

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MARKFORGED INC.,
Petitioner,

v.

CONTINUOUS COMPOSITES, INC.,
Patent Owner.

IPR2022-00548
Patent 9,511,543 B2

Before GRACE KARAFFA OBERMANN, JO-ANNE M. KOKOSKI, and
SHELDON M. McGEE, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

DECISION

Denying Institution of *Inter Partes* Review
35 U.S.C. § 314, 37 C.F.R. § 42.4

I. INTRODUCTION

Markforged, Inc. (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1–15 and 17–41 (the “challenged claims”) of U.S. Patent No. 9,511,543 B2 (“the ’543 patent,” Ex. 1001). Paper 3 (“Pet.”). Continuous Composites Inc. (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4 (2021). For the reasons discussed below, we deny the Petition and do not institute an *inter partes* review.

A. Real Parties in Interest

Each party identifies itself as the real party in interest. Pet. 1; Paper 6, 1.

B. Related Matters

The parties indicate that the ’543 patent is asserted in *Continuous Composites, Inc. v. Markforged, Inc.*, No. 1:21-cv-00998-MN (D. Del.). Pet. 1; Paper 6, 1. The ’543 patent also is the subject of IPR2022-00652, filed by Petitioner. Paper 6, 1.

C. The ’543 Patent

The ’543 patent relates to “the additive manufacturing of three-dimensional objects.” Ex. 1001, code (57). The ’543 patent explains that the most common additive manufacturing processes build a three-dimensional part by converting a digital file into horizontal layers, each of which is referred to as a “slice.” *Id.* at 1:8–14. After a base slice is created, successive slices are added one at a time on top of each other to build the

part from the bottom up. *Id.* at 1:14–17. The ’543 patent states that “[t]o strengthen the parts, some additive manufacturing techniques add reinforcing particles,” which “creates a heterogeneous mixture rather than pure resin, plastic, or metal.” *Id.* at 1:40–42. According to the ’543 patent, these techniques have several disadvantages, including that the process is slow, it necessitates that parts are designed to accommodate the slicing process, and the vulnerable joints between the slices creates a relatively weak part. *Id.* at 1:46–51.

The ’543 patent addresses these problems by providing a method it calls Continuous Composite Three Dimensional Printing (CC3D). Ex. 1001, 1:63–65. “This method enables the additive manufacturing of parts utilizing two or more materials, and uses an alternate means of building parts with paths rather than slices” and “affords stronger lighter parts, with flexibility in structure, design, and functionality.” *Id.* at 1:65–2:3. In particular, the ’543 patent teaches that “the method allows for two or more materials simultaneously incorporated into the construction of a part.” *Id.* at 2:6–7. The primary material is a curable liquid, such as a photosensitive resin, and the secondary material is a solid strand, such as carbon fiber. *Id.* at 2:9–12. “These two materials are extruded together, with the secondary material fully encased within the primary material,” creating a composite material. *Id.* at 2:12–16. In this method, a digital model of the part is analyzed and broken up into one or more paths, where each path is one continuous extrusion of the composite material. *Id.* at 2:21–24. The composite material is extruded in a continuous path, and is cured as it is extruded. *Id.* at 2:16–19; *see also id.* at 5:42–44 (“The composite material is extruded and then cured. The best mode cures the composite material immediately after extrusion, creating a solid path.”). “When a path is completed, the

composite material is cut and additional paths may be printed to create the part.” *Id.* at 2:24–26. The ’543 patent explains that “[t]he combination of composite material and pathing adds strength to the part” and “more efficiently uses the primary material.” *Id.* at 2:27–34.

The ’543 patent further teaches that, “[p]rior to manufacturing a part, the manufacturer designates an origin,” which “may be any point on any surface suitable for anchoring the part during manufacturing.” Ex. 1001, 8:19–21. This contact point is called an anchor, and some parts may require multiple anchor points to support the part during manufacturing. *Id.* at 8:21–24. The extruder nozzle is then positioned so that the point of extrusion is at the anchor point. *Id.* at 8:25–27. When the first extruded path reaches its endpoint, the path is cut and the nozzle is positioned for the start of the next path. *Id.* at 8:35–38. “Paths are continuously extruded and cured until the sequence and the part is complete.” *Id.* at 8:38–40.

D. Challenged Claims

Petitioner challenges claims 1–15 and 17–41 of the ’543 patent, of which claims 1, 17, 30, and 38 are independent. Claim 1 is illustrative of the claimed subject matter, and is reproduced below.

