 5 of Heusser, inner screw thread 25 is provided on an outer circumference of connection part 22. Ex. 1007, Fig. 5. A POSITA would have understood that these threads are placed at an incline to the longitudinal direction so that, as housing 1 is rotated relative to vessel 2, the threads move housing 1 axially towards, or away from, vessel 2. Ex. 1007, 2:56-62; Ex. 1003, ¶151.

Pet. 71. Petitioner asserts “Yu’s male thread elements 80 are first engagement parts of a rotational guide placed at an incline to the longitudinal direction and are provided on an outer circumference of the nipple 86, as depicted in Figure 3 of Yu. Ex. 1006, 4, 12, 16.” Pet. 72.

Patent Owner does not dispute that Yu teaches or suggests limitation [1G]. *See generally* PO Resp. Patent Owner does dispute whether there would have been a reason to combine the device of Heusser and Yu. PO Resp. 40. We will address this argument below as argued by Patent Owner. *Id.* at 41.

- i) [1H]: “corresponding second engagement parts of the rotational guide are provided on the inner circumference of the socket,”

Petitioner asserts

as depicted in Figure 5 of Heusser, outer screw thread 15' is provided on the inner circumference of transition part 11. Ex. 1007, Fig. 5. A POSITA would have understood that these

threads are placed at an incline to the longitudinal direction so that, as housing 1 is rotated relative to vessel 2, the threads move housing 1 axially towards, or away from, vessel 2. Ex. 1007, 2:56-62; Ex. 1003, ¶154.

Pet. 73. Petitioner further asserts

Yu discloses female thread grooves 82 on the inner circumference of the socket, which “is proportioned to receive said discharge nipple,” as depicted in Figure 3, and amounts to a thread-groove socket with one part of a coarse thread connection that “will seat the nozzle on the nipple in response to a rotation.” Ex. 1006, 4-6, 16; Ex. 1003, ¶155.

Pet. 74.

Patent Owner does not dispute that Yu teaches or suggests limitation [1H]. *See generally* PO Resp. Patent Owner does dispute whether there would have been a reason to combine the device of Heusser and Yu. PO Resp. 40. We will address this argument below as argued by Patent Owner. *Id.* at 41.

j) [11]: “wherein the connecting components are adapted to be rotated into each other over an effective connecting section along the rotational guide after the connector part has been plugged into the socket,”

Petitioner asserts

in Yu, to attach the nozzle to the cartridge, the nozzle is first “positioned on the nipple 86” and then rotated 60° such that nipple 86 is rotated into the socket over an effective connecting section along the rotational guide formed by male thread elements 80 and female thread grooves 82 after the top portion of nipple 86 (where the nipple lacks male thread elements) has been plugged into the socket. Ex. 1006, 12, Fig. 3; Ex. 1003, ¶157.

Pet. 76–77.

Patent Owner does not dispute that Yu teaches or suggests limitation [1I]. *See generally* PO Resp. Patent Owner does dispute whether there would have been a reason to combine the device of Heusser and Yu. PO Resp. 40. We will address this argument as argued by Patent Owner. *Id.* at 41.

- k) [1J]: “wherein one of the engagement parts comprises guide grooves and the other engagement parts cooperating with the guide grooves comprise at least two ramps, which are designed corresponding to the guide grooves, and”

Petitioner asserts “in the combined Heusser/Yu apparatus, the female thread grooves comprise guide grooves and the male thread elements cooperating with the female thread grooves comprise at least two ramps, which are designed corresponding to the guide grooves. Ex. 1006, 16.”Pet. 78–79.

Patent Owner does not dispute that Yu’s engagement parts cooperate regarding limitation [1J], but Patent Owner does dispute what the term “at least two ramps” means as discussed in detail in the claim interpretation section. *See generally* PO Resp., especially PO Resp. 31–37. Patent Owner also disputes whether there would have been a reason to combine the device of Heusser and Yu. PO Resp. 40. We will address this argument below as argued by Patent Owner. *Id.* at 41.

- l) [1K]: “wherein the guide grooves and the at least two ramps are adapted to be brought increasingly into engagement with each other while being guided in the axial direction and to be disengaged from each other while being guided over an effective connecting section in the axial direction, such that, when the connection is established, the accessory part is positively guided towards the cartridge in a constrained manner, and such that,

when the connection is released, the accessory part is lifted from the cartridge in a positively guided manner to cause a constrained lifting.”

