

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMERICAN ORTHODONTICS CORPORATION,
Petitioner,

v.

DENTSPLY INTERNATIONAL INC.,
Patent Owner.

Case IPR2016-01652
Patent 6,276,930 B1

Before JAMES A. TARTAL, FRANCES L. IPPOLITO, and
JAMES A. WORTH, *Administrative Patent Judges*.

TARTAL, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

American Orthodontics Corporation (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting institution of *inter partes* review of claims 1–10 of U.S. Patent No. 6,276,930 B1 (Ex. 1001, “the ’930 patent”). Dentsply International Inc. (“Patent Owner”) filed a Preliminary Response (Paper 6, “Prelim. Resp.”).

Pursuant to 35 U.S.C. § 314(a), we determined the Petition showed a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of claims 1–10 of the ’930 patent and instituted *inter partes* review on certain asserted grounds of unpatentability. Paper 7 (“Inst. Dec.”). After institution, Patent Owner filed a Patent Owner Response. Paper 15 (“PO Resp.”). Petitioner filed a Reply to Patent Owner’s Response. Paper 20 (“Pet. Reply”). Oral argument was held before the Board on November 21, 2017. Paper 27 (“Tr.”).

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. Having considered the record before us, we determine Petitioner has shown by a preponderance of the evidence that claims 1–10 of the ’930 patent are unpatentable. *See* 35 U.S.C. § 316(e).

II. BACKGROUND

A. THE ’930 PATENT

The ’930 patent, titled “Orthodontic Aid,” issued August 21, 2001, from U.S. Application No. 09/443,724, filed November 19, 1999. Ex. 1001. The ’930 patent generally relates “to an orthodontic aid or bracket.” Ex. 1001, 1:11–12. In particular, the ’930 patent describes “an orthodontic bracket having a retention base for a respective tooth and identifying indicia in relation to the tooth for which the orthodontic aid is suitable.” *Id.* at

2:18–21. “The size of the indicia is at least 3 square millimeters,” and the indicia has “substantially null depth with respect to the retention base.”

Id. at 2:22–24.

Figures 1 and 2 of the '930 patent are reproduced below:

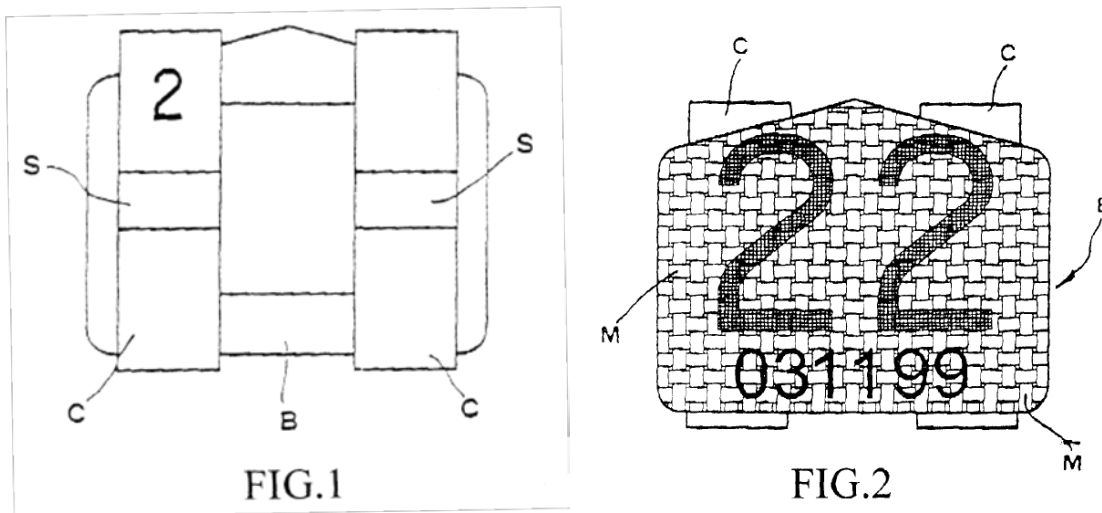


Figure 1 illustrates “a plan view of an orthodontic aid with traditional identification codes.” *Id.* at 2:53–54. Figure 2 illustrates “a back view of an orthodontic aid in accordance with the [claimed] invention.” *Id.* at 2:55–56. The orthodontic bracket “consists of a retention base (B) and of two bodies (C) wedded to the retention base and provided with seats for a corresponding section of an orthodontic archwire.” *Id.* at 2:67–3:4. The orthodontic aid taught by the '930 patent includes indicia consisting of a numerical code (the number “22” appearing in Figure 2) provided on the backside of the retention base (B) which is the side that will adhere to the tooth. *Id.* at 3:4–7. A further code may be provided on the backside of the orthodontic base, such as a number representing the manufacturing date or source (illustrated as “031199” in Figure 2). *Id.* at 3:44–47. The claimed invention may be applied to various types of bases, with Figure 2 illustrating a “net-like base structure” which was known in the art and consists of individual

elements (M) in a lattice arrangement. *Id.* at 3:54–64 (citing Miller¹ as disclosing “[a]n orthodontic aid featuring a net-like retention base”).

Figure 4 of the '930 patent is reproduced below.

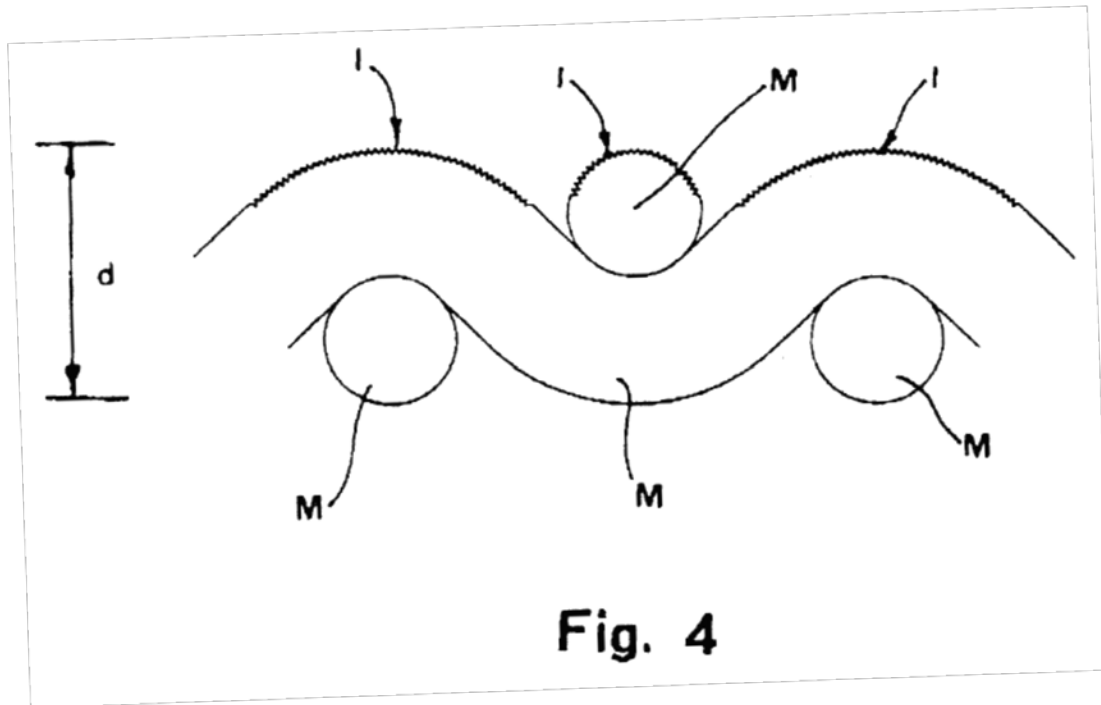


Figure 4 is “a schematic partial cross section of the net-like back side of an orthodontic aid in accordance with the [claimed] invention.” *Id.* at 2:60–62. The net-like base structure “consists of individual mesh elements (M) in a lattice arrangement.” *Id.* at 3:57–60. A laser beam or other equivalent means may be used for marking of the indicia, resulting in roughened portions of elements (M) identified in Figure 4 by the letter “I,” which also provide a wider area where adhesive can operate more effectively. *Id.* at 4:5–15. The depth of the portion altered by marking is substantially null with respect to the depth (d) of the base. *Id.* at 4:26–29. The indicia also follows the outer profile of the net-like base. *Id.* at 4:17–19.

¹ U.S. Patent No. 4,068,379, issued Jan. 17, 1978 (Ex. 1007, “Miller”).

B. ILLUSTRATIVE CLAIMS

Claims 1 and 6 of the '930 patent are independent. Claims 2–5 depend from claim 1 and claims 7–10 depend from claim 6. Claims 1 and 6 are illustrative of the claimed subject matter and are reproduced below:

1. An orthodontic bracket, comprising:
a retention base for a respective tooth, said retention base having a back side; identifying indicia for identifying the respective tooth for which the orthodontic bracket is suitable, said indicia including a sign provided on the back side of said retention base, the size of said indicia being at least 3 square millimeters, the depth of said indicia being substantially null with respect to the depth of the retention base, said indicia having a profile which follows the outer profile of said retention base.