1. A method of manufacturing a three-dimensional object comprising:
 - extruding through one or more openings at least one path comprising at least one primary material and at least one secondary material;
 - wherein the at least one primary material comprises a liquid material,
 - wherein the at least one secondary material comprises at least one strand, and

wherein the at least one primary material and the at least one secondary material are extruded contemporaneously;

encasing at least a portion of the at least one secondary material in the at least one primary material;

coupling a portion of the at least one path to an anchor point;

pulling the at least one path through the one or more openings by at least one of moving the one or more openings and moving the anchor point;

adjusting orientation of the at least one path relative to the one or more openings to adjust the shape of the at least one path;

hardening at least a portion of the at least one primary material; and

forming at least a portion of the three-dimensional object from the at least one path as the at least one path is extruded.

Ex. 1001, 10:41–67.

E. Asserted Grounds

Petitioner asserts that claims 1–15 and 17–41 would have been unpatentable based on the following grounds:

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
1–3, 6–8, 15, 38–40	103	Wohrl ²

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (2011), revised 35 U.S.C. § 103 effective March 16, 2013. Because the ’543 patent claims priority to a provisional application filed before March 16, 2013 (Ex. 1001, code (60)), we refer to the pre-AIA version of Section 103.

² Wohrl, UK Patent App. GB 2213 793 A, published Aug. 23, 1989 (Ex. 1006).

Claim(s) Challenged	35 U.S.C. § ¹	Reference(s)/Basis
4, 5, 9, 11, 12, 14, 17–22, 24, 25, 27–29, 41	103	Wohrl, Ma ³
10, 13, 30–33, 35	103	Wohrl, Lipsker ⁴
26, 34, 36, 37	103	Wohrl, Ma, Lipsker
23	103	Wohrl, Ma, Crump ⁵

Petitioner relies on the Declaration of David Rosen, Ph.D. (Ex. 1002) in support of its contentions.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

Petitioner contends that a person having ordinary skill in the art (“POSITA”) would have had “a master’s degree in mechanical engineering, materials science, or a related degree, and at least 3–5 years of experience in composite materials or additive manufacturing,” or a bachelor’s degree in the same fields and at least 5–6 years of experience. Pet. 9–10 (citing Ex. 1002 ¶ 36). Patent Owner states that it “does not agree that Petitioner’s proposed level of skill in the art accurately reflects the level of ordinary skill in the art as of the priority date But regardless of what level of skill is applied, the Petition does not show a reasonable likelihood to prevail.” Prelim. Resp. 10. Patent Owner does not propose a different level of skill in the art at this stage of the proceeding. *See id.* (“Patent Owner reserves the right to propose a level of ordinary skill in the art in this proceeding should it be instituted, or in other proceedings.”).

³ Erjian Ma, *Solid Freeform Fabrication of Continuous Fiber Reinforced Composite Materials* (August 6, 2001) (Doctoral dissertation, Auburn University) (UMI No. 3016100) (Ex. 1007).

⁴ Lipsker, US 6,153,034, issued Nov. 28, 2000 (Ex. 1008).

⁵ Crump, US 5,121,329, issued June 9, 1992 (Ex. 1009).

On this record, we determine that the level of ordinary skill is reflected in the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (specific findings on the ordinary skill level are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))). A more specific definition is not necessary for purposes of deciding whether to institute review.

B. Claim Construction

We construe each claim “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2019). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019).

Petitioner asserts that the “claim terms should be given their plain and ordinary meaning because, to the extent certain claim terms are subject to multiple interpretations, those questions do not affect the grounds advanced here.” Pet. 10 (footnote omitted). Patent Owner does not address claim construction at this stage of the proceeding. *See generally*, Prelim. Resp.

We determine that no claim term requires express construction for purposes of this Decision.

C. Asserted Obviousness over Wohrl

Petitioner contends that claims 1–3, 6–8, 15, and 38–40 would have been obvious over the teachings of Wohrl. Pet. 19–38.

1. Overview of Wohrl

Wohrl relates to the “manufacture of a three-dimensionally twisted airfoil of a rotor blade.” Ex. 1006, code (57). Wohrl explains that technical problems are encountered “in the manufacture of fibre-reinforced components of complex shapes with three-dimensionally twisted surfaces, especially if these take a partially concave form and if the requirements are for different strength and vibration properties in different directions,” and “[c]onventional manufacture of these components is associated with considerable effort involving high manufacturing costs.” *Id.* at 1:18–23, 2:1–3. Wohrl seeks “to enable the manufacture of” such fiber-reinforced components “by a simple and rapid method that permits selective manipulation of component properties by selective routing of the fibres and more particularly so as to permit ready application of fibres also to concave surfaces.” *Id.* at 2:10–16.

Wohrl describes a method “wherein fibre strands wetted with a resin matrix are pressed against the core[,] for example, by means of a nip roller, and the resin matrix precured immediately thereafter.” Ex. 1006, 2:17–24. Wohrl teaches that “[f]ibres can be applied in a simple manner, in each and every direction and on any shape of airfoil surface and so that they will then adhere and not subsequently become dislodged.” *Id.* at 2:27–3:2. According to Wohrl, after the fibers have precured, they will adhere to concave surfaces and therefore “can be laid rapidly and accurately in position.” *Id.* at 3:2–4.