Petitioner asserts

Heusser discloses that screw thread 15' and inner screw thread 25 are adapted to be brought increasingly into engagement with each other while being guided in the axial direction and to be disengaged from each other while being guided over an effective connecting section in the axial direction, such that, when the connection is established, housing 1 is positively guided towards vessel 2 in a constrained manner, and such that, when the connection is released, housing 1 is lifted from vessel 2 in a positively guided manner to cause a constrained lifting. Ex. 1007, 2:42-62, Fig. 5; Ex. 1003, ¶160.

Pet. 80. Petitioner asserts “Yu’s ‘female thread grooves 82’ and ‘coarse male thread elements 80’ are brought increasingly into engagement with each other because the female thread grooves ‘threadably engage the male thread elements’ upon ‘rotating the nozzle through 60°.’ Ex. 1006, 12, 16; Ex. 1003, ¶161.” Pet. 80. Petitioner asserts “Yu also discloses that removing the nozzle merely requires ‘rotat[ing] the nozzle through 60° in the opposite direction,’ which disengages the guide grooves and the ramps from each other. Ex. 1006, 12; Ex. 1003, ¶162.” Pet. 81.

Patent Owner does dispute that Yu teaches or suggests the constrained lifting requirement limitation [1K]. *See* PO Resp. 75–81. Patent Owner also disputes whether there would have been a reason to combine the device of Heusser and Yu. PO Resp. 40. We will address these arguments below as argued by Patent Owner. *Id.* at 41.

m) Reasons to Combine

Petitioner asserts the Heusser and Yu “modified design would have been desirable to a POSITA because the mixer would be attached and

removed from the cartridge through a rotation of less than 90°, rather than requiring multiple complete rotations of the mixer relative to the cartridge.

Ex. 1003, ¶134.” Pet. 60. Specifically, Petitioner asserts:

A POSITA viewing Yu would have been motivated to improve Heusser’s threaded connection by implementing Yu’s coarse thread connection, allowing Heusser’s housing 1 to be attached to and removed from vessel 2 through a mere 60° relative rotation. Ex. 1003, ¶137. A POSITA would have recognized that this modification would simplify the attachment and removal process by reducing rotations necessary to attach and detach housing 1 and vessel 2, while preserving the mechanical advantage provided by Heusser’s threaded connection that reduces the amount of force needed to attach or remove housing 1. Ex. 1003, ¶137. Combining aspects of these discharge arrangements would have involved substituting one known element for another according to known methods to yield predictable results. Ex. 1003, ¶137.

Pet. 61. Petitioner asserts that Yu “discloses ‘tang’s on the dispenser that engage the nozzle during dispensing ‘to prevent the nozzle from becoming separated from the body during the caulking operation.’ Ex. 1006, 10. If desiring such reinforcement, a POSITA would have been motivated to use these tangs on the Heusser apparatus. Ex. 1003, ¶139.” Pet. 62.

Patent Owner disputes Petitioner’s motivation to combine arguments. *See* PO Resp. 40–41. As further discussed below, considering all of the arguments and cited evidence of record, we find that Petitioner has met its burden to demonstrate unpatentability of the claims based on the combination of Yu and Heusser.

2. *Analysis*

Because the issues are substantially similar between Grounds 1 and 2, we incorporate our reasoning from the Ground 1 analysis of Yu and Keller

'574 into all of our Ground 2 analyses of Yu and Heusser. We will address those points that are more specific to Ground 2 below.

a) Particularity and Yu's tangs

(1) Patent Owner's position

Patent Owner addresses Keller '574 on these issues and then states that the analysis is "similar for Heusser." PO Resp. 39. Patent Owner relies upon the same reasoning for both Keller '574 and Heusser. *See* PO Resp. generally. Patent Owner contends

The Petition does not demonstrate to a POSITA with sufficient particularity that the claims would be unpatentable by adding Yu's tangs "on" Keller '574's or Heusser's apparatus. A POSITA would not have known from the Petition how the tangs would be combined with Keller '574 or Heusser, particularly considering the "hundreds of different designs" that a POSITA could implement with or without tangs, and "dozens of varieties of tangs that could be implemented."

PO Resp. 67 (citing Ex. 2021, 94:5–95:20; 97:15–98:2).

(2) Petitioner's position

Petitioner contends they

described how Yu teaches using tangs for reinforcement "to prevent the nozzle from becoming separated from the body during the caulking operation." Paper 2 ("Pet.") at 25, 62; Ex. 1006, 10. Based on this teaching, Petitioner explained how, "[i]f desiring such reinforcement, a POSITA would have been motivated to use these tangs on the" Keller '574 and Heusser apparatuses.

Pet. Reply 1 (citing Pet. 25, 62 (citing Ex. 1003 ¶¶ 91, 139)).