Ex. 1001, 4:41–51.

6. An orthodontic bracket, comprising:
a retention base for a respective tooth, said retention base having a net-like structured back side;
identifying indicia for identifying the respective tooth for which the orthodontic bracket is suitable, said indicia including a sign provided on the back side of said retention base, the size of said indicia being at least 3 square millimeters, the depth of said indicia being substantially null with respect to the depth of the retention base, said indicia having a profile which follows the outer profile of said retention base

Id. at 4:64–5:8.

C. RELATED PROCEEDINGS

The parties indicate that the '930 patent is asserted in the United States District Court for the Middle District of Pennsylvania in a case captioned *Dentsply Int'l, Inc. v. American Orthodontics Corp.*, No. 15-CV-1706 (M.D. Pa.). Pet. viii; Paper 4, 1.

D. REAL PARTIES IN INTEREST

Petitioner identifies only itself as a real party in interest. Pet. viii. Patent Owner identifies Dentsply Sirona Inc. as the real party in interest and owner of the '930 patent following a 2016 merger of Dentsply International Inc. and Sirona Dental Systems. Paper 4, 1.

E. THE INSTITUTED GROUNDS OF UNPATENTABILITY

We instituted *inter partes* review of claims 1–10 of the '930 patent on the following grounds of unpatentability asserted in the Petition. Inst. Dec. 24.

Reference(s)	Basis	Claims Challenged
Roman, ² Horng, ³ and Farzin-Nia ⁴	§ 103(a)	1–10
Miller, ⁵ Kesling, ⁶ and Orikasa ⁷	§ 103(a)	1–3 and 6–8
Miller, Kesling, Orikasa, and Roman	§ 103(a)	4, 5, 9, and 10

Petitioner supports its challenge with the Declaration of W. Eugene Roberts, D.D.S., Ph.D., dated August 19, 2016 (Ex. 1010) and the Declaration of Michael L. Lebby, Ph.D., dated August 18, 2016 (Ex. 1011). In opposition, Patent Owner relies on the Declaration of Brad James, Ph.D, P.E., FASM, dated May 26, 2017 (Ex. 2001).

² U.S. Patent No. 5,556,276, issued Sep. 17, 1996 (Ex. 1002, “Roman”).

³ U.S. Patent No. 5,322,436, issued June 21, 1994 (Ex. 1003, “Horng”).

⁴ U.S. Patent No. 5,480,301, issued Jan. 2, 1996 (Ex. 1004, “Farzin-Nia”).

⁵ See footnote 1 *supra*.

⁶ U.S. Patent No. 4,120,090, issued Oct. 17, 1978 (Ex. 1005, “Kesling”).

⁷ U.S. Patent No. 5,595,484, issued Jan. 21, 1997 (Ex. 1008, “Orikasa”).

III. ANALYSIS

A. CLAIM CONSTRUCTION

We interpret claims of an unexpired patent using the broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b). We presume a claim term carries its “ordinary and customary meaning,” which is “the meaning that the term would have to a person of ordinary skill in the art in question” at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (citation and quotations omitted). This presumption, however, is rebutted when the patentee acts as his own lexicographer by giving the term a particular meaning in the specification with “reasonable clarity, deliberateness, and precision.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

1. “*indicia including a sign*”

Claims 1 and 6 each recite “indicia including a sign.” Ex. 1001, 4:46, 5:2–3. Petitioner contends that “sign” should be construed to mean “marking, figure, or symbol.” Pet. 7–9. In particular, Petitioner argues that “sign” is broader than a “plus” or “minus” sign, noting that claim 2 of the ’930 patent, for example, recites “said sign comprises character markings consisting of a number with two figures.” *Id.* at 8 (quoting Ex. 1001, 4:53–54). Patent Owner does not contest Petitioner’s proposed construction. PO Resp. 6.

We agree with Petitioner that “sign,” as used in the ’930 patent, is not limited to a “plus sign” or a “minus sign,” but more broadly includes character markings, such as numbers and figures. In the absence of any dispute, the claim term “indicia including a sign” does not further require an

express construction. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999): “only those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”

2. “*the size of said indicia being at least 3 square millimeters*”

Claims 1 and 6 recite “the size of said indicia being at least 3 square millimeters” (the “size” limitation). Ex. 1001, 4:47–48, 5:4–5. The Parties do not propose express constructions for the “size” limitation. Patent Owner states, and Petitioner agrees, that the “size” limitation corresponds to “the area that the markings take up.” Tr. 37:12–13. For example, in the case of an indicia in the form of the number “2,” the “size of the indicia” is the “actual marking of the 2” and “the spaces that help define the 2 as well to make it readable.” *Id.* at 37:9–15; *see also id.* at 47:14–22 (Ppetitioner agreeing with Patent Owner and stating “that is essentially putting a box and determining the area around the marking size”). The “size” limitation does not constrain the number of characters or the size of individual characters that compose the indicia. *See id.* at 29:14–15. Thus, the number and size of individual characters that compose the indicia may vary, so long as they collectively encompass an area of at least 3 square millimeters. Ex. 1001, 3:38–40. In the example discussed above, the “size” limitation provides that the area taken up by the indicia in the form of the number “2” must be at least 3 square millimeters. In an example provided in the ’930 patent, the indicia in the form of the number “22” must be at least 3 square millimeters. *Id.* at 3:4–7, 3:38–40. We further determine, in the absence of any dispute, that the claim term “the size of said indicia being at least 3 square millimeters” does not further require an express construction. *Vivid Techs.*, 200 F.3d 795 at 803.

B. LEVEL OF ORDINARY SKILL

With respect to the level of ordinary skill, Petitioner contends:

A person of ordinary skill in the art would have at least some experience in the design, manufacture, or use of orthodontic brackets, or in the field of laser based technologies; such a person would have at least a bachelor's degree in an engineering or science field and at least one year of relevant work experience.

Pet. 9 (citing Ex. 1010 ¶¶ 31–35; Ex. 1011 ¶¶ 24–25). In the Institution Decision, we stated that the level of ordinary skill in the art is reflected by the prior art of record. Inst. Dec. 14–15. Patent Owner did not propose an alternative level of ordinary skill to Petitioner's proposal and did not dispute that the level of ordinary skill in the art is reflected by the prior art of record. PO Resp. 5; Tr. 26:12–19. We determine, based on the full record, that the level of ordinary skill is not in dispute and is reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

C. REFERENCES ASSERTED AS PRIOR ART

Petitioner relies on Roman, Horng, Farzin-Nia, Miller, Kesling, and Orikasa with respect to its contentions that claims 1–10 of the '930 patent would have been obvious under the instituted grounds. Pet. 2. Patent Owner does not dispute the prior art status of any of the asserted references.

1. *Roman (Ex. 1002)*

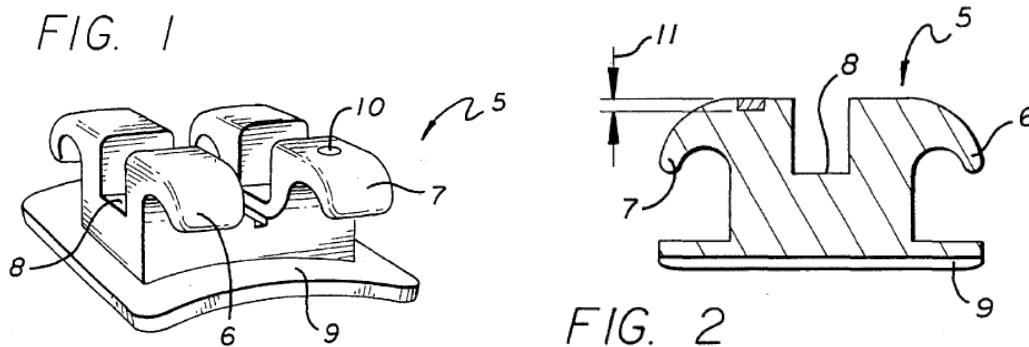
Roman, titled "Laser Annealing Marking of Orthodontic Appliance," describes the use of a laser to anneal the surface of an orthodontic bracket for identification purposes. Ex. 1002, Abstract.

Roman explains the problem it seeks to address, stating that:

As a result of the sterilization process, the orthodontic appliances become commingled and are difficult to identify because of their small size and nearly identical shape. In order to more easily identify orthodontic appliances, various methods have been employed such as color coding portions of the appliance. Unfortunately, the color tends to wash away with the sterilization process leaving the orthodontist with the task of sorting through unmarked appliances.

Id. at 1:37–44. Roman describes using a laser beam “of sufficient power to anneal the surface thereby causing a marking area on a portion of the surface, without remelting the surface area.” *Id.* at 2:9–12.

Roman Figures 1 and 2 are reproduced below.