Wohrl's Figure 1 is reproduced below.

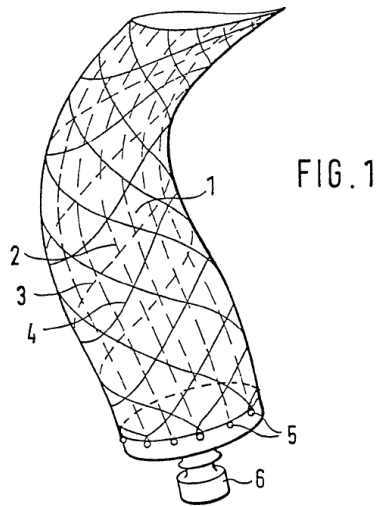


Figure 1 is a perspective view of airfoil 1 of a rotor blade. Ex. 1006, 4:7, 4:12–13. Tensile direction 2 and diagonal layers 3 and 4 illustrate the preferred directions of the fibers to be deposited. *Id.* at 4:13–15. “The fibres are preferably looped around attaching nipples 5 on a blade root 6, so as to ensure a satisfactory union between the two components and for good transfer to the blade root 6 of the tensile force arising in operation.” *Id.* at 4:15–19.

Wohrl's Figure 2 is reproduced below.

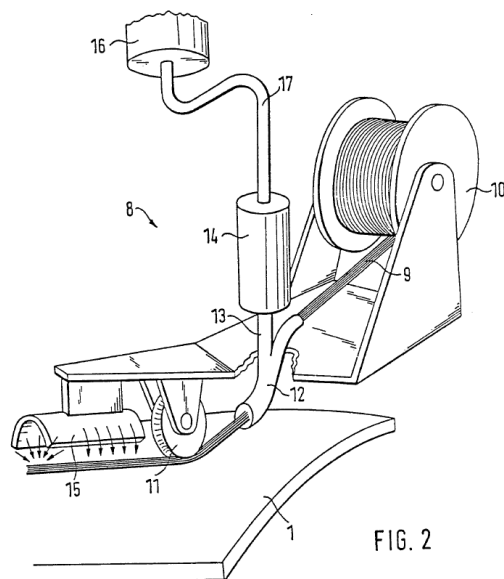


Figure 2 is a perspective view of a fiber laying device described in Wohrl. Ex. 1006, 4:8–9. Fiber laying device 8 includes fiber drum 10, fiber feed duct 12 leading to fiber nip roll 11, and precuring facility 15. *Id.* at 4:20–23. Fiber strand 9, unwound from fiber drum 10, is pulled by nip roll 11 through fiber feed duct 12. *Id.* at 4:23–25. Matrix material is supplied from storage container 16 to matrix unit 14 through flexible feed line 17. *Id.* at 4:27–5:1. The matrix material is then fed into feed duct 12 in defined quantities from matrix metering unit 14 through feed duct 13. *Id.* at 4:25–27. The wetted fibers are laid on to the component in the desired track under fiber nip roll 11 and precured by precuring device 15, which causes the surface to dry and stick. *Id.* at 5:3–7. Wohrl explains that, “[i]n this manner, the fibre is fixed to a point where it can be laid on to radiused tracks,” and “further fibre layers can be deposited in any desired orientation over the precured fibres.” *Id.* at 5:7–10.

Wohrl teaches that fiber laying device 8 “is connected to the ‘wrist’ of a six-axis portal robot 7 and can thus—under computer control—deposit the fibres strand 9 on the component core fully automatically along precalculated tracks.” Ex. 1006, 5:11–16. According to Wohrl, “[t]his makes for very accurate reproducibility (<0.2 mm) of the fibre laying process.” *Id.* at 5:16–17.

2. Analysis

Petitioner contends that Wohrl teaches or suggests all the limitations of independent claims 1 and 38. Pet. 19–28, 35–37. We focus our discussion on the “coupling a portion of the at least one path to an anchor point” and “pulling the at least one path through the one or more openings by at least one of moving the one or more openings or moving the anchor

point” limitations of claims 1 and 38, because they are dispositive for purposes of this Decision.