(3) Analysis

As in the analysis with Keller '574 and Yu discussed above, while we agree with Patent Owner that it is Petitioner's burden to show by a preponderance of the evidence that the claims at issue of the '578 patent are

unpatentable, we find that Petitioner has satisfied this burden both with and without the use of tangs for the combination of Heusser and Yu. Petitioner provided a specific use of tangs in the Petition as discussed above. Specific to Heusser, Dr. Gale stated

a POSITA would have known that Yu's design would also accommodate the types of materials discharged by the Heusser apparatus (i.e., there would be an expectation of success in the combination). Moreover, for reinforcement, Yu discloses "tangs" on the dispenser that engage the nozzle during dispensing "to prevent the nozzle from becoming separated from the body during the caulking operation." Ex. 1006, 10. If desiring such reinforcement, a POSITA would have been motivated to use the tan[g]s described in Yu.

Ex. 1003 ¶ 139. Dr. Gale states "a POSITA would recognize that tangs can be implemented in multiple different ways." Ex. 2021, 34:21–22. Dr. Gale further states

if you want some reinforcement or, you know, want to make sure that it's not going to come off for any reason, maybe a factor of safety, you could certainly put tangs on to this device and that would be obvious to a person of ordinary skill in the art on how to do that.

Ex. 2021, 95:15–20.

We agree with Petitioner that the ordinary artisan would have found it obvious that when the materials being discharged required more reinforcement of the nozzle, the ordinary artisan would have incorporated tangs as needed. "Non-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references. . . . [The reference] must be read, not in isolation, but for what it fairly teaches in combination with the prior art as a whole." *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

We find that Petitioner provides substantial reasons for the use of tangs in the combination of Yu and Heusser. *See* Pet. 62 (citing Ex. 1003 ¶ 139).

b) Reason to Combine

(1) Patent Owner's position

Patent Owner contends that “Yu’s coarse threads would . . . result in backdriving and leakage. Ex.2006, ¶116. A POSITA would have therefore not had a reason to apply Yu’s coarse threads ‘in place of’ . . . Heusser’s multiple-turn interlocking screw threads.” PO Resp. 47 (citing Ex. 2006 ¶ 117). Patent Owner contends “[i]nstead of accounting for Yu’s reliance on an external interlock, and the references’ need to resist backpressure during dispensing, Petitioner cherry-picked just Yu’s portions that purportedly fit the claim elements.” *Id.* at 48. Patent Owner contends “[a]bsent such hindsight, a POSITA would not have looked to Yu’s coarse threads (which do not interlock for use) as a replacement for . . . Heusser’s existing, interlocking designs.” *Id.*

Dr. Brown states

Strangely, Dr. Gale and the Petition do not mention whether a tight seal is needed in Heusser. Instead, they again focus on the advantages of using three of Yu’s 1/6 turn, short “coarse thread design” in place of Heusser’s multi-turn continuous interlocking screw threads. *See* Ex. 1003, ¶¶130-35. Again, the benefits of Yu’s “coarse thread design” are not relevant to the main issue of ensuring any attached mixing nozzle is securely connected to resist the high backpressures present during dispensing. *See, e.g.*, Ex. 1005, 2:13-17; Ex. 1007, 3:61-65; Ex. 1008, [0007].

Ex. 2006 ¶ 110.

(2) *Petitioner's position*

Petitioner contends “a POSITA would have been motivated to make the proposed combinations, and would have had a reasonable expectation of success, at least because the threaded connection would have made attachment and removal easier.” Pet. Reply 13 (citing Pet. 21–23, 60–61; Ex. 1006, 2; Ex. 1003 ¶¶ 85–90, 136–138). Petitioner contends “[n]othing in the [‘578] patent—claims or otherwise—requires the interlocking that Patent Owner demands. Instead, the patent simply requires that a ‘connecting device’ connect an ‘accessory part’ (e.g., mixer) to a ‘cartridge or syringe.’” *Id.* at 9 (citing Ex. 1001, 1:17–21, 5:10–12). Petitioner contends the ‘578 patent “*does not require* the connection to withstand all backpressures that might occur during use—it mentions nothing about this at all.” *Id.*

Petitioner also contends that “Yu discloses ‘tang’s on the dispenser that engage the nozzle during dispensing ‘to prevent the nozzle from becoming separated from the body during the caulking operation.’ Ex. 1006, 10. If desiring such reinforcement, a POSITA would have been motivated to use these tangs on the Heusser apparatus.” Pet. at 62 (citing Ex. 1003 ¶ 139).