Roman Figures 1 and 2 illustrate orthodontic bracket 5 with tie wings 6, 7 mounted on base pad 9. *Id.* at 38–43. “Base pad 9 is used as an interface between the orthodontic bracket and the patient’s tooth and is commonly attached to the tooth by an adhesive.” *Id.* at 2:44–46.

In a preferred embodiment, marking area 10 is provided on orthodontic bracket 5, and generally on one or both of the wings 6, 7. Marking area 10 can include any specific pattern or design, or may include any combination of alpha and numeric characters for identification of orthodontic bracket 5.

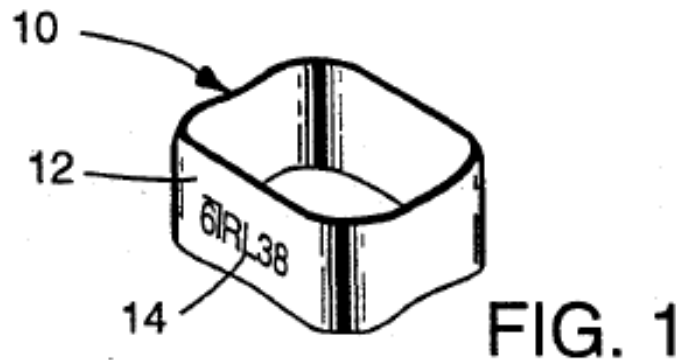
Id. at 2:51–56. The depth of marking area 11, shown in Figure 2, is determined by a number of factors, including the velocity of the laser

and the thermoconductivity, color, and surface finish of the bracket. *Id.* at 3:33–43.

2. *Horng (Ex. 1003)*

Horng, titled Engraved Orthodontic Band, describes an orthodontic band with an easy-to-read, laser-engraved mark. Ex. 1003, Abstract.

Figure 1 of Horng is reproduced below.

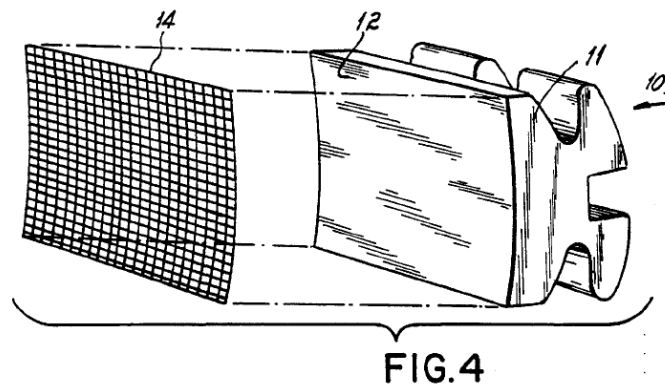


Horng Figure 1 illustrates orthodontic band 10, including outer wall 12 and “an engraved identification mark 14 preferably made by a laser.” *Id.* at 2:55–63. Horng does not expressly explain the purpose of each character in mark 14, but states that it “includes numerals sufficient to identify the location of the tooth for which the band 10 is intended, as well as a manufacturer’s notation that represents a size of the band 10.” *Id.* at 2:63–66. “The mark 14 is preferably located on a portion of the wall 12 that is positioned in an interproximal manner on a mesial side of the tooth when the band 10 is placed over the tooth in its correct orientation.” *Id.* at 2:66–3:2. In one example, the laser engraved mark produced characters with a height of 0.15 cm. *Id.* at 29–33.

3. *Farzin-Nia (Ex. 1004)*

Farzin-Nia, titled Orthodontic Appliances Having Improved Bonding Characteristics and Methods of Making, describes a “primary mechanical interlock retention surface” in the form of a mesh applied to the tooth contact surfaces. Ex. 1004, Abstract.

Figure 4 of Farzin-Nia is reproduced below.



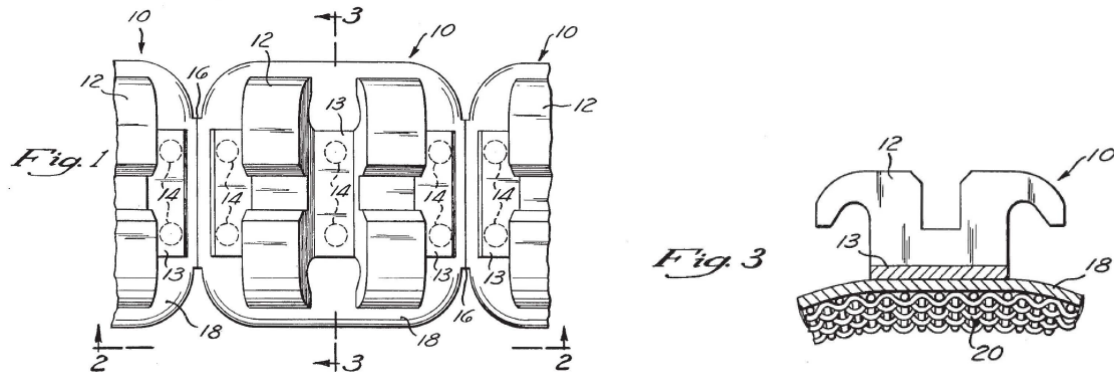
Farzin-Nia Figure 4 illustrates orthodontic bracket 10 with bonding base 11, which has tooth contact surface 12 designed to be bonded to the exterior surface of a tooth. *Id.* at 4:62–66, 5:48–56. Mesh 14 is preferably diffusion bonded to tooth contact surface 12. *Id.* at 5:52–54. “[A]fter woven mesh 14 has been secured to tooth contact surface 12, bracket 10 is subjected to ion bombardment whereby very small amounts of material are removed from the mesh 14 and the exposed areas of tooth contact surface 12,” thereby increasing the roughness of the surface. *Id.* at 6:10–16. Roughening the surface “provides more area for mechanical adhesion with the dental adhesive used to bond the bracket to the tooth and thus results in increased mechanical bond strength.” *Id.* at 6:16–19.

4. *Miller (Ex. 1007)*

Miller, titled Orthodontic Appliance with Porous Tooth-Abutting Face, describes bonding mesh to the base of an orthodontic appliance.

Ex. 1007, Abstract.

Figures 1 and 3 of Miller are reproduced below.

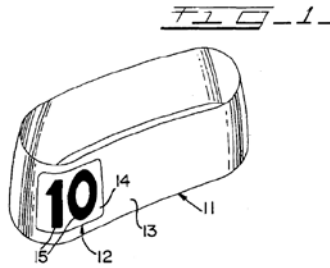


Miller Figures 1 and 3 illustrate composite pad assembly 10 attached to orthodontic bracket 12 at base portion 13. *Id.* at 3:13–15, 3:18–19, 4:4–10. Composite pad 10 consists of upper nonporous surface 18 and lower porous tooth-abutting surface 20, which may be a mesh or screen. *Id.* at 4:19–23.

5. *Kesling (Ex. 1005)*

Kesling, titled Orthodontic Band with Identification and Method of Making the Identification, describes applying identification to an orthodontic band by applying a “first coating or layer of material in the form of a suitable geometrical shape and a second coating or layer of material on the first coating in the form of indicia.” Ex. 1005, Abstract. Kesling explains that it was well known to apply indicia to orthodontic bands and that “such identification has been applied by printing or stamping of indicia such as numerals and/or letters onto the exterior surface of the bands.” *Id.* at 1:21–29.

Figure 1 of Kesling is reproduced below.



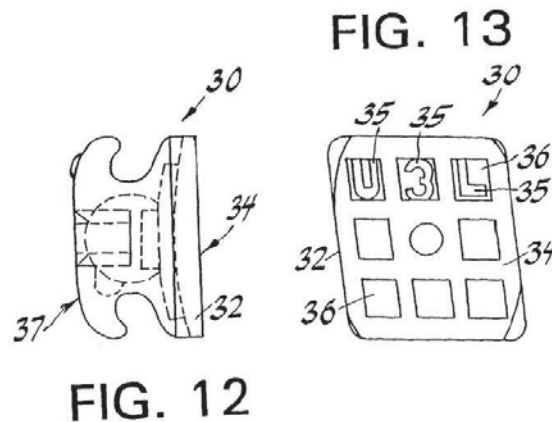
Kesling Figure 1 illustrates preformed orthodontic band 11 with identification 12 applied to exterior surface 13. *Id.* at 2:62–63.

“Identification 12 in [Fig.] 1 includes a first coating or layer 14 of non-toxic FDA approved material such as a suitable ink or paint; and a second layer or coating 15 of non-toxic FDA approved material and in the form of indicia, and, in this illustration the numeral ‘10.’” *Id.* at 3:24–28. “The identification 12 is located on the lingual side band which would not show when mounted on a tooth of a patient.” *Id.* at 3:18–20. “The first layer is in the form of a continuous sheet which will have good adhesion characteristics to the highly polished surface of the band.” *Id.* at 2:14–17. “The second coating in the form of indicia would be of a substantially opaque nature and of a color that would contrast with the color of the first coating.” *Id.* at 2:22–25.