Petitioner contends that “[a] POSITA would have ascertained from the description of the ’543 patent that an anchor point is a bonding site on any suitable surface or point used to secure portions of the part during the object formation process.” Pet. 23 (citing Ex. 1001, 8:19–24). Petitioner then points to Wohrl’s disclosure that “[p]recuring the matrix material causes it to gel to a point where the fibre is cemented into place before the fibre matrix mixture is fully cured” and “the fibre is fixed to a point where it can be laid on radiused tracks” as support for its contention that “Wohrl discloses anchor points according to the description of the ’543 patent.” *Id.* at 24 (quoting Ex. 1006, 3:7–9, 5:7–10; citing Ex. 1002 ¶ 109). According to Petitioner, “[a] POSITA would have understood that Wohrl’s extruded impregnated fibre forms at least one path . . . which when cured, is cemented or secured in place (coupled to an anchor point).” *Id.* (citing Ex. 1002 ¶ 110) (emphasis omitted).

Thus, as we understand it, Petitioner is arguing that a POSITA would have understood Wohrl’s teaching of laying fiber strands on a core and precuring the fibers so that the fibers dry and stick to the core is “coupling a portion of the at least one path to an anchor point” as recited in claims 1 and 38. Petitioner’s argument appears to be premised on the understanding that any point at which the path contacts a “surface suitable for anchoring the part” is the claimed “anchor point.” The ’543 patent, however, describes an “anchor point” as something more than just any point to which a part of the path is affixed.

In particular, the ’543 patent teaches that, “[p]rior to manufacturing a part, the manufacturer designates an origin. The origin may be any point on

any surface suitable for anchoring the part during manufacturing. This point of contact is called an anchor. Some parts may require multiple anchor points to support a part during manufacturing.” Ex. 1001, 8:19–24.

The ’543 patent further teaches that “[t]he origin of the path adheres to the anchor, allowing the extruder to pull on the secondary material during the extrusion” and “[t]he initial contact between the proposed part and the anchor must provide enough adhesion to support the tension force desired.” *Id.* at 9:55–66. Taken together, these disclosures indicate that an anchor point is a contact point to which the fiber is affixed and that serves as an origin point for the formation of the path and provides support for the part during manufacturing.

Petitioner does not point us to, nor do we discern, any disclosure in Wohrl of affixing the fiber to a contact point that serves as the origin point for path formation. Wohrl describes wrapping a core by pressing the path against the core using a nip roller, and then precuring so that the matrix material “gel[s] to a point where the fibre is cemented in place before the fibre matrix mixture still is fully cured.” Ex. 1006, 2:17–26, 3:7–10. Wohrl teaches that this precuring allows the fibers to adhere to concave surfaces “so that they can be laid rapidly and accurately in position.” *Id.* at 3:3–5; *see also id.* at 5:3–7 (“Having been wetted in this manner the fibres are accurately laid on to the component in the desired track under the fibre nip roll 11 and are precured (gelled) by means of the precuring device 15, causing the surface to dry and stick.”). In light of these disclosures in Wohrl, Petitioner does not adequately explain why a POSITA would have understood that using a nip roller to press the path onto the core, then precuring the path as it is laid, creates an “anchor point” as the ’543 patent teaches and claims 1 and 38 require. Nor does Petitioner sufficiently address

why a POSITA would have understood Wohrl to be teaching the use of an “anchor point” when Wohrl uses a core to support the formation of the part.

Even if Wohrl did teach the claimed “anchor point,” however, Petitioner does not sufficiently establish that Wohrl teaches “pulling the at least one path through the one or more openings by at least one of moving the one or more openings and moving the anchor point” as set forth in claims 1 and 38.

In that regard, Petitioner points to Wohrl’s disclosure that “[t]he fibre strand 9 unwound from the fibre drum 10 is pulled by the nip roller through the fibre feed duct 12 into which matrix material is fed in defined quantities from a matrix metering unit 14 through a feed duct 13.” Pet. 24 (citing Ex. 1006, 4:23–27) (emphasis omitted). Petitioner then acknowledges that Wohrl teaches using nip roll 11 to pull fibre strand 9 through fibre feed duct 12, and argues that “a POSITA would have understood that the anchor points and nip roll 11 *can be used together* as a means to pull (unwind) the fibre strand” when fibre feed duct 12 “moves relative to the anchored path so that additional path can be laid down.” Pet. 25 (citing Ex. 1002 ¶ 111) (emphasis added). Obviousness, however, “concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of [the] prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015); *see also In re Giannelli*, 739 F.3d 1375, 1380 (Fed. Cir. 2014) (“[T]he mere *capability* of pulling the handles is not the inquiry the Board should have made; it should have determined whether it would have been obvious to modify the prior art apparatus to arrive at the claimed rowing machine.”). Although Petitioner alleges an anchor point and nip roll 11 could be used together to pull the path in Wohrl’s method, Petitioner does

not address why a POSITA would have been motivated to make that modification to Wohrl's method in the first instance.