(3) *Analysis*

As we consider all of the evidence, we first note that Petitioner provided a specific and persuasive reason in the petition to combine Yu’s nozzle with thread design for the attachment of the Heusser nozzle with the dual delivery cartridge where

A POSITA viewing Yu would have been motivated to improve Heusser’s threaded connection by implementing Yu’s coarse thread connection, allowing Heusser’s housing 1 to be attached to and removed from vessel 2 through a mere 60° relative rotation. Ex. 1003, ¶137. A POSITA would have recognized that this modification would simplify the attachment and removal process by reducing rotations necessary to attach

and detach housing 1 and vessel 2, while preserving the mechanical advantage provided by Heusser's threaded connection that reduces the amount of force needed to attach or remove housing 1. Ex. 1003, ¶137. Combining aspects of these discharge arrangements would have involved substituting one known element for another according to known methods to yield predictable results.

Pet. 61 (citing Ex. 1003 ¶ 137). This mechanical advantage benefit has been the basis of Petitioner's reason to combine throughout this proceeding, and a preponderance of the evidence of record does not support Patent Owner's argument that Petitioner relies on hindsight. The requirement of a reason to combine is a safeguard against hindsight bias, which is characterized by the "temptation to read into the prior art the teachings of the invention in issue." *KSR*, 550 U.S. at 421.

We are not persuaded by Dr. Brown's concerns about high backpressures as it relates to the reason to combine because the claims of the '578 patent do not include any specific pressure requirements or materials, e.g., those having high viscosity. Dr. Brown acknowledges Yu provides a reason to modify nozzles with the use coarse threading "for easier seating and removal of the nozzle." Ex. 2006 ¶ 116. We find Dr. Brown's leakage criticisms of this express reason to combine Yu and Heusser unpersuasive because there is no claim limitation addressing leakage and because Dr. Gale explains the ordinary artisan would friction-fit the nozzle to the cartridge to avoid leakage (*see* Ex. 1023 ¶¶ 26, 31). Moreover, Dr. Gale explains that the use of tangs in the combination as taught by Yu would also address Dr. Brown's concern regarding leakage. *See* Ex. 1003, 91; Ex. 2021, 34:21–35:3, 42:14.

We therefore find that a preponderance of the evidence of record supports Petitioner's reasoning that an ordinary artisan would have had

reason to use Yu's inclined surface to make nozzle attachment and removal to and from a dispensing cartridge easier by creating mechanical advantage.

c) Reasonable Expectation of Success

(1) Patent Owner's position

Patent Owner contends Heusser "relies upon its multiple-turn screw threads to 'engage the nozzle and lock and to therefore seal from pressure' during use." PO Resp. 43 (citing Paper 7, 38; Pet. 86). Patent Owner contends "[r]eplacing Heusser's interlocking screw threads with Yu's coarse threads alone would lead to backdriving under pressure during dispensing, and thus leakage." *Id.* at 45 (citing Ex. 2006 ¶ 111). Patent Owner contends that Heusser operated with a rear-mount dispensing gun while Yu relied on a frame-mount dispensing gun and, "[w]ithout considering how a POSITA would have expected dispensing to occur, each of Petitioner's combinations cannot have a reasonable expectation of success." *Id.* at 46.

Dr. Brown states "Petitioner proposes replacing Heusser's inner and outer multi-turn continuous screw threads with three of Yu's 1/6 turn, short coarse threads." Ex. 2006 ¶ 111 (citing Pet. 59; Ex. 1003 ¶ 133). Dr. Brown states

Thus, the inner and outer screw threads of Heusser, which have multiple complete turns about the mixing nozzle and are capable of resisting the high backpressures, are expressly replaced by three of Yu's 1/6 turn, short coarse threads in Petitioner's combination which only extend 60° around the nozzle. Because Yu's coarse threads are both partial-type and multi-start, a POSITA would have recognized that backdriving (and thus leakage) would occur under the pressure of material mixing and delivery. *See* Ex. 2016, 7.

Id.

(2) *Petitioner's position*

Petitioner contends that

Patent Owner incorrectly contends that the . . . Heusser cartridges are compatible only with rear-mount guns because those references purportedly disclose flanges that exist at the cartridge base. . . . For Heusser, Patent Owner points to no flange disclosure in Heusser itself—it identifies another unlabeled feature in a separate reference mentioned in Heusser. POR 26. Thus, the flange disclosures Patent Owner relies on are threadbare.

