

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DONGHEE AMERICA, INC. and DONGHEE ALABAMA, LLC,
Petitioner,

v.

PLASTIC OMNIUM ADVANCED INNOVATION AND RESEARCH,
Patent Owner.

Case IPR2017-01890
Patent 9,399,327 B2

Before MITCHELL G. WEATHERLY, CHRISTOPHER M. KAISER, and
ROBERT L. KINDER, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318; 37 C.F.R. § 42.73

INTRODUCTION

A. Background

Donghee America, Inc. and Donghee Alabama, LLC (collectively, “Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1, 7, 9, and 15 of U.S. Patent No. 9,399,327 B2 (Ex. 1001, “the ’327 patent”). Plastic Omnium Advanced Innovation and Research (“Patent Owner”) did not file a Preliminary Response. On February 1, 2018, we instituted trial. Paper 7 (“Inst. Dec.”). On April 30, 2018, we added to the trial those asserted grounds on which we had not originally instituted trial. Paper 11. During the trial, Patent Owner filed a Response (Paper 17, “PO Resp.”), Petitioner filed a Reply (Paper 25), and Patent Owner filed a Sur-Reply (Paper 27). We held a hearing, the transcript of which has been entered into the record. Paper 33 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6, and we issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. We conclude that Petitioner has established by a preponderance of the evidence that claims 1, 7, 9, and 15 of the ’327 patent are unpatentable.

B. Related Matters

The parties note that the ’327 patent is asserted in *Plastic Omnium Advanced Innovation and Research v. Donghee America, Inc. et al.*, C.A. No. 16-cv-00187-LPS-CJB (D. Del.). Pet. 2; Paper 5, 1.

C. The Asserted Grounds of Unpatentability

Petitioner contends that claims 1, 7, 9, and 15 of the ’327 patent are unpatentable based on the following grounds (Pet. 14–68):¹

¹ Petitioner also relies on a declaration from Dr. David O. Kazmer. Ex. 1007.

Statutory Ground	Basis	Challenged Claims
§ 103	Van Schaftingen ² and Ishimaru ³	1, 7, 9, and 15
§ 103	Van Schaftingen, Ishimaru, and Harvey ⁴	1, 7, 9, and 15
§ 103	Van Schaftingen and Staargaard ⁵	1, 7, 9, and 15

D. The '327 Patent

The '327 patent, titled “Method for Fastening an Accessory in a Plastic Fuel Tank,” issued on July 26, 2016. Ex. 1001, at [45], [54]. “Fuel tanks on board vehicles of various kinds generally have to meet imperviousness and permeability standards” related to “environmental requirements” set by various governments throughout the world. *Id.* at 1:11–18. One way of minimizing emissions losses “is to incorporate certain accessories and pipe work within the tanks, thus eliminating their interface with the external surroundings.” *Id.* at 1:23–26. The '327 patent is intended “to provide a method that allows an accessory based on a material different from that of the tank to be fastened inside a plastic fuel tank . . . quickly, easily, without consuming excessive amounts of material and without the risk of damaging the barrier layer or of creating excessive internal tensions.” *Id.* at 1:58–63.

² Van Schaftingen et al., US 2001/0015513 A1, published Aug. 23, 2001 (Ex. 1004, “Van Schaftingen”).

³ Ishimaru et al., Japanese Patent Application Publication No. P2003-291208A, published Oct. 14, 2003 (English translation and Japanese original both provided) (Ex. 1003, “Ishimaru”).

⁴ Harvey et al., U.S. Patent No. 3,387,481, issued June 11, 1968 (Ex. 1006, “Harvey”).

⁵ Staargaard et al., US 2004/0072006 A1, published Apr. 15, 2004 (Ex. 1005, “Staargaard”).