Moreover, Petitioner does not adequately explain why modifying Wohrl's process to use an anchor point and nip roll 11 to pull the fibre strand would have been an improvement over what Wohrl already provides. In other words, Wohrl already teaches that nip roll 11 is sufficient to unwind fibre strand 9 from fibre drum 10, and Petitioner does not identify any deficiencies in this process such that a POSITA would have been motivated to modify it. *See* Ex. 1006, 4:23–27. Thus, it is not evident why Wohrl's process would have benefitted from Petitioner's proposed modification.

For these reasons, we conclude that Petitioner does not sufficiently establish that Wohrl teaches “coupling a portion of the at least one path to an anchor point” and “pulling the at least one path through the one or more openings by at least one of moving the one or more openings and moving the anchor point” as recited in claims 1 and 38. Accordingly, we determine that Petitioner does not demonstrate a reasonable likelihood of prevailing in showing that the subject matter of claims 1 and 38 would have been obvious over Wohrl. Because claims 2, 3, 6–8, and 15 depend from claim 1, and claims 39 and 40 depend from claim 38, we also determine that Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to these dependent claims.

D. Asserted Obviousness over Wohrl and Ma

Petitioner contends that claims 4, 5, 9, 11, 12, 14, 17–22, 24, 25, 27–29, and 41 would have been obvious over the combined teachings of Wohrl and Ma. Pet. 38–71.

1. *Overview of Ma*

Ma is a dissertation relating to rapid prototyping and manufacturing technology. Ex. 1007, 7. Ma discloses an “Active Material Supplying” method where “[t]he material is affected by the pressure inside the nozzle that pushes the fluent material out of the orifice.” *Id.* at 53. Ma also discloses a “Passive Material Supplying” method where “the towpreg is pulled out by the object instead of being pushed out by nozzle pressure.” *Id.* at 54.

Ma distinguishes between these two methods, noting that with the “active” method, “the forming quality of a previous layer does not influence the forming of the current layer,” while with the “passive” method, “the quality of a previous layer has a profound effect on the forming quality of the current layer.” Ex. 1007, 53. Ma sets forth other problems with using the “passive” method. *See, e.g., id.* at 95–96, 98–107, 143, 145–147, 149. For example, Ma teaches that during deposition using the “passive” method, “it is possible to make a big error, especially when the nozzle makes a big-angle turn” (*id.* at 98), and that “[a] toolpath error could be generated if an anchoring point is not formed properly” when using the “passive” method (*id.* at 143). Ma also discloses that forming speed is an issue with the “passive” method, (*id.* at 146), but discloses “[o]ne of the advantages [of the “active” method] is that the forming speed is not limited by the solidification condition of the towpreg during the forming process” (*id.* at 168).

2. *Motivation to Combine Wohrl and Ma*

To support a conclusion of obviousness when combining the teachings of multiple references, an articulated reason with some rational underpinning to combine the known elements in the fashion claimed must be provided. *See KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007); *see*

also In re Magnum Oil Tools, Int’l, Ltd., 829 F.3d 1364, 1381 (Fed. Cir. 2016) (It is the petitioner’s “burden to demonstrate both that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention[s], and that the skilled artisan would have had a reasonable expectation of success in doing so.”) (citation and internal quotation omitted). Having reviewed the parties’ arguments and evidence of record, we are not persuaded that Petitioner provides sufficient articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Wohrl and Ma in the manner recited in the challenged claims.

Petitioner contends that a POSITA would have been motivated to combine Wohrl and Ma because both “are directed to computer-based methods for manufacturing three-dimensional objects using resin-impregnated fiber materials.” Pet. 38 (citing Ex. 1002 ¶ 262). Petitioner’s identification of similarities between Wohrl and Ma, however, is not sufficient, by itself, to support a conclusion of obviousness. *See KSR*, 550 U.S. at 418. The Federal Circuit has said that merely asserting that two references are drawn from the same field of art is “simply too conclusory” to show that the skilled artisan would have combined the references in the way of the claimed invention, because “[s]uch short-cut logic would lead to the conclusion that any and all combinations of elements known in this broad field would automatically be obvious, without the need for further analysis.” *Securus Techs., Inc. v. Glob. Tel*Link Corp.*, 701 F. App’x 971, 976 (Fed. Cir. 2017); *see Microsoft Corp. v. Enfish, LLC*, 662 F. App’x 981, 990 (Fed. Cir. 2016) (determining that “the Board correctly concluded” that a petitioner “did not articulate a sufficient motivation to combine” where the

only reason given was “that the references were directed to the same art or same techniques.”).

The question of whether the prior art references are in the same field of endeavor is merely a jumping-off point in the determination of whether a claimed invention is obvious. *See K-Tec, Inc. v. Vita-Mix, Corp.*, 696 F.3d 1364, 1375 (Fed. Cir. 2012) (to qualify as prior art in an obviousness analysis, references must be analogous art—either in the same field of endeavor, or reasonably pertinent to the problem with which the inventor is involved). Even assuming the references are analogous art, it is still necessary to show that it would have been obvious to a POSITA to select and combine the teachings of those references in the manner claimed.