Pet. Reply 6. Petitioner contends a POSITA

would have had a reasonable expectation of success, at least because the threaded connection would have made attachment and removal easier. Pet. 21–23, 60–61; see Ex. 1006, 2; Ex. 1003 ¶¶85–90, 136–138. The modified apparatuses would retain the interference fit between the inlets and outlets. Pet. 20, 58–62. In arguing that the mixers in Petitioner's proposed combinations would fall off in response to backpressure, Dr. Brown admittedly failed to account for the impact of the interference fit during use—a major oversight.

Id. at 13–14 (citing Ex. 1022, 73:2–13, 98:24–100:2, 132:1–14; Ex. 1023 ¶¶ 6–10).

Dr. Gale states

A POSITA would have had a reasonable expectation of success with the proposed Yu modification, in my opinion, because threads were commonly understood to provide a mechanical advantage when moving two components relative to each other axially, as is the case in both Heusser and Yu. Heusser already provides a threaded connection comprising inclined threads, so incorporating Yu's male thread elements and female thread grooves would have been a routine modification of familiar elements according to known methods to predictably yield a quick and efficient way to securely attach and remove Heusser's mixer from the cartridge, similar to Yu's nozzle and cartridge. Ex. 1007, 2:56–62.

Ex. 1003 ¶ 138.

(3) *Analysis*

We find that Petitioner’s combination of Yu and Heusser provides a reasonable expectation of success in creating a discharge arrangement as recited in claim 1 of the ’578 patent. As we have already noted, neither the Specification nor claim 1 of the ’578 patent limits the materials for which the discharge arrangement may be used. That is, there is no disclosure regarding the viscosity or other characteristics of materials being discharged from the two component cartridge recited in the ’578 patent Specification and claims.

As applied to the instant facts, there is a reasonable expectation of success in modifying the device of Heusser to use the threads of Yu in order to form a dispensing device. As Dr. Gale states

Heusser and Yu both address the importance minimizing the impact of leakage, smearing, and clogging/plugging of the cartridge outlets. Ex. 1007, 3:30-42; Ex. 1006, 2. Yu’s ramped coarse thread design is intended to accommodate thick materials like caulk. Ex. 1006, 2, 10. Thus, a POSITA would have known that Yu’s design would also accommodate the types of materials discharged by the Heusser apparatus (i.e., there would be an expectation of success in the combination).

Ex. 1003 ¶ 139. Dr. Gale states a POSITA “would have known that the angle of the threads was a design variable that could have been adjusted based on the desired amount of axial movement of the mixer upon rotation and any need for the connection to resist backdriving during use.” Ex. 1023 ¶ 30. We find that the preponderance of the evidence supports the obviousness of replacing one type of thread elements in the dispensing device of Heusser with Yu’s easier to attach and remove thread elements, whether incorporating a tang to prevent separation or not, would have been obvious because “[o]bviousness does not require absolute predictability of

success . . . all that is required is a reasonable expectation of success.” *In re Kubin*, 561 F.3d 1351, 1360 (Fed. Cir. 2009). A preponderance of the evidence of record supports a finding of a reasonable expectation of success in combining Yu’s nozzle and Heusser’s cartridge and device for a discharge arrangement.

d) Inoperable for intended purpose

(1) Patent Owner’s position

Patent Owner contends “Petitioner’s combination removes Heusser’s interlocking multiple-turn screw threads in favor of Yu’s coarse threading that does **not** sealingly maintain the connection during dispensing.” PO Resp. 55 (citing Ex. 1006, 10; Ex. 1007, 3:55–65; Ex. 2006 ¶¶ 147–48). Patent Owner contends “[a]pplying Yu’s coarse thread design in place of Heusser’s multiple-turn threading would cause Heusser’s modified mixer to backdrive during use and therefore leak.” *Id.* at 56.

As discussed above, Dr. Brown states “the ‘tendency towards backdriving for helix (lead) angles at or above a certain value has . . . been described by a general heuristic that ‘when the screw lead is less than 1/3 the diameter, backdriving will not occur.’ Ex. 2018.” Ex. 2006 ¶ 65. Patent Owner relies on Dr. Brown’s calculations that, “from Yu’s coarse thread design, a POSITA applying the heuristic would find the screw lead on Heusser to be much greater than one-third Heusser’s socket diameter as well, an approximately 10:1 relationship.” PO Resp. 56 (citing Ex. 2006 ¶¶ 151–54). Patent Owner contends “Petitioner’s suggested combination would, therefore, also render Heusser ‘inoperable for its intended purpose,’ and thus ‘fail[s] to support a conclusion of obviousness.’” *Id.* at 58.