E. Illustrative Claims

Claims 1, 7, 9, and 15 of the '327 patent are challenged. Claims 1 and 9 are independent and illustrative; they recite:

1. A method for stake-fastening an accessory into a plastic fuel tank, wherein the accessory is equipped with at least one orifice which passes right through the accessory, said method comprising:

melting at least some of the plastic of which the wall of the tank is made to form molten plastic;

forcing some of the molten plastic through the orifice of the accessory without becoming detached from the remainder of the molten plastic, thereby forming protruding molten plastic;

shaping the protruding molten plastic to provide a self-formed plastic rivet, and allowing the molten plastic to solidify;

whereby the size and shape of the orifice and/or of the solidified plastic are such that the accessory is mechanically fastened to the tank by at least some of the solidified plastic, and

wherein stake-fastening the accessory into the tank occurs at the time of manufacture of the tank when moulding a split or at least two-part parison and

wherein the accessory comprises a material selected from the group consisting of metal, polyacetal, polyoxymethylene, polyamide, glass-fibre-reinforced polyamide, and polybutylene terephthalate.

Ex. 1001, 7:20–43 (some paragraphing added).

9. A method for stake-fastening an accessory into a multilayer plastic fuel tank comprising a thermoplastic layer and either a fuel-impermeable layer or fuel-impermeable surface treatment, wherein the accessory is equipped with at least one orifice which passes right through the accessory, said method comprising

melting at least some of the plastic of which the wall of the tank is made to form molten plastic;

forcing some of the molten plastic through the orifice of the accessory without becoming detached from the remainder of the molten plastic and without rupturing the fuel-impermeable layer or fuel-impermeable surface treatment of the multilayer plastic fuel tank wall, thereby forming protruding molten plastic;

shaping the protruding molten plastic to provide a self-formed plastic rivet, and allowing the molten plastic to solidify;

whereby the size and shape of the orifice and/or of the solidified plastic are such that the accessory is mechanically fastened to the multilayer plastic fuel tank by at least some of the solidified multilayer plastic, and

wherein stake-fastening the accessory occurs at the time of manufacture of the multilayer plastic fuel tank when moulding of a split or at least two-part parison, and

wherein the accessory comprises a material selected from the group consisting of metal, polyacetal, polyoxymethylene, polyamide, glass-fibre-reinforced polyamide, and polybutylene terephthalate.

Id. at 8:8–34 (some paragraphing added).

ANALYSIS

A. Claim Construction

In an *inter partes* review, we construe claim terms in an unexpired patent according to their broadest reasonable construction in light of the specification of the patent in which they appear.⁶ 37 C.F.R. § 42.100(b)

⁶ A recent amendment to this rule does not apply here because the Petition was filed before November 13, 2018. See Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 100(b) effective November 13, 2018).

(2017); *see Cuozzo Speed Techs. LLC v. Lee*, 136 S. Ct. 2131, 2144 (2016) (upholding the use of the broadest reasonable interpretation standard).

Claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). The parties propose three terms for construction: “accessory,” “self-formed plastic rivet,” and “shaping the protruding molten plastic.” Pet. 10–12; PO Resp. 14–16.

1. “Accessory”

Petitioner proposes construing “accessory” as “any object or functional device generally associated with the fuel tank in its conventional mode of use or of operation and which collaborates therewith in order to perform certain useful functions or a support for one or several of such devices.” Pet. 10–11. Patent Owner agrees with this proposed construction. PO Resp. 16. Moreover, this construction is taken directly from the ’327 patent, which states that “‘accessory’ is intended to denote” the construction Petitioner offers. Ex. 1001, 3:7–15. When an inventor defines specific terms used to describe an invention, we will give effect to those definitions, as long as they are set out “with reasonable clarity, deliberateness, and precision,” “so as to give one of ordinary skill in the art notice of the change” in meaning. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Accordingly, we adopt the parties’ agreed construction of “accessory.”

2. “Self-Formed Plastic Rivet”

Petitioner proposes construing “self-formed plastic rivet” as “a protrusion formed in-situ from molten plastic from the wall of the tank.”