Petitioner also contends that “Ma provides to a POSITA additional information about raw material selection—*e.g.*, fiber and resin combinations—and additional processing details, which Wohrl omits in favor of brevity.” Pet. 38–39. For example, Petitioner contends that “Ma discusses the importance of the resin’s phase change speed and affinity between the fiber and the resin to achieve favorable impregnation, both of which are very relevant to Wohrl’s precuring and anchor point formation.” *Id.* at 39 (citing Ex. 1002 ¶ 264). Therefore, according to Petitioner, “Ma complements Wohrl and describes additional method considerations without contradicting Wohrl.” *Id.* (citing Ex. 1002 ¶ 263).

This alleged motivation to combine is also insufficient. Petitioner provides little more than a conclusory assertion that Ma contains complementary teachings that are relevant to Wohrl’s process, without identifying those teachings or explaining why a POSITA reading Wohrl would have looked to Ma for those teachings. Such conclusory statements fall short of providing the requisite rationale sufficient to support a

conclusion of obviousness. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (*cited with approval in KSR*, 550 US at 418).

Finally, Petitioner further contends that “[t]he teachings and considerations of Ma would allow a POSITA to improve on Wohrl’s methods effortlessly, and for this reason, the combination of Wohrl and Ma would yield predictable results.” Pet. 39 (citing Ex. 1002 ¶ 266). This, too, does not suffice as an articulated reason with rational underpinning to combine the respective teachings of Wohrl and Ma. That Ma’s teachings would “improve on Wohrl’s methods effortlessly” says nothing about what those teachings are, or how they would be used to improve Wohrl in order to meet all of the elements of the challenged claims. Instead, Petitioner appears to be arguing that a POSITA could have combined unspecified teachings of Ma in unspecified ways to improve Wohrl’s method. However, “obviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of [the] prior art to arrive at the claimed invention.” *Belden*, 805 F.3d at 1073; *see also In re Giannelli*, 739 F.3d at 1380 (“[T]he mere *capability* of pulling the handles is not the inquiry the Board should have made; it should have determined whether it would have been obvious to modify the prior art apparatus to arrive at the claimed rowing machine.”). It is Petitioner’s burden to provide an articulated reason with some rational underpinning to combine known elements from the cited art in the fashion claimed in order to support a conclusion of obviousness. *See KSR*, 550 U.S. at 418. Here, the Petition lacks an adequate explanation as to why a skilled artisan reading Wohrl would have looked specifically to Ma for its particular teachings, and how a skilled artisan would have combined the teachings of Wohrl and Ma in the manner claimed.

The absence of such an explanation is particularly noteworthy here in view of Ma's numerous teachings against the "passive" method of pulling the composite strand from the extruder as claimed. Patent Owner identifies no fewer than eight disclosures within Ma that seemingly disparage the passive "pulling" method and discuss benefits of the active "pushing" method. Prelim. Resp. 15–18 (citing Ex. 1007, 53, 95–96, 98–107, 143–147, 149, 167–168). In the absence of any explanation from Petitioner on this point, we determine that Petitioner does not show sufficiently, for purposes of institution, that a POSITA would have ignored those teachings and selected Ma's pulling method.

Therefore, we are not persuaded that Petitioner has made a sufficient showing that a POSITA would have combined the teachings of Wohrl and Ma as proposed. *See Johns Manville Corp. v. Knauf Insulation, Inc.*, IPR2018-00827, Paper 9 (PTAB Oct. 16, 2018) (informative). Accordingly, we conclude that Petitioner has not demonstrated a reasonable likelihood of prevailing in showing that claims 4, 5, 9, 11, 14, 17–22, 24, 25, 27–29, and 41 would have been obvious over the combined teachings of Wohrl and Ma.

E. Asserted Obviousness over Wohrl and Lipsker

Petitioner contends that claims 10, 13, 30–33, and 35 would have been obvious over the combined teachings of Wohrl and Lipsker. Pet. 71–89.

1. Overview of Lipsker

Lipsker is directed "to rapid prototype deposition modeling techniques and apparatus." Ex. 1008, 1:4–6. In particular, Lipsker "seeks to provide improved rapid prototype deposition modeling techniques and apparatus, wherein a building material is added layer by layer to build an accurate replica of a given object, without having to remove building material to arrive at the finished prototype." *Id.* at 1:52–56.

Lipsker's Figure 1 is reproduced below.