6. *Orikasa (Ex. 1008)*

Orikasa, titled Orthodontic Bracket, describes an orthodontic bracket with a plastic bracket body and metal reinforcement member. Ex. 1008, Abstract.

Figures 12 and 13 of Orikasa are reproduced below.



Orikasa Figures 12 and 13 illustrate bracket 30 with base 32 and lingual surface 34, which is adapted to be fixed to a tooth. *Id.* at 6:41–45. Further, Figure 13 is the rear view of the bracket 30 illustrating the back of the base 32. *Id.*

Identification characters 35 (shown for example as “U3L” in the drawing) are molded in recessed portions 36 of the lingual surface 34 of the bracket 30. An important advantage of locating the identification characters 35 on the lingual surface 34 is that after cement or other bonding material is applied to the lingual surface 34 to bond the bracket 30 to the tooth, the reference characters should not be noticeable.

Id. at 6:46–53.

D. PRINCIPLES OF LAW

To prevail in its challenges to the patentability of the claims, Petitioner must prove unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

A patent claim is unpatentable as obvious under 35 U.S.C. § 103(a) if “the differences between” the claimed subject matter “and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which

said subject matter pertains.” 35 U.S.C. § 103(a). An invention “composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). Rather, “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *Id.* An obviousness determination “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Id.* (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); see *In re Magnum Oil Tools Int’l*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). 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 skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

E. OBVIOUSNESS OVER ROMAN, HORNG, AND FARZIN-NIA

Petitioner contends that claims 1–10 of the ’930 patent would have been obvious over Roman, Horng, and Farzin-Nia. Pet. 13–26. Patent Owner disagrees. PO Resp. 9–21.

1. Claim 1

Petitioner provides a claim chart identifying how it contends the combination of Roman and Horng teaches each element of claim 1. Pet. 23; see also *id.* at 14 (stating that “Roman and Horng alone render obvious at

least Claims 1–5 of the '930 patent”).⁸ We determine that Roman teaches an orthodontic bracket (orthodontic bracket 5) with a retention base (base pad 9) with a backside (the side of base pad 9 that abuts the tooth), as claimed. Ex. 1002, 38–47, Figs. 1, 2; *see also* Pet. 15; Ex. 1010 ¶ 65; Ex. 1011 ¶ 51. Roman also teaches identifying indicia, including a sign, for identifying the respective tooth for which the orthodontic bracket is suitable (marking area 10), as claimed. Ex. 1002, 2:51–3:4; *see also* Pet. 16–17; Ex. 1010 ¶¶ 72–74; Ex. 1011 ¶ 52.

Claim 1 further recites “said indicia including a sign provided on the back side of said retention base.” We determine Roman teaches this limitation as well because it expressly claims a method for surface treating an orthodontic appliance that includes marking a selected portion of the “outer surface” of the appliance by applying a laser beam. Ex. 1002, 5:1–7; *see also* Pet. 17 (explaining that the examples illustrated in Roman do not show marking the backside but that Roman discloses marking any “outer surface” which includes the backside); Ex. 1010 ¶ 80; Ex. 1011 ¶ 53.

Patent Owner seeks to disregard the broader disclosure of Roman by focusing on the statement in Roman that “[i]n a preferred embodiment, marking area 10 is provided on orthodontic bracket 5, and generally on one or both of tie wings 6, 7.” Ex. 1002, 2:51–53; PO Resp. 9–13. That Roman describes a preferred embodiment that places the mark on the front of the bracket does not refute the fact that Roman more broadly teaches marking an “outer surface,” and there is no dispute that the outer surface of a bracket includes the back of the bracket.

⁸ As discussed below, Petitioner relies on Farzin-Nia with respect to an additional limitation in claim 6 not present in claim 1. *See* Pet. 23.

Patent Owner also argues that according to Roman the “marking area is visible with the naked eye,” and, therefore, presumably not on “any outer surface.” PO Resp. 12 (quoting Ex. 1002, 2:12–14). Patent Owner offers no explanation or evidence to support that Roman’s reference to a mark being visible with the naked eye means it is visible after the bracket is installed. Roman makes clear that the mark is applied to the bracket to allow the orthodontist to identify the correct bracket to be used when it is installed on a patient’s tooth. Ex. 1002, 1:13–42. Patent Owner also argues that Petitioner has not shown “how placing a mark between teeth on the front side of an orthodontic band is at all related or suggestive of a sign on the back side of a retention base of an orthodontic bracket.” PO Resp. 13 (emphasis omitted). We disagree and find Petitioner’s explanation that applying Horng’s teaching of the benefit of placing a mark on a band between teeth so that it is not visible after being installed supports placing a mark on the back of a bracket to obtain the same benefit to be persuasive. See PO Resp. 13; Pet. 17–18.

With regard to the limitations of claim 1 that the “depth of said indicia being substantially null with respect to the depth of the retention base,” and “said indicia having a profile which follows the outer profile of said retention base,” we determine these features are also taught by Roman. Roman explains that the “annealing process is actually an oxidation of the surface of the material being annealed.” Ex. 1002, 3:22–23. Moreover, Roman states that “[s]ince the annealing process does not actually melt orthodontic bracket 5 in the marking area 10, there is no surface irregularity nor are there any weakened points as a result of melting.” *Id.* at 4:34–37.

Petitioner reasons, and we agree, that because the annealing process described by Roman is only on the surface, the depth of the marking is substantially null and necessarily follows the surface profile. Pet. 19–20. We credit the testimony of Dr. Lebby in support of Petitioner’s contentions in this regard. In addition to providing an explanation of the annealing process described in Roman, Dr. Lebby explains that the annealing process does not change the shape of the material, but creates a surface feature with a substantially null depth that follows the original surface profile. Ex. 1011 ¶¶ 48, 49, 54–63 (noting, for example, that a publication cited by Roman explains that surface annealing will have “very shallow material presentation”); *see also* Ex. 1010 ¶¶ 95–98, 102, 103, 105. We are not persuaded by Dr. James’s statement that the description in Horng “of ‘engraving,’ ‘deep’ marks, patient ‘aesthetic,’ passivation treatments to create a ‘frosty’ appearance, and the placement of marking on the outer-facing surface of the orthodontic appliance all teach away from the underlying principles of the ’930 patent.” Ex. 2001 ¶ 46. Dr. James does not explain sufficiently why the portions of Horng he identified are inconsistent with a mark having a “substantially null depth” that follows the surface profile, particularly in light of the annealing process used to create the mark in Horng.⁹

⁹ Though not directly referencing Roman or Horng, Dr. James acknowledged that the “depth of markings on brackets being substantially null with respect to the depth of the retention base” was known prior to the ’930 patent. Ex. 1038, 46:3–13. Similarly, Dr. James also confirmed that markings that follow the outer flat profile of the material on which it is marked were known prior to the ’930 patent as well. *Id.* at 46:8–24 (further distinguishing between a “flat profile” and a “curved or difficult profile”).

Lastly, claim 1 recites “the size of said indicia being at least 3 square millimeters.” We find two alternative reasons support Petitioner’s obviousness contentions with respect to the “size” limitation: (a) Petitioner has shown sufficiently that Horng teaches and suggests the “size” limitation; and (b) the “size” limitation is not a patentable distinction over the prior art.

First, we find Petitioner has shown sufficiently that Horng teaches and suggests the “size” limitation. Horng teaches an orthodontic band with a laser engraved mark that is “easy to read.” Ex. 1003, Abstract. More specifically, Horng teaches using a laser engraving apparatus to mark the orthodontic band with characters having a height of 0.15 cm, but does not specify a character width. *Id.* at 4:29–33. According to Dr. Roberts, knowing a height of 0.15 cm for the characters shown in Figure 1 of Horng, one can observe the cumulative area of the identification mark is more than 3 square millimeters. Ex. 1010 ¶ 87. To more precisely estimate the area of the mark taught by Horng, Dr. Roberts states that a letter whose width is approximately 80% of its height is considered “normal,” while a letter whose width is approximately 60% of its height is considered “condensed.” Ex. 1010 ¶ 86 (quoting ROB CARTER ET AL., *TYPOGRAPHIC DESIGN: FORM AND COMMUNICATION* 34 (2d ed. 1993)) (Ex. 1031). Using the lower and, therefore, more conservative condensed ratio of 60% for the width of a letter, Dr. Roberts reasons that each number or letter shown in mark 14 of Horng would have a width of 0.09 cm and a calculated area of 1.35 square millimeters. Ex. 1010 ¶ 87. Thus, an indicia with three letters or numbers would cover an area of over 3 square millimeters, and the indicia illustrated in Figure 1 of Horng has a combination of five letters and numbers.