Pet. 11–12. Patent Owner disagrees and proposes “protrusion of plastic formed from the molten plastic wall of the fuel tank.” PO Resp. 14–15. Patent Owner argues that adopting Petitioner’s construction might cause “self-formed plastic rivet” to cover rivets formed from “some extraneous material such as a metal or plastic rivet introduced into and through the tank wall.” *Id.* We disagree; Petitioner’s construction makes clear that the “self-formed plastic rivet” is “formed . . . from the wall of the tank.” Ultimately, however, the only differences between the parties’ two constructions are (1) that Petitioner’s construction does not state that the protrusion is made of plastic and (2) that Patent Owner’s construction does not make clear that the rivet is formed in-situ. Given that the specification of the ’327 patent states that “‘self-form[ing]’ a plastic rivet” is “form[ing] the rivet in-situ from molten plastic from the wall of the tank,” Ex. 1001, 3:35–44, we determine that in-situ formation should be part of the proper construction. And adding to Petitioner’s proposed construction a statement that the protrusion is made of plastic follows logically from the portion of Petitioner’s proposed construction that states that the “self-formed plastic rivet” is “formed . . . from molten plastic.” Accordingly, we construe “self-formed plastic rivet” as “a protrusion of plastic formed in-situ from molten plastic from the wall of the tank.”

3. *“Shaping the Protruding Molten Plastic”*

Petitioner proposes construing “shaping the protruding molten plastic” as “manipulating or allowing the protruding molten plastic to form a shape.” Pet. 12. Patent Owner argues that this phrase should be construed as “shaping the protruding molten plastic to provide a self-formed plastic rivet.” PO Resp. 15–16. In its argument, Patent Owner makes clear that the

“shaping” need not necessarily involve manipulating the plastic with any tools; instead, “the self-formed rivet can be shaped by the natural flow of plastic through the orifice.” *Id.* at 16 (citing Ex. 2001 ¶¶ 47–49). Thus, both parties agree that “shaping” the molten plastic can take the form either of “manipulating” the plastic into a shape or of “allowing” the plastic to form a shape. The difference between the two proposed constructions is that Petitioner argues that forming “a shape” is sufficient, and Patent Owner argues that the “shape” must be “a self-formed plastic rivet.”

It is not clear that there is any practical difference between these constructions. The challenged claims use the phrase “shaping the protruding molten plastic” only in the phrase “shaping the protruding molten plastic to provide a self-formed plastic rivet.” Ex. 1001, 7:20–43, 8:8–34. Thus, even if “shaping the protruding molten plastic” is itself construed to permit any “shape” rather than just a “self-formed plastic rivet” as the product of the shaping step, the challenged claims are still limited to methods in which the step of “shaping the protruding molten plastic” produces a “self-formed plastic rivet.” Because both proposed constructions result in the same claim scope, they both are reasonable. Consistent with the applicable version of 37 C.F.R. § 42.100(b), we choose the broadest reasonable construction. Accordingly, we construe “shaping the protruding molten plastic” as “manipulating or allowing the protruding molten plastic to form a shape.”

B. Asserted Obviousness over Van Schaftingen and Ishimaru

Petitioner argues that the subject matter of claims 1, 7, 9, and 15 would have been obvious to a person of ordinary skill in the art given the teachings of Van Schaftingen and Ishimaru. Pet. 14–42.

1. *Van Schaftingen*

Van Schaftingen relates to a “[p]rocess for manufacturing hollow plastic bodies, especially motor-vehicle fuel tanks.” Ex. 1004, at [57]. In the process of Van Schaftingen, a “parison is cut twice over its entire length . . . so as to produce two separate sheets.” *Id.* ¶ 25. These separate sheets “are held apart at a sufficient distance from each other so that it is possible to insert between them, before [molding], an object intended to be incorporated inside the hollow body.” *Id.* ¶ 27. The tank of Van Schaftingen may be a “multilayered structure[] consisting of stacked layers fastened to one another,” where the “external layers” may be “made of high-density polyethylene,” with a “central barrier layer made of ethylene-vinyl alcohol copolymer.” *Id.* ¶¶ 14, 45. The accessory to be inserted into the fuel tank of Van Schaftingen may be a “ventilation device[.]” *Id.* ¶ 32. The “preferred method of fastening” the accessories of Van Schaftingen to the tank “is welding.” *Id.* ¶ 39.