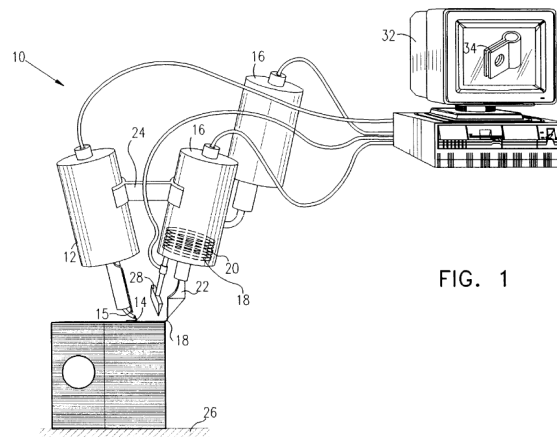


Figure 1 is a “simplified pictorial illustration of [a] rapid prototype apparatus” described in Lipsker. Ex. 1008, 2:65–67. Prototype apparatus 10 includes adhesive dispenser 12 for dispensing adhesive 14 and wire dispenser 16 for dispensing wire 18. *Id.* at 3:27–28, 3:46–47. Wire 18 is stored within storage receptacle 20 and dispensed through nozzle 22 onto bed 26. *Id.* at 3:47–49, 3:56. Bracket 24 fixedly attaches adhesive dispenser 12 to wire dispenser 16. *Id.* at 3:54–55. Cutter 28 is provided for cutting wire 18 after being dispensed by wire dispenser 16. *Id.* at 4:50–51. Apparatus 10 also includes actuator 30, which moves adhesive dispenser 12 and wire dispenser 16 in at least one (preferably four or six) of six degrees of freedom. *Id.* at 4:60–63. Actuator 30 communicates with computer 32, which contains a database containing the three-dimensional geometry of object 34. *Id.* at 5:1–3. Actuator 30 may be used to move adhesive dispenser 12 and wire dispenser 16 according to the geometry of object 34. *Id.* at 5:17–19.

Lipsker explains that actuator 30 “dispenses layers of wire 18 in accordance with the geometry of object 34, and adhesive dispenser 12 applies adhesive 14 to wire 18 so as to bond a previously dispensed portion

of wire 18 to a presently dispensed portion of wire 18.” Ex. 1008, 5:24–28. When adhesive 14 cures, the layers of wire 18 form a prototype of object 34. *Id.* at 5:30–31. Lipsker teaches that “wires of different materials may be dispensed to form a multi-material prototype,” and that “a portion of the prototype may be formed with a discardible wire . . . which serves as a support for other wires and which is purposely removed later to form the finished prototype.” *Id.* at 5:32–36. Lipsker further teaches that “[a]dhesive dispenser 12 may be located so as to dispense adhesive 14 into nozzle 22 such that wire 18 is dispensed from wire dispenser 16 pre-coated with adhesive 14,” and “application of the wires and adhesive may be synchronized in any desired manner.” *Id.* at 5:56–60. Lipsker also describes embodiments wherein the prototype is “produced by only dispensing layers of adhesive 14 . . . in accordance with the geometry of object 34, and thereafter curing the layers of adhesive 14.” *Id.* at 5:61–67.

2. *Motivation to Combine Wohrl and Lipsker*

Petitioner contends that a POSITA would have been motivated to combine Wohrl and Lipsker because both “are directed to automated, computer-based methods for manufacturing three-dimensional objects from fibers or wires impregnated or precoated with a curable material, like resin or adhesive.” Pet. 71 (citing Ex. 1002 ¶¶ 337–339). As was the case with Petitioner’s proposed combination of Wohrl and Ma, Petitioner’s identification of similarities between Wohrl and Lipsker is not sufficient, by itself, to support a conclusion of obviousness. *See KSR*, 550 U.S. at 418; *see also Securus Techs., Inc. v. Glob. Tel*Link Corp.*, 701 F. App’x at 976; *Microsoft Corp. v. Enfish, LLC*, 662 F. App’x at 990. Even assuming the references are analogous art, it is still necessary to show that it would have

been obvious to a POSITA to select and combine the teachings of those references in the manner claimed.

Petitioner also contends that “the processes disclosed by Wohrl and Lipsker are closely related and operate under the same fundamental principle And because Lipsker benefits from the advances in computer and material technology, it discloses several improvement options for Wohrl’s method.” Pet. 71 (citing Ex. 1002 ¶ 340). For example, Petitioner contends that “Lipsker discloses a cutter ‘for cutting the wire after being dispensed by the wire dispenser,’” which “allows the formation of complex three-dimensional geometries—an improvement over Wohrl’s continuous fiber dispensing process.” *Id.* at 71–72. Therefore, according to Petitioner, “Lipsker complements Wohrl and provides to a POSITA additional method considerations without contradicting Wohrl.” *Id.* at 72 (citing Ex. 1008, 2:34–36; Ex. 1002 ¶ 341).