Patent Owner argues that Dr. Roberts admitted he did not read the entire book on typographic design he used to identify a height to width ratio for characters and, therefore, his testimony is speculative. PO Resp. 14; *see also* Ex. 2001, ¶¶ 47, 48. Patent Owner, however, does not identify anything in the text relied upon by Dr. Roberts that is contrary to the testimony of Dr. Roberts or the disclosure that a conservative estimate of the width of a character is 60% of the height of the character. Because Dr. Roberts' testimony is supported by the book on typographic design he consulted, and because Patent Owner identifies no error in the ratio relied upon by Dr. Roberts, we credit his testimony notwithstanding the fact that he did not read the entire book on typographic design.

Patent Owner also argues that Dr. Roberts' calculation of the area was based on five letters and numbers, which included indicia of the size of the band. *Id.* at 15–16. By contrast, the “size” limitation of claim 1 is limited to “indicia for identifying the respective tooth for which the orthodontic bracket is suitable,” not indicia of the size of the band. In reply, Petitioner persuasively explains that in Figures 1 and 2 of Horng three of the five letters and numbers illustrated correspond to the indicia for the respective tooth – “6RL” – and that with each character having a calculated area of 1.35 square millimeters, only three of the five characters would have an area of approximately 4.05 square millimeters, well over the claimed area of 3 square millimeters. Pet. Reply 6.

Patent Owner further argues that Dr. Roberts' calculation was “based upon two different tooth locations and sizes” and, therefore, was “flawed and fails to disclose or suggest the size of the indicia claimed in the '930 Patent.” *Id.* at 16. Patent Owner explains that Figures 1 and 2 of Horng

illustrate a band for the right lower permanent molar, whereas the example described by Horng as having a letter height of 0.15 cm was for a band for the “lower left first tooth.” PO Response 15–16. We have considered this distinction and find it insufficient to discredit the testimony of Dr. Roberts as there is no evidence to suggest that the location of the tooth being identified in Horng has any bearing on the size of the indicia taught by Horng. The only letter height taught by Horng is 0.15 cm and there is no evidence to suggest that a letter height of 0.15 cm could not be used on the band illustrated in Figures 1 and 2 of Horng. Thus, based on the record, including all of Patent Owner’s arguments and accompanying evidence, we determine that Petitioner has sufficiently shown by a preponderance of the evidence that Horng teaches “the size of said indicia being at least 3 square millimeters,” as recited by claim 1 of the ’930 patent.

Second, and in the alternative, based on the complete record here, we determine the “size” limitation is not a patentable distinction. The Federal Circuit stated that the recitation of dimensional limitations which “did not specify a device which performed and operated any differently from the prior art” fail to distinguish the claimed device from the prior art. *Gardner v. TEC Sys., Inc.*, 725 F.2d 1338, 1349 (Fed. Cir. 1984); *see also* Pet. Reply 6 (quoting *Smith v. Nichols*, 88 U.S. 112, 119 (1875)) (“[c]hanges in ‘form, proportions, or degree’ will not ‘sustain a patent’”). With regard to the operation of the prior art in this case, Petitioner has shown, and there is no dispute, that the use of identifying indicia on an orthodontic device was well known. Pet. 16–17; Ex. 1011 ¶ 44; Ex. 1002, 2:1–7. Horng, for example, teaches an orthodontic band with a laser engraved identification mark which includes “numerals sufficient to identify the location of the tooth for which

the band” is intended. Ex. 1003, 2:61–65. The “size” limitation of the ’930 patent does not alter how identifying indicia on an orthodontic device operates as taught by the asserted prior art. By way of an example, if a retention base employed the number “2” as the “identifying indicia” and was in a font size that occupied 2 square millimeters, it would not satisfy the “size” limitation because it would occupy an area of less than 3 square millimeters. If the same retention base were marked with the number “22” as the “identifying indicia” in the same font size, it would presumably occupy twice as much space and would satisfy the “size” limitation because it would occupy an area of at least 3 square millimeters. The retention base in this example would not operate or perform any differently whether it was labeled with the number “2” or the number “22.”

Patent Owner was provided an opportunity during the oral argument to address whether the ’930 patent operates differently from the prior art. Patent Owner identified the “ability to have that larger marking in front of you which was not known before,” which Patent Owner described as “more of a feature or an advantage.” Tr. 29:8–9. Patent Owner, however, also recognized that “the size of said indicia” does not specify a font size or a size of the characters of the indicia, but rather it is “the size of the areas that surrounds the indicia.” *Id.* at 29:14–15. Thus, the individual elements that compose the indicia could be any size, and need not be “larger,” so long as they collectively encompass an area of at least 3 square millimeters. In this circumstance, where the evidence demonstrates that the “size” limitation does not alter how the claimed orthodontic device operates, and where Patent Owner has not shown any significance to the “size” limitation, the

“size” limitation does not render claim 1 patentably distinct from the relied upon prior art.

With regard to the rationale for combining Roman and Horng, the only feature recited in claim 1 not expressly taught in Roman is the size limitation. First, we agree with Petitioner that it would have been obvious to apply the size of the indicia taught be Horng corresponding to the “size” limitation to the bracket of Roman as it is a simple combination of known elements “for their intended purposes, yielding predictable results.” Pet. 13. Roman does not discuss expressly the size of marking area 10, but does state that it may include “any specific pattern or design, or may include any combination of alpha and numeric characters.” Ex. 1002, 2:53–55. Roman also states that “alpha numeric characters can be annealed into orthodontic bracket 5 and would be clearly visible under magnification.” *Id.* at 3:2–3. Both Roman and Horng are directed to the marking of orthodontic appliances, and specifically to resolving the same problem of providing easy-to-read identifiers. *See* Ex. 1002, 2:12–13; Ex. 1003, 2:15–17; Ex. 1010 ¶¶ 72, 109, 117.

On an orthodontic bracket as taught by Roman, there are a finite number of locations to place a marking, of which the back of the pad is the largest. *Id.* ¶ 111; *see also* Ex. 1011 ¶ 69 (stating that there are “a limited number of places that are suitable for legible markings” on an orthodontic bracket, including the back of the bracket which “allows for a relatively large marking”). A person of ordinary skill in the art using orthodontic brackets would have experience with the difficulty in seeing small markings, and would be motivated to find a solution to reduce fatigue and the risk of making mistakes. *Id.* ¶ 114. Horng, itself, identifies the benefit of using a

mark that is easy to perceive and discern. Ex. 1003, 2:15–17, 4:16–18. Using a larger marking would remedy the problems of a smaller marking. Ex. 1010 ¶ 115. As Dr. Lebby explains, “[a] simple desire to increase readability would motivate variations in the size and placement of the marking.” Ex. 1011 ¶ 69.

Dr. Roberts further explains that an additional advantage of marking the back of a bracket would have been to hide the markings once the bracket was affixed to the patient’s tooth. Ex. 1010 ¶ 120. Dr. Roberts notes that Horng, for example, places the mark on a band at a location in between adjacent teeth so that the mark is not visible when the patient speaks or smiles. *Id.* ¶ 121. Based on the foregoing reasons, we determine Petitioner has provided reasoning with rational underpinning to support the combination of Roman and Horng that renders claim 1 obvious, including the motivation to produce a mark that was more easily seen to reduce fatigue and errors in correctly identifying the mark and to conceal the mark from view after installation of the bracket on a tooth.

Patent Owner argues that Horng teaches away from the proposed combination with Roman. PO Resp. 16–21. In particular, Patent Owner contends that Roman and Horng disclose different types of laser marking techniques and that they are “not necessarily interchangeable.” *Id.* at 18. Patent Owner’s arguments are substantially unsupported by Dr. James, who provides only one conclusory sentence indicating that annealing is incompatible with engraving. Ex. 2001 ¶ 51. Patent Owner attempts to explain that “[o]ne of ordinary skill in the art would not combine Roman with laser scribing, such as the laser scribing of Horng, because laser scribing would damage the surface of Roman by forming a ‘relatively wide

and has a roughened topography” (Ex. 1003, 2:26-27) that is “wide and deep” (*Id.* at 3:24). PO Resp. 19. Patent Owner further reasons that either “Horng teaches away from Roman by forming a surface contrary to the object of the invention,” or “one of ordinary skill in the art would be discouraged from scribing Roman to avoid the undesirable surface.” *Id.*

Patent Owner’s arguments are misplaced as claim 1 does not require any particular method of marking, and Petitioner does not rely on Roman or Horng as disclosing any particular method of marking. Patent Owner’s argument that Petitioner relies on “scribing or engraving” from Horng to modify Roman is incorrect, as Petitioner relies on Horng only with regard to the “size” limitation. *See* PO Resp. 18; Pet. 23. Petitioner’s reliance on Horng as teaching the “size” limitation has no bearing on whether the laser marking technique of Horng is interchangeable with the laser marking technique of Roman. Patent Owner does not suggest, and there is no evidence to show, that a larger marking, as taught by Horng, could not be produced by the laser marking technique employed by Roman. *See* Ex. 1038. 85:2–86:22. We, therefore, determine that Patent Owner has not shown that Horng teaches away from, or otherwise discourages, the combination of elements relied on by Petitioner.