2. *Ishimaru*

Ishimaru relates to “a production method for a resin hollow article capable of producing molded products that offer excellent gas barrier properties.” Ex. 1003, at [57]. The molded products may include “an automotive fuel tank.” *Id.* ¶ 18. In the method of Ishimaru, “a resin preform” is “maintained at a moldable temperature, a lost core is disposed in the preform tube; and the preform having the lost core disposed therein is maintained at a moldable temperature and set in a press device,” where it is molded. *Id.* ¶ 6. Ishimaru also teaches attaching a pre-molded “sub-tank” to the tank. *Id.* ¶ 34. Ishimaru teaches accomplishing this by creating a “through-hole” with a “reverse-tapered shape (with the diameter becoming

smaller in the direction of the outer wall)” in the sub-tank, allowing “a part of the preform . . . to penetrate the through-hole . . . during the press-molding.” *Id.* “In this manner, the sub-tank . . . can be even more securely attached to the outer wall.” *Id.*

3. *Analysis*

Petitioner argues that a person of ordinary skill in the art would have had reason to combine the teachings of Van Schaftingen with the teachings of Ishimaru and that those combined teachings teach or suggest every limitation of claims 1, 7, 9, and 15. Pet. 14–42. Patent Owner argues that the combination of Van Schaftingen and Ishimaru fails to teach several limitations of the challenged claims. PO Resp. 19–27.

a. Claim 1

As Petitioner notes, Pet. 13–27, claim 1 recites a preamble and six limitations: “[a] method for stake-fastening an accessory into a plastic fuel tank, wherein the accessory is equipped with at least one orifice which passes right through the accessory,” “melting at least some of the plastic of which the wall of the tank is made to form molten plastic,” “forcing some of the molten plastic through the orifice of the accessory without becoming detached from the remainder of the molten plastic, thereby forming protruding molten plastic,” “shaping the protruding molten plastic to provide a self-formed plastic rivet, and allowing the molten plastic to solidify,” “whereby the size and shape of the orifice and/or of the solidified plastic are such that the accessory is mechanically fastened to the tank by at least some of the solidified plastic,” “wherein stake-fastening the accessory into the tank occurs at the time of manufacture of the tank when [molding] a split or at least two-part parison,” and “wherein the accessory comprises a material

selected from the group consisting of metal, polyacetal, polyoxymethylene, polyamide, glass-[fiber]-reinforced polyamide, and polybutylene terephthalate.” Ex. 1001, 5:44–6:5.

(1) Preamble and Reason to Combine

Petitioner argues that the combination of Van Schaftingen and Ishimaru teaches or suggests the preamble of claim 1 and that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Ishimaru. Pet. 15–23. Patent Owner argues that the combination “fails to disclose” a “method for stake-fastening an accessory into a . . . plastic fuel tank.” PO Resp. 19–22.

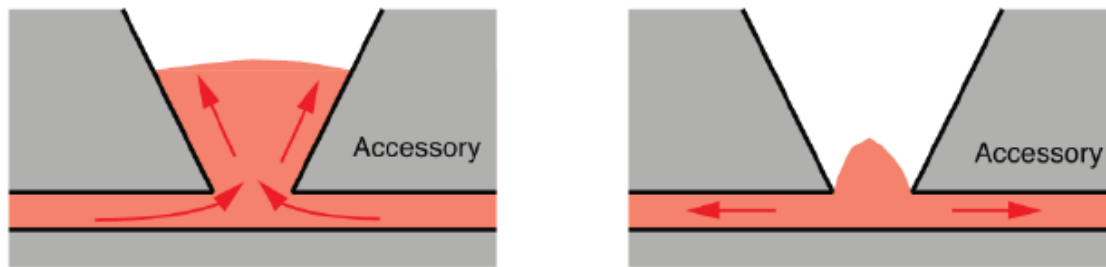
Van Schaftingen teaches a “[p]rocess for manufacturing hollow plastic bodies, especially motor-vehicle fuel tanks,” including installing accessories into the tanks by attaching them to the walls of the tanks. Ex. 1004, at [57], ¶¶ 31, 34. The accessories of Van Schaftingen are defined identically to our construction of “accessory,” and examples include “ventilation devices.” *Id.* ¶ 32.