(2) *Petitioner's position*

Petitioner contends

Patent Owner assumes “viscous materials” are stored in the cartridge that create a “backpressure” upon evacuation, then relies on this assumption when making its “interlock” arguments described above. See POR 10, 42-58, 78-82. The problem with this assumption and the arguments flowing from it is the ’578 patent never discloses—in the claims or otherwise—what components/materials are stored in the cartridge. The claims, for example, simply recite “a cartridge for at least two components.” Ex. 1001, 9:50. Keller ’574 and Heusser likewise disclose generic discharge arrangements without limitation on the types of materials to be discharged.

Pet. Reply 17 (citing Ex. 1005, Title, 1:21–2:33; Ex. 1007, Title, 1:5–65; Ex. 1003 ¶ 91). Petitioner contends “a POSITA would have had no concerns with applying Yu’s threaded connection design to . . . Heusser for at least materials with relatively low viscosity.” *Id.* at 18 (citing Ex. 1010, 1:24-31; Ex. 1003 ¶ 91).

(3) *Analysis*

As we discussed above, we begin our analysis by noting that claim 1 of the ’578 patent does not recite any intended purpose, with the preamble of claim 1 simply reciting a “discharge arrangement.” Ex. 1001, 9:48. And the ’578 patent states the “present invention relates to a discharge arrangement comprising a cartridge or syringe for at least two components and comprising an accessory part.” *Id.* at 1:17–19.

We already discussed Yu above. Dr. Gale explains that “[b]oth Heusser and Yu disclose an accessory part for a discharge arrangement that is threaded onto a cartridge.” Ex. 1003 ¶ 131 (citing Ex. 1007, 2:42–62, Fig. 5; Ex. 1006, 12, 16, Fig. 3). Dr. Gale states “Heusser discloses that transition part 11 includes an outer screw thread 15' and connection part 22 includes an

inner screw thread 25 that ‘forms the counterpart to the outer screw thread 15’.” *Id.* (citing Ex. 1007, 2:42–62). Dr. Gale states “a POSITA would have been motivated to modify Heusser by using Yu’s male thread elements on the outer circumference of connection part 22 in place of inner screw thread 25 and Yu’s female thread grooves on the inner circumference of transition part 11 in place of outer screw thread 15’.” *Id.* ¶ 133. Dr. Gale states

With this design, the male thread elements would need to be placed near the bottom of connection part 22 to ensure that the inlets to the mixer are fully inserted into the outlets of the cartridge upon completion of the threaded connection, which is important to prevent leakage of the components.

Id. ¶ 135.

Dr. Brown states the “tendency towards backdriving for helix (lead) angles at or above a certain value has also been described by a general heuristic that ‘when the screw lead is less than 1/3 the diameter, backdriving will not occur.’ Ex. 2018.” Ex. 2006 ¶ 65. Dr. Brown states

Yu expressly expects the external tangs of a caulking gun “to resist the pressure within the cartridge in use” by engaging “the flange 54 of the nozzle ... during the caulking operation.” Ex. 1006, 10. A POSITA would therefore recognize that Yu’s coarse threading alone is unable to resist the backpressures during use without the external interlock provided by the tangs-flange interaction.

Id. ¶ 147.

Dr. Gale responds “a person of ordinary skill in the art would have known how to manipulate the coefficient of friction (by selecting certain materials) and/or the lead angle to make sure Yu’s design was self-locking if a self-locking design was desired. *See* Ex. 2023, 1.” Ex. 1023 ¶ 26. Dr. Gale states “[i]f a person of ordinary skill in the art wanted to design a self-locking connection using polyethylene while maintaining the 0.72-inch

Lead from Yu’s Figure 3, one would have only needed to increase the diameter from 1 inch to 1.15 inches.” *Id.* ¶ 27. As to viscosity, Dr. Gale states that for “two-part epoxies, there’s a pretty wide range of viscosities. I’ve seen everything from pretty thin to pretty thick. But I’m -- you know, one that you can do with your thumb probably is limited to about, you know, 5 bar or something like that.” Ex. 2021, 23:6–11.

Both experts have demonstrated that the ordinary artisan, interested in ensuring dispensing without a nozzle separating from the cartridge, would have known the necessary parameters to ensure this result, including selecting helix lead angles to avoid backdriving (Ex. 2006 ¶ 65), selecting viscosity of the material being dispensed (Ex. 2021, 23:6–11), and selecting parameters such as the coefficient of friction of the materials. Ex. 1023 ¶ 26.