This sort of alleged motivation to combine is insufficient because it “fails to explain why a person of ordinary skill in the art would have combined elements from specific references *in the way the claimed invention does.*” *ActiveVideo Networks, Inc. v. Verizon Commc’ns, Inc.*, 694 F.3d 1312, 1328 (Fed. Cir. 2012) (discussing expert trial testimony which was “generic and [bore] no relation to any specific combination of prior art elements”). Although Petitioner contends that Lipsker “discloses several improvement options for Wohrl’s method,” Petitioner neither identifies Lipsker’s alleged “improvement options,”⁶ nor explains with sufficient

⁶ We recognize that Petitioner alleges that Lipsker’s cutter would improve Wohrl’s continuous dispensing process. Pet. 71–72. Of the claims Petitioner alleges are rendered obvious by the combination of Lipsker and Wohrl, only one claim (claim 35) includes a cutting step. Petitioner’s

specificity the manner in which a POSITA would have combined Lipsker's teachings with Wohrl's method to meet all the elements of the challenged claims.

Finally, Petitioner contends that "Lipsker's teachings and considerations would further improve Wohrl seamlessly, and for this reason, the combination of Wohrl and Lipsker would yield predictable results." Pet. 72 (citing Ex. 1002 ¶ 342). This, too, does not suffice as an articulated reason with rational underpinning to combine the respective teachings of Wohrl and Lipsker. That Lipsker's teachings "would further improve Wohrl" says nothing about what those teachings are, or how they would be used to improve Wohrl in order to meet all of the elements of the challenged claims. Instead, Petitioner appears to be arguing that a POSITA could have combined unspecified teachings of Lipsker in unspecified ways to improve Wohrl's method. However, "obviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of [the] prior art to arrive at the claimed invention." *Belden*, 805 F.3d at 1073 (Fed. Cir. 2015); *see also In re Giannelli*, 739 F.3d at 1380.

Accordingly, the Petition lacks an adequate explanation as to why a skilled artisan reading Wohrl would have looked specifically to Lipsker for its particular teachings, and how a skilled artisan would have combined the teachings of Wohrl and Lipsker in the manner claimed. Therefore, we are

contentions about Lipsker's cutter, therefore, are not relevant to the combination of Lipsker and Wohrl for any elements of the other challenged claims (including the independent claim), and cannot provide an articulated reason with rational underpinning regarding the combination of Wohrl and Lipsker.

not persuaded that Petitioner has made a sufficient showing that a POSITA would have combined the teachings of Wohrl and Lipsker as proposed. *See Johns Manville Corp.*, IPR2018-00827, Paper 9.

For these reasons, we conclude that Petitioner has not demonstrated a reasonable likelihood of prevailing in showing that claims 10, 13, 30–33, and 35 would have been obvious over the combined teachings of Wohrl and Lipsker.

F. Remaining Grounds

Petitioner contends that dependent claims 26, 34, 36, and 37 would have been obvious over the combined teachings of Wohrl, Lipsker, and Ma (Pet. 89–92), and dependent claim 23 would have been obvious over the combined teachings of Wohrl, Ma, and Crump (*id.* at 92–94). Petitioner relies on its arguments with respect to the combination of Wohrl and Lipsker, and of Wohrl and Ma, in its contentions regarding the motivation to combine Wohrl, Lipsker, and Ma. Pet. 89. Petitioner relies on its arguments with respect to the combination of Wohrl and Ma in its contentions regarding the motivation to combine Wohrl, Ma, and Crump. *Id.* at 92–93. Petitioner does not provide additional contentions that remedy the deficiencies in the motivations to combine Wohrl with either Ma or Lipsker, discussed above. *See id.* at 89 (“As discussed in Grounds 2 and 3, a POSITA would be motivated to combine Wohrl with Ma and Wohrl with Lipsker, respectively. Therefore, a POSITA would be motivated to combine Lipsker with Wohrl and Ma.”), 92 (“As discussed in Ground 2 . . . , a POSITA would be motivated to combine Wohrl and Ma. A POSITA would be further motivated to combine Crump with Wohrl and Ma.”). Accordingly, for the reasons discussed above with respect to the combination of Wohrl and Ma, and Wohrl and Lipsker, we conclude that

Petitioner has not demonstrated a reasonable likelihood of prevailing in showing that claims 26, 34, 36, and 37 would have been obvious over the combined teachings of Wohrl, Lipsker, and Ma, or that claim 23 would have been obvious over the combined teachings of Wohrl, Ma, and Crump.

III. CONCLUSION

Based on the arguments in the Petition and the Preliminary Response, and the evidence of record, we determine that Petitioner has not established a reasonable likelihood that it would prevail on its challenge that claims 1–15 and 17–41 of the '543 patent are unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied* and no trial is instituted.

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