Although Van Schaftingen does not teach or suggest attaching its accessories to the walls of the tanks by stake-fastening, Petitioner argues that Ishimaru teaches or suggests stake-fastening accessories inside plastic fuel tanks. Pet. 17–18 (citing Ex. 1003, at [57], ¶¶ 18, 34, Fig. 14; Ex. 1007 ¶¶ 47–48). Patent Owner argues that Ishimaru does not teach or suggest stake-fastening its accessories because it relates only to a “welding aid to make the attachment to the tank wall more secure.” PO Resp. 20–22 (citing Ex. 1003 ¶¶ 27, 33, 34, Fig. 9, Fig. 10; Ex. 2001 ¶¶ 64–67).

As an initial matter, we agree with Patent Owner that claim 1 requires that the stake-fastening process result in a protrusion of solidified plastic that

cooperates with the accessory orifice in a way that causes the accessory to become mechanically fastened to the wall of the fuel tank. Ex. 1001, 7:32–35. Accordingly, if Ishimaru teaches only an aid to welding an accessory to the tank wall, it does not teach a stake-fastening method. On the other hand, the method of claim 1 need only “compris[e]” an orifice and solidified plastic whose “size and shape . . . are such that the accessory is mechanically fastened to the tank.” *Id.* at 7:20–35. In patent claims, “comprising” means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim. *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997). Accordingly, if Ishimaru teaches stake-fastening in addition to welding, the additional teaching does not preclude us from relying on Ishimaru’s teaching of stake-fastening. Thus, the only question for us is whether Ishimaru teaches a method of stake-fastening, not whether Ishimaru limits the method it teaches to use with welding.

On the record developed during trial, we agree with Petitioner that Ishimaru teaches a method of stake-fastening its accessory to a fuel tank wall. Patent Owner’s declarant, Professor Tim Osswald, testifies that Ishimaru’s process would result in some molten plastic entering the reverse-tapered orifice in Ishimaru’s accessory but not in the molten plastic filling any entire cross-section of the reverse-tapered orifice. Ex. 2001 ¶ 67. Professor Osswald provides two figures of his own, reproduced below, that illustrate this testimony.



Id. The figure reproduced above on the left depicts a large amount of plastic wall material entering the reverse-tapered orifice in an accessory and filling the entire cross-section of that orifice to some unspecified depth. *Id.* The figure reproduced above on the right depicts plastic wall material largely moving away from the reverse-tapered orifice when the accessory is pushed against the wall, with only a small portion of the plastic entering the orifice and failing to fill the entire cross-section of the orifice to any substantial depth at all. *Id.* Professor Osswald testifies that the figure on the right illustrates what would occur if a person of ordinary skill in the art were to carry out Ishimaru’s process better than does the figure on the left. *Id.*

If true, this would mean that Ishimaru’s process could not result in any mechanical connection between the accessory and the wall. The problem with this testimony is that it is inconsistent with the language of Ishimaru. The process of Ishimaru results in the accessory being “even more securely attached to the outer wall.” Ex. 1003 ¶ 34. If the plastic enters Ishimaru’s reverse-tapered orifice only in the way described by Professor Osswald, it is not clear how it would improve the security of the attachment of the accessory to the wall. Neither Patent Owner nor Professor Osswald explains how Professor Osswald’s interpretation of Ishimaru’s process satisfies the language of Ishimaru requiring such an improvement. We credit the express language of Ishimaru over Professor Osswald’s

interpretation of the reference, and we find that Ishimaru teaches a process in which a solidified protrusion of molten plastic cooperates with a reverse-tapered orifice in an accessory to more securely attach the accessory to the wall of a fuel tank. Accordingly, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests the preamble of claim 1.