We find that a preponderance of the evidence of record supports the position that the combination of Heusser and Yu as proposed by Petitioner would result in a device operable to discharge materials as required by claim 1 of the ’578 patent. “[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 550 U.S. at 417.

e) Analogous art

As discussed above, Patent Owner contends “Yu is non-analogous art to the ’578 patent because Yu relates to single component cartridge systems – not multiple-component systems.” PO Resp. 59. Patent Owner does not assert that Heusser is not analogous art. *See generally id.*

We have already fully addressed this issue in our discussion above of Ground I. *See* Section IX.C.2.e) above. For the reasons given, we find that Yu and Heusser are in the same field of endeavor as the ’578 patent of

designing rapid and reliable connections between a cartridge and an outlet nozzle, and that both Yu and Heusser are pertinent to the issue of attaching a nozzle to a cartridge with two components. *See, e.g.*, Ex. 1003 ¶ 130.

f) Ramps Limitation

As discussed above, Patent Owner contends “Yu’s coarse threads do not render obvious ‘*at least two ramps*,’ properly understood as ‘webs having respective upper and lower inclined planes of substantially the same width along the webs’ lengths,’ combined with . . . Heusser.” PO Resp. 74 (citing Ex. 2006 ¶ 199).

We have already fully addressed this issue in our discussion above of Ground I. *See* Section IX.C.2.f) above. For the reasons given, we find that Yu reasonably teaches the “at least two ramps” requirement in claim 1 of the ’578 patent as actually recited in the patent for the reasons given in the Petition.

g) Positively guided manner to cause a constrained lifting limitation

As discussed above, Patent Owner contends the “Heusser-Yu combination[] fail[s] to render obvious independent claim 1’s ‘*discharge arrangement*’ including [1K]’s ‘*when the connection is released, the accessory part is lifted from the cartridge in a positively guided manner to cause a constrained lifting.*’ PO Resp. 78 (citing Ex. 2006 ¶ 210).

We have already fully addressed this issue in our discussion above of Ground I. *See* Section IX.C.2.g) above. Dr. Gale explains with regard to this combination that

A POSITA would have understood that when the nozzle is rotated, the nozzle is positively guided towards the cartridge in a constrained manner by the engagement of the female thread grooves and male coarse threads because, for example, Yu

discloses that “forming a coarse thread connection between the nipple and nozzle . . . will seat the nozzle on the nipple in response to a rotation of less than 90°.

Ex. 1003 ¶ 161 (citing Ex. 1006, 4). Dr. Brown, in rebuttal, argues that the combination of Heusser and Yu would result in “an unconstrained lifting of the nozzle assembly. This is because the lifting would occur during use as a result of backdriving.” Ex. 2006 ¶ 221. Dr. Brown relies on the failure of the components to engage resulting in leakage and backdriving.

However, as already stated, both experts have demonstrated that the ordinary artisan, interested in ensuring dispensing without backdriving a nozzle to separate from the cartridge, would have known the necessary parameters to ensure this result, including selecting helix lead angles to avoid backdriving (Ex. 2006 ¶ 65), selecting viscosity of the material being dispensed (Ex. 2021, 23:6–11), and selecting parameters such as the coefficient of friction of the materials. Ex. 1023 ¶ 26. Thus, we find Dr. Gale more persuasive on this point that the coarsely threaded nozzle and cartridge combination of Heusser and Yu would resist backdriving with some materials, pressures, and conditions within the scope of claim 1 of the ’578 patent.

For the reasons given, we find that the combination of Heusser and Yu reasonably teaches the “positively guided manner to cause a constrained lifting” requirement in claim 1 of the ’578 patent.

h) Conclusion

Therefore, overall, we find that a preponderance of the evidence shows that claims 1–3 and 16 of the ’578 patent would have been obvious over the teachings of Heusser and Yu.

E. Ground 3: Obviousness over Keller '574, Heusser, and Yu

Petitioner contends that dependent claims 10, 11, 13, and 17 would have been obvious over Keller, Yu, and Heusser. Pet. 45–56, 82–92.

Petitioner contends regarding claim 10 that “in the combined Heusser/Yu apparatus, the female thread grooves and transition part 11 combine to form the ‘first connecting component’ on housing 1 (accessory part), and the male threads and connection part 22 combine to form a ‘second connecting component’ on vessel 2 (cartridge).” Pet. 83–84. Petitioner contends

It would have been obvious in view of Keller to modify the above design by switching the thread/groove arrangement. Ex. 1003, ¶168. That is, it would have been obvious for a POSITA to put the male thread elements on the outer circumference of transition part 11 instead of having female thread grooves on the inner circumference, and to use female thread grooves on the inner circumference of modified thread-groove sockets instead of having male threads on the outer circumference of connection part 22. Ex. 1003, ¶168.