Patent Owner also contends that Petitioner has not shown sufficient reasoning for modifying Roman to include marking on the back of the bracket based on Horng. PO Resp. 19–20. According to Patent Owner, the placement of the marking on Horng, a band, is inapplicable to Roman because Roman is a bracket. PO Resp. 20–21. On a related point, Dr. James states that, unlike the markings of Roman which are visible with magnification, the ’930 patent “indicated large markings . . . that do not

require magnification.” Ex. 2001 ¶¶ 41–42. The testimony of Dr. James, however, is not commensurate with the scope of claim 1 of the ’930 patent, which does not require large markings, or markings of any size for that matter. As explained above, the “size” limitation of claim 1 pertains to “the area that the markings take up” (Tr. 37:12–13), not to the size of any individual character.

As explained above, Roman teaches marking an outer surface of a bracket, which includes the back of the bracket. To show marking on the back of a bracket, no modification of Roman based on Horng is necessary. To the extent Petitioner has shown a benefit to marking the back of the bracket of Roman, Horng is relied on only to show that it was known to place a marking on an orthodontic device in a location that could not be seen after it was installed. The presence or absence of that benefit has no bearing on our determination that Roman, alone, teaches marking the back of a bracket.

We determine that Petitioner has shown sufficiently that it would have been obvious as a simple “combination of these known elements for their intended purposes, yielding predictable results,” to apply the teaching of the “size” limitation by Horng to the bracket of Roman for the reasons provided above. Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claim 1 of the ’930 patent would have been obvious over Roman and Horng.

Second, and in the alternative, because we also determined that the “size” limitation is not a patentable distinction, Petitioner has shown by a preponderance of the evidence that claim 1 would have been obvious over

Roman, which teaches all of the limitations of claim 1, regardless of the rationale for the asserted combination with Horng.

2. Claims 2 and 3

Claims 2 and 3, which depend from claim 1, further require either that the sign “comprises character markings consisting of a number with two figures” or “consists of a number with one figure preceded or followed by the plus sign or by a minus sign,” respectively. As explained by Dr. Roberts, claims 2 and 3 describe either the FDI or the Haderup numbering systems for teeth, respectively, both of which were well known prior to the ’930 patent’s earliest priority date. Ex. 1010, ¶¶ 55, 58, 214. Both Roman and Horng teach the use of a sign consisting of a number with at least two figures. Ex. 1002 2:63–66, 3:2–17; Ex. 1003, Figs. 1, 2; *see also* Ex. 1010 ¶ 204. Petitioner contends it would have been an obvious substitution to use one known numbering system for another. Pet. 24; *see also* Ex. 1010 ¶ 207, 224. Patent Owner does not dispute Petitioner’s contentions with regard to claims 2 and 3 beyond the arguments Patent Owner advances with respect to claim 1 from which they depend.

Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claims 2 and 3 of the ’930 patent would have been obvious over Roman, alone or in combination with Horng.

3. Claims 4 and 5

Claims 4 and 5, which depend from claim 1, further require either the sign is provided with “a laser apparatus” or “a diode-pumped laser apparatus,” respectively. As shown by Petitioner, both Roman and Horng

teach the use of a diode pump laser to provide a sign. Pet. 25–26; *see also* Ex. 1002, 3:51–52; Ex. 1003, 3:3–5; Ex. 1011 ¶¶ 43, 49. Patent Owner does not dispute Petitioner’s contentions with regard to claims 4 and 5 beyond the arguments Patent Owner advances with respect to claim 1 from which they depend.

Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claims 4 and 5 of the ’930 patent would have been obvious over Roman, alone or in combination with Horng.

4. Claim 6

Claim 6 is identical to claim 1, but for one additional limitation: claim 1 recites “said retention base having a backside,” whereas claim 6 recites “said retention base having a *net-like structured* backside.” *Compare* Ex. 1001, 4:41–51, *with id.* at 4:64–5:8 (emphasis added). For the reasons provided above with regard to claim 1, Petitioner has shown that all limitations of claim 6 other than the “net-like structured” backside are taught by Roman, alone or in combination with Horng. The “net-like structured backside” of claim 6 was also well known in the art. As noted above, the ’930 patent states that “[a]n orthodontic aid featuring a net-like retention base is known from [Miller] which also relates to manufacturing of orthodontic aids having a net-like back side.” *Id.* at 43:61–64. Similarly, Farzin-Nia teaches an orthodontic bracket with a retention base having a mesh or screen retention surface corresponding to the claimed “net-like structured backside.” Ex. 1004, 4:64–66, 5:23–29; *see also* Ex. 1010 ¶¶ 61, 63. With Petitioner having shown that the asserted references teach each of

the claimed limitations, the only remaining issue in dispute is whether Petitioner provided a sufficient rationale to support the combination of Roman, Horng, and Farzin-Nia.

Petitioner reasons that a “person of ordinary skill in the art would have been motivated to combine Roman with Horng and Farzin-Nia to put the laser engraved markings of Roman and Horng on the back of any orthodontic bracket—including the brackets taught in Roman and Farzin-Nia.” Pet. 20; *see also* Pet. Reply 9 (“Applying the annealing technique in Roman and the indicia size and placement teaching in Horng to Farzin-Nia’s bracket, a person of ordinary skill in the art easily achieves the ’930 patent claims.”).

According to Dr. Roberts, “the standard practice in orthodontics evolved away from using bands [like Horng orthodontic band 10] and toward the use of un-banded brackets [like Farzin-Nia bracket 10].” Ex. 1010 ¶ 111; *see also id.* at ¶ 126 (citing Ex. 1004, 12:60–65) (noting that Farzin-Nia teaches that brackets having mesh screens had been used for some time and provided improvements in bonding characteristics over brackets without mesh). Dr. Roberts further explains that it would have been obvious to apply the earlier teachings of Roman and Horng to the more modern bracket of Farzin-Nia, and, in particular, “the laser engraving of identification marks of Horng to the mesh screen of Farzin-Nia using the annealing process of Roman.” *Id.* at ¶¶ 111–112. The advantages of the combination are similar to those discussed above with respect to the combination of Roman and Horng: larger markings are easier to see than smaller markings, and reduce fatigue and the risk of making mistakes; there are a limited number of surfaces to mark on a bracket and the back of a

bracket is an outer surface that provides the largest area for a marking; and marking the back side of a bracket has the additional advantage of hiding the markings once affixed to a patient's tooth. *Id.* at ¶¶ 114–123; *see also* Pet. 20–22; Ex. 1011 ¶¶64–66, 69.

Dr. Roberts also explains that a person of ordinary skill in the art would have been motivated to use the annealing technique of Roman to create the mark on the bracket of Farzin-Nia because a person of ordinary skill in the art would have wanted to avoid deformation of the mesh or a reduction in the bonding area that may decrease the bonding strength. *Id.* at ¶¶ 128, 129 (citing Ex. 1002, 2:3–7, 4:34–38), 132 (further noting that Roman provides a marking area that does not cause “disruption or weakness in the appliance,” “surface irregularity,” or “weakened points”).

Patent Owner's arguments in opposition to the asserted combination of Roman, Horng, and Farzin-Nia overlap its arguments with regard to the combination of Roman and Horng. PO Resp. 16–21. Patent Owner's arguments do not turn on the addition of Farzin-Nia to the combination; thus, we find them unpersuasive with respect to claim 6 for the same reasons provided above with respect to claim 1. Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claim 6 of the '930 patent would have been obvious over Roman, Horng, and Farzin-Nia.

5. *Claims 7 and 8*

Claims 7 and 8, which depend from claim 6, further require either that the sign “comprises character markings consisting of a number with two figures” or “consists of a number with one figure preceded or followed by

the plus sign or by a minus sign,” respectively. As explained by Dr. Roberts, claims 7 and 8 describe either the FDI or the Haderup numbering systems for teeth, respectively, both of which were well known prior to the ’930 patent’s earliest priority date. Ex. 1010, ¶¶ 55, 58, 214. Both Roman and Horng teach the use of a sign consisting of a number with at least two figures. Ex. 1002 2:63–66, 3:2–17; Ex. 1003, Figs. 1, 2; *see also* Ex. 1010 ¶ 204. Petitioner contends it would have been an obvious substitution to use one known numbering system for another. Pet. 24; *see also* Ex. 1010 ¶ 207, 224. Patent Owner does not dispute Petitioner’s contentions with regard to claims 7 and 8 beyond the arguments Patent Owner advances with respect to claim 6 from which they depend.

Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claims 7 and 8 of the ’930 patent would have been obvious over Roman, Horng, and Farzin-Nia.

6. Claims 9 and 10

Claims 9 and 10, which depend from claim 6, further require either the sign is provided with “a laser apparatus” or “a diode-pumped laser apparatus,” respectively. As shown by Petitioner, both Roman and Horng teach the use of a diode pump laser to provide a sign. Pet. 25–26; *see also* Ex. 1002, 3:51–52; Ex. 1003, 3:3–5; Ex. 1011 ¶¶ 43, 49. Patent Owner does not dispute Petitioner’s contentions with regard to claims 9 and 10 beyond the arguments Patent Owner advances with respect to claim 6 from which they depend.

Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claims 9 and 10 of the '930 patent would have been obvious over Roman, Horng, and Farzin-Nia.

F. OBVIOUSNESS OVER MILLER, KESLING, AND ORIKASA

Petitioner contends that claims 1–3 and 6–8 would have been obvious over Miller, Kesling and Orikasa. Pet. 38–45. Patent Owner disagrees. PO Resp. 21–28.

1. *Claims 1 and 6*

Petitioner provides a claim chart identifying how it contends the combination of Miller, Kesling, and Orikasa teaches each element of claims 1 and 6. Pet. 43–44. We determine that Miller teaches an orthodontic bracket (orthodontic bracket 12) with a retention base (composite pad assembly 10) with a net-like structured backside (lower porous tooth-abutting surface 20), as claimed. Ex. 1007, 4:4–11, 4:38–42, Figs. 1, 3; *see also* Pet. 38–39; Ex. 1010 ¶ 62; Ex. 1011 ¶ 67. Kesling teaches identifying indicia, including a sign, for identifying the respective tooth for which the orthodontic bracket is suitable (identification 12), as claimed. Ex. 1005, 3:24–28, Fig. 1; *see also* Pet. 39–40; Ex. 1010 ¶¶ 71; Ex. 1011 ¶ 81. Orikasa also teaches identifying indicia, including a sign, for identifying the respective tooth for which the orthodontic bracket is suitable (identification characters 35), as claimed. Ex. 1008, 6:46–53, Figs. 12, 13; *see also* Pet. 39–40; Ex. 1010 ¶ 70. Further, identification characters 35 of Orikasa are molded in recessed portions 36 of lingual surface 34 of bracket 30,

corresponding to the claimed “said indicia including a sign provided on the back side of said retention base.” *Id.*

With regard to the limitations of claim 1 that the “depth of said indicia being substantially null with respect to the depth of the retention base,” and “said indicia having a profile which follows the outer profile of said retention base,” we determine these features are taught by Kesling because Kesling teaches the use of “suitable ink or paint” to make the indicia. Ex. 1005, 2:5–6; *see also* Ex. 1001, 2:42–44 (“marking may be also performed with appropriate inks”); Ex. 1010 ¶¶ 100–101, 106; Ex. 1011 ¶ 83.

Lastly, claim 1 recites “the size of said indicia being at least 3 square millimeters.” For the reasons provided below, we first determine that Petitioner has not shown sufficiently that the combination of Miller, Kesling, and Orikasa teaches and suggests the “size” limitation. Second, however, we determine that Petitioner has shown that the “size” limitation is not a patentable distinction over the prior art.

Petitioner argues that the “size” limitation is taught by Kesling and Orikasa. Pet. 41. Kesling teaches an orthodontic band with an “easy-to-read identification formed by a coating of ink or paint.” Ex. 1005, 4:5–13. Petitioner argues that “[g]iven typical dimensions for prior art brackets and bands, any ‘easy-to-read’ indicia would easily satisfy [the ‘size’ limitation], or at least make this element obvious to one of ordinary skill in the art.” Pet. 41 (citing *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295 (Fed. Cir. 2012)). Petitioner provides no additional explanation of the relevance or applicability of *Applied Materials*. *Applied Materials* discusses a “result-effective variable” and provides that where the prior art discloses values

overlapping the claimed range, discovery of an optimum value is ordinarily within the skill of the art. 692 F.3d at 1295. Petitioner has not expressly identified a result effective variable and has not shown how the prior art discloses values of that variable overlapping a claimed range. Because any argument that may have been made based on *In re Applied Materials* was not sufficiently developed, we decline to further speculate as to Petitioner's intent.

Petitioner also argues that Dr. Roberts estimated Kesling's identification 12 to cover an area of 5.6 square millimeters, based on typical band sizes at the relevant time and an estimated percentage of one side of the band purportedly covered in Figure 1 of Kesling. Ex. 1010 ¶¶ 88–90. Dr. Roberts also estimated that Orikasa discloses a size of indicia in excess of 3 square millimeters based on: (1) the smallest size of the back of a common bracket offered at the time (not disclosed in Orikasa), (2) Orikasa's disclosure of a base surface of about 10 square millimeters in an embodiment that does not show indicia on the back of the bracket (Ex. 1008, 6:16–18), and (3) an estimation that the eight recessed portions of the back surface of a bracket in another embodiment of Orikasa accounts for 32 percent of lingual surface 34. *Id.* at ¶¶ 91–92 (estimating that all eight recessed portions 36 of Orikasa, collectively, span an area of 3.2 square millimeters).

Patent Owner argues that the illustrations of Kesling and Orikasa relied upon by Petitioner contain no dimensions and are not disclosed to be to scale, such that any argument based on measurements from the illustrations is of little value. PO Resp. 23 (*citing Hockerson-Halberstady, Inc., v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000)). In the absence

of any specific marking size, Patent Owner asserts that there is no basis to reliably estimate the size of the markings of Kesling or Orikasa. *Id.* at 23. Patent Owner also asserts that only three of the eight recesses of Orikasa contain identification characters, such that estimation of the size of the indicia based on all eight recesses by Dr. Roberts was flawed and unreliable. *Id.* at 24.

In Reply, Petitioner argues that “[t]he Board cannot ignore the drawings but rather must ‘evaluate and apply the teachings of all relevant references on the basis of what they reasonably disclose and suggest to one skilled in the art.’” Pet. Reply 12 (quoting *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979)). Petitioner further argues that patent drawings may be used to show obviousness and that its reliance on different embodiments of Orikasa (one showing indicia on the back of the bracket and another describing the back of a bracket as having an areas of about 10 square millimeters) “does not matter,” because all embodiment must be considered. PO Reply 12–14. Finally, Petitioner argues that all 8 recesses “could be” used for indicia. *See* PO Reply 14–15.

We agree with Patent Owner that Petitioner has not sufficiently shown that either Kesling or Orikasa teaches the “size” limitation (and Petitioner does not rely on Miller with regard to the “size” limitation). Petitioner’s reliance on estimations based on patent drawings that are not to scale and the purported size of other brackets “of an actual working drawing of a band from 1991” not disclosed in the asserted references is too speculative to reliably establish by a preponderance of the evidence the claimed size. *See* Pet. Reply 15. Likewise, Petitioner’s reliance on multiple embodiments of Orikasa without any explanation for their combination is insufficient. In

particular, Petitioner makes no sufficient showing that Orikasa's reference to a bracket with a base of 10 square millimeters corresponds to another embodiment of Orikasa illustrating indicia on the back of the bracket. Moreover, based on Petitioner's estimation of sizes, the area of the indicia Orikasa teaches to identify "the respective tooth for which the orthodontic bracket is suitable" uses only three of the eight recesses, covering an area far less than 3 square millimeters. That all eight recesses "could be" used for indicia fails to provide any articulated reasoning with some rational underpinning for why it would have been obvious to use eight recesses when three was sufficient. *See* PO Reply 14–15. We also disagree with Petitioner's characterization of Dr. James as having "agreed" with Petitioner as Dr. James clearly stated his understanding that the patent drawings relied on by Petitioner were not to scale. *See id.*

Notwithstanding our determination that Petitioner has failed to show by a preponderance of the evidence that the combination of Miller, Kesling, and Orikasa teaches the "size" limitation, e.g., based on the illustrations, we still consider whether claims 1 and 6 would have been obvious over the combination because, as explained above, the "size" limitation is not a patentable distinction. Petitioner argues that "a person of ordinary skill in the art would have combined the teachings of Miller and Kesling to solve the problem identified in Kesling of 'easy-to-read' identifiers," thereby achieving "predictable results." *Id.* at 42. Petitioner also asserts that "a person of ordinary skill in the art would have been motivated to try to retain the bonding characteristics and benefits obtained from" the mesh textured bracket base taught by Miller and that Orikasa suggests placing the marking on the bracket base. *Id.* at 42–43. With regard to the rationale for

combining Miller, Kesling, and Orikasa, we agree with Petitioner that it would have been obvious as a simple combination of known elements for their intended purposes, yielding predictable results. *Id.*

Miller and Orikasa are both directed to orthodontic brackets, and Kesling and Orikasa are both directed to marking orthodontic appliances. *See* Ex. 1010 ¶ 170. Dr. Roberts reasons that given the transition in orthodontics away from using bands, as with Kesling, to brackets, such as Miller, it would have been obvious to apply the markings from ink as taught in Kesling to the bracket of Miller to achieve the same result—an identifier on the appliance. *Id.* at ¶ 171; *see also id.* at ¶ 187 (also discussing the benefits of a bracket with mesh as taught by Miller to increase bond strength). Moreover, there are a finite number of surfaces to mark on a bracket with an identifier, a larger marking would reduce fatigue and mistakes over a smaller marking, the greatest amount of space for a marking is provided on the back of a bracket, Orikasa teaches marking the back of a bracket, and Orikasa identifies the additional advantage of marking the back of the bracket to hide the marking after the bracket is affixed to a patient’s tooth. Pet. 42–43, Ex. 1010 ¶¶ 171, 174–182. All of these considerations support Petitioner’s rationale for demonstrating that the combination of Miller, Kesling, and Orikasa would have been obvious.