In addition, Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Ishimaru. Pet. 19–23. Patent Owner does not dispute Petitioner’s argument other than by arguing that “[n]either Petitioners nor Dr. Kazmer even attempt to explain how Ishimaru’s lost core concept could be incorporated into Van Schaftingen.” PO Resp. 24 (citing Ex. 2001 ¶¶ 74–75). Of course, “[c]ombining the teachings of references does not involve an ability to combine their specific structures,” so Petitioner is not required to explain how to incorporate Ishimaru’s lost core into Van Schaftingen’s process. *In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973); *see also In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of those references would have suggested to those of ordinary skill in the art.”). We agree with Petitioner that the evidence of record shows that a person of ordinary skill in the art would have had a reason to use Ishimaru’s stake-fastening method to attach Van Schaftingen’s accessories to Van Schaftingen’s fuel tank. Van Schaftingen teaches welding its accessories to the tank wall, Ex. 1004 ¶ 39, and a person of ordinary skill in the art would have understood that welding works only with similar materials. Ex. 1007 ¶¶ 52–53. Thus, to attach

accessories made of materials dissimilar to the material of the tank wall, a different mounting method would be needed, and Ishimaru provides such a method. Moreover, by referring to welding only as “[a] preferred method of fastening,” Van Schaftingen acknowledges that other mounting methods are possible. Ex. 1004 ¶ 39. Accordingly, we find that the preponderance of the evidence of record shows that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Ishimaru.

(2) “Melting at least some of the plastic of which the wall of the tank is made to form molten plastic”

In our decision on institution, we found that Petitioner had not directed us to sufficient evidence to show that the combination of Van Schaftingen and Ishimaru teaches or suggests melting the tank wall to produce molten plastic. Inst. Dec. 8–10. Patent Owner echoed this finding during the trial, arguing that neither Van Schaftingen nor Ishimaru teaches or suggests “us[ing] molten plastic to form a rivet or otherwise attach an accessory to a fuel tank.” PO Resp. 17–18. Based on the final record before us, however, we are persuaded that the preponderance of evidence now of record supports a finding that Ishimaru teaches or suggests melting some of the plastic of the tank wall to form molten plastic.

Ishimaru teaches that the walls of its tank are “maintained at a moldable temperature” while the tank is placed in a mold and the accessories are placed inside the tank. Ex. 1003 ¶¶ 6, 9. In addition, Ishimaru teaches causing the plastic at a moldable temperature “to penetrate the through-hole” in the accessory that is being attached to the tank wall during the molding of the tank. *Id.* ¶ 25.

In our decision on institution, we considered this evidence insufficient to show that Ishimaru's plastic was molten, because plastic that is soft and moldable is not necessarily above its melting point. Inst. Dec. 10. There is some testimony from Petitioner's declarant, Dr. Kazmer, to support this view. Ex. 1007 ¶¶ 54 (describing material flowing through Ishimaru's orifice as "semi-molten" rather than "molten"), 164 (discussing disclosure in Harvey of "forcing . . . plastic through an orifice" after the plastic has been heated "to the softening point of the resin"). But the record developed during trial includes considerable testimony from Patent Owner's own declarant, Professor Osswald, contradicting this view. Ex. 1010, 80:17–19 ("molten plastic is basically understood by somebody in the art" as plastic that "can be shaped" or "formed"), 82:19–20 ("molten plastic . . . [c]ertainly . . . is not defined by a temperature"), 83:18–20 ("as long as the material can be formed and flow, . . . we have a molten plastic"); Ex. 1011, 33:18–22 (in Ishimaru, "[t]he plastic is molten"). Moreover, the record now also includes testimony from Dr. Kazmer explaining his earlier "semi-molten" comment. Ex. 1009 ¶ 11 (explaining that "semi-molten" does not mean non-molten, but rather a state in which the interior of the plastic is "molten," but there is "a thin layer of cooler plastic on the surfaces of the parison"). Accordingly, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests this limitation of claim 1.

(3) *“Forcing some of the molten plastic through the orifice of the accessory without becoming detached from the remainder of the molten plastic, thereby forming protruding molten plastic”*

Petitioner argues that Ishimaru teaches or suggests forcing some molten plastic through