Id. at 84. Petitioner contends with regard to claim 11 that in “the Heusser/Yu/Keller apparatus, the transition part 11 is the connector part and, in view of Keller’s above disclosures, is rotatable with respect to the inlets of the accessory part and is axially secured.” *Id.* at 88 (citing Ex. 1003 ¶ 173). Petitioner contends with regard to claim 13 that Keller teaches coding mean for mixer inlets so a “POSITA would have found it obvious to modify the Heusser/Yu apparatus’s inlets and outlets by using different diameters or one of Keller’s other coding techniques to improve the connection between the static mixer and cartridge.” *Id.* at 89–90 (citing Ex. 1005, 16:6–9; Ex. 1003 ¶ 175). Petitioner contends, regarding claim 17, that for “the combined Heusser/Yu/Keller apparatus, the transition part 11 is the connector part and, in view of the Keller disclosures described above, is

integrally formed directly on the housing of the accessory part. Ex. 1003, ¶177. A POSITA would have had a reasonable expectation of success in making this combination.” *Id.* at 91.

Patent Owner contends “Petitioner’s reasons supporting the combination suffer similar pitfalls as the Keller ’574-Yu and Heusser-Yu respective reasons. Backdriving remains the expectation for the Heusser-Yu-Keller ’574 combination in the absence of Yu’s tangs. And a POSITA would have not had a reasonable expectation of success when using Yu’s tangs.” PO Resp. 85. Patent Owner contends “Petitioner’s justification for combining with Keller ’574 ‘to provide a more secure connection’ confirms the impermissible hindsight bias behind all of Petitioner’s combinations.” *Id.* at 86. Patent Owner contends

Petitioner therefore adds Keller ’574 to correct a problem of Petitioner’s own making, which Heusser did not originally experience. If a POSITA had wanted increased surface area for a “more secure connection,” a POSITA would not have had a reason to modify Heusser with Yu to begin with, and thus would not have needed to then turn to Keller ’574.

Id.

We have already found Patent Owner’s arguments relating to backdriving, tangs, and hindsight unpersuasive for the reasons discussed above. We remain persuaded that this falls in the situation when “a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 550 U.S. at 417. “A person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

Accordingly, we find that a preponderance of the evidence shows the claims 10, 11, 13, and 17 of the '578 patent would have been obvious over the teachings of Heusser, Keller '574, and Yu.

X. OBJECTIONS TO DEMONSTRATIVES

Prior to the oral argument, Patent Owner submitted an objection to slide 80 of Petitioner's demonstratives. *See* Paper 25. This objection alleges that slide 80 improperly contain new theories and arguments "directed towards the 'constrained lifting' claim feature." *Id.*

Demonstratives are not evidence. *See* PTAB Consolidated Trial Practice Guide, 84 (Nov. 2019) ("Demonstrative exhibits used at the final hearing are aids to oral argument and not evidence . . ."). In this Final Written Decision, we rely on the arguments properly presented in the parties' briefs and the evidence of record, not on the demonstratives.

Therefore, we overrule Patent Owner's objections as being moot.

XI. CONCLUSION

After considering the evidence and arguments presently before us in the complete trial record, we conclude that Petitioner has demonstrated, by a preponderance of the evidence, that challenged claims 1–3, 9–13, 16, and 17 of the '578 patent are unpatentable.¹⁵

¹⁵ 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, 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:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not shown Unpatentable
1–3, 9–13, 16, 17	103	Keller '574, Yu	1–3, 9–13, 16, 17	
1–3, 16	103	Heusser, Yu	1–3, 16	
10, 11, 13, 17	103	Heusser, Yu, Keller '574	10, 11, 13, 17	
Overall Outcome			1–3, 9–13, 16, 17	

XII. ORDER

In consideration of the foregoing, it is:

ORDERED that claims 1–3, 9–13, 16, and 17 of U.S. Patent 9,010,578 B2 are determined to be unpatentable; and

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

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Patent 9,010,578 B2

For PETITIONER:

Jason Stach

David Mroz

Robert High

Matthew Ritter

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP

Jason.stach@finnegan.com

David.mroz@finnegan.com

Robert.high@finnegan.com

Matthew.ritter@finnegan.com

For PATENT OWNER:

Andrew Lowes

John Emerson

Adam Fowles

HAYNES AND BOONE, LLP

Andrew.lowes.ipr@haynesboone.com

Russ.emerson@haynesboone.com

Adam.fowles.ipr@haynesboone.com