Patent Owner argues that because Kesling applies ink to a “highly polished and smooth” external surface, it would not suggest applying ink to Miller’s “porous, mesh-like side of the bracket that bonds to the tooth.” PO Resp. 25–26. There is no evidence to support Patent Owner’s argument, and Kesling in fact suggests the opposite. Kesling states that it is the “highly polished exterior surface” of bands that makes the application of

identification “difficult.” Ex. 1005, 1:24–26; *see also* Ex. 1038, 84:4–98, 86:15–22. We are not persuaded that Kesling suggests avoiding marking a porous surface as Patent Owner argues.

Patent Owner further reasons that applying ink in a continuous sheet as taught by Kesling to the mesh of Miller “would likely fill the small voids” thereby diminishing the bond performance and rendering Miller “unsatisfactory for its intended purpose.” PO Resp. 26. Patent Owner’s arguments are not persuasive because it is clear from Miller that it was well known to apply an indicia with ink or paint by stamping or printing. *See* Ex. 1005, 1:26–29. Marking an orthodontic bracket with ink was not a novel disclosure of the ’930 patent, which concedes that “marking may be also performed with appropriate inks.” Ex. 1001, 2:42–43. Indeed, Dr. James agreed “[t]hat a person of ordinary knowledge and skill in this would know how to apply an ink so as marking - - so as not to fill the holes of the device, yes.” Ex. 1038, 99:18–20. That Kesling also teaches other means for marking in multiple layers does not refute the fact that Kesling supports the conclusion that it would have been obvious to mark the bracket of Miller on the back with ink. As Dr. Lebby also explained “[m]arking with ink is predictable and is old and predictable technology” and that “varying the thickness of a layer of ink would be common sense to any person of ordinary skill, and obvious as well.” Ex. 1011 ¶¶ 84, 110.

Patent Owner further argues that Kesling teaches away from the combination with Miller and Orikasa because it only applies markings “to areas that will not interfere with the attachment of any appliances to the band” by cementing and the same consideration would apply to the surface used to bond the bracket to a tooth. PO Resp. 27 (citing Ex. 1005, 1:18–21,

3:13–15; Ex. 2001 ¶ 57. While we agree that Kesling suggests avoiding “interference” between the marking and a surface that is being cemented, Patent Owner has not shown on the record that an ink marking on the back of a bracket would interfere with the bonding of the bracket to a tooth. As Petitioner explains, “[t]eaching away requires discouragement away from the claimed combination; ‘[a] reference that “merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into” the claimed invention does not teach away.’” Pet. Reply 7 (quoting *Meiresonne v. Google, Inc.*, 849 F.3d 1379, 1382 (Fed. Cir. 2017) (citing *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013))). Patent Owner has not shown that Kesling teaches away from the asserted combination.

Patent Owner further argues that Petitioner does not explain “how the identification characters situated within the recesses of Orikasa could be incorporated into the much smaller recesses of the denser lattice of Miller.” PO Resp. 28. Petitioner need not, and does not, contend that the recesses of Orikasa would be incorporated into Miller. Accordingly, no such explanation is required to establish the obviousness of the claims.

2. Claims 2, 3, 7, and 8

As stated above, claims 2 and 3, which depend from claim 1, further require either that the sign “comprises character markings consisting of a number with two figures” or “consists of a number with one figure preceded or followed by the plus sign or by a minus sign,” respectively. Claims 7 and 8 recite the same additional limitations with respect to claim 6, from which they depend. As explained by Dr. Roberts, claims 2 and 7 describe the FDI numbering system, and claims 3 and 8 describe the Haderup numbering

system for teeth, both of which were well known prior to the '930 patent's earliest priority date. Pet. 44–45; Ex. 1010, ¶¶ 198, 199, 203, 205, 211–212, 214, 221. Both Kesling and Orikasa teach the use of a sign consisting of a number with at least two figures. Ex. 1005, Figs 1–3, 5; Ex. 1008, Fig. 13. Petitioner has also shown that it would have been an obvious substitution to use one known numbering system for another. Pet. 44; *see also* Ex. 1010 ¶ 221. Patent Owner does not dispute Petitioner's contentions with regard to claims 2, 3, 7, and 8 beyond the arguments Patent Owner advances with respect to claims 1 and 6 from which they depend.

Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claims 2, 3, 7, and 8 of the '930 patent would have been obvious over Miller, Kesling, and Orikasa.

G. OBVIOUSNESS OVER MILLER, KESLING, ORIKASA, AND ROMAN

As stated above, claims 4 and 5, which depend from claim 1, further require either the sign is provided with “a laser apparatus” or “a diode-pumped laser apparatus,” respectively. Claims 9 and 10 recite the same additional limitations with respect to claim 6, from which they depend. As shown by Petitioner, Roman teaches the use of a diode pump laser to provide a sign. Pet. 46–47; *see also* Ex. 1002, 3:51–52; Ex. 1010 ¶¶ 232, 234, 240, 241, 243, 244, 250, 251; Ex. 1011 ¶¶ 43, 49. According to Petitioner, “[g]iven the prevalence of the use of lasers, including diode-pumped lasers, for numerous different applications, including the use of lasers in orthodontics and dentistry, it would have been obvious to a person trying to create ‘easy-to-read’ markings to use a laser or a diode-pumped

laser to do so.” Pet. 46 (citing Ex. 1011 ¶¶ 64–69). In particular, Dr. Lebby states that “[t]he process taught in Roman for marking brackets could also readily be applied by any laser engineer in the mid-1990s to mark the bracket shown in Miller.” Ex. 1010 ¶ 67.

Patent Owner asserts that Roman does not overcome any of its alleged deficiencies with Petitioner’s contentions that claims 1 and 6 would have been obvious over Miller, Kesling, and Orikasa. PO Resp. 30 For the reasons provided above, we determine that Petitioner demonstrated by a preponderance of the evidence that claims 1 and 6 would have been obvious over Miller, Kesling, and Orikasa; therefore, Roman need not be relied upon to cure any deficiency based on those claims.

Patent Owner further argues that the marking methods of the asserted references are “incompatible and teach further away from the combination of references applied.” *Id.* at 31. Patent Owner then returns to an argument addressed above, and asserts that Roman “does not suggest the coating of ‘any outer surface.’” *Id.* We understand Patent Owner to be referring to laser marking (not coating) as Roman describes laser marking and Patent Owner next asserts that “[l]aser marking can cause local damage and applying thermal energy to a mesh increases the likelihood of debonding, warping and other deterioration of the structure that must be carefully considered and evaluated.” *Id.*; *see also* Ex. 2001 ¶ 69. Petitioner further reasons that Roman teaches marking the tie wings, Kesling teaches marking a smooth surface, and Roman discourages marking the net-like surface of Miller “when other locations that would reduce or eliminate the potential for damage to the mesh were available and already identified as preferred.” *Id.* at 31–32.

In reply, Petitioner shows that Dr. James agreed that the use of lasers to mark brackets was known prior to the '930 patent. Pet. Reply 21 (citing Ex. 1038, 45:8–10). Dr. James also agreed that a person of ordinary skill in the art, given “an average bracket with a net-like base structure . . . could mark that net-like base structure by annealing without deforming it.” *Id.* (citing Ex. 1038, 84:4–9). We discern no sufficient evidence to support Patent Owner’s contention that the asserted references are incompatible or teach away from one another. While there may be technical considerations for laser marking a net-like structure on the back of a bracket, the evidence above demonstrates that it was known to mark brackets with a laser, and it was within the capacity of a person of ordinary skill to do so without causing deformation.

Based on the Petition, Patent Owner Response, and Reply, as well as the evidence of record, we determine for the foregoing reasons that Petitioner has shown by a preponderance of the evidence that claims 4, 5, 9 and 10 of the '930 patent would have been obvious over Miller, Kesling, Orikasa, and Roman.

III. CONCLUSION

For the foregoing reasons and based on the full record, Petitioner has established by a preponderance of the evidence with respect to the '930 patent that the subject matter of claims 1–5 would have been obvious over Roman, alone or in combination with Horng; of claims 6–10 would have been obvious over Roman, Horng, and Farzin-Nia; of claims 1–3 and 6–8 would have been obvious over Miller, Kesling, and Orikasa; and of claims 4,

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5, 9, and 10 would have been obvious over Miller, Kesling, Orikasa, and Roman.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–10 of U.S. Patent Number 6,276,930 B1 are held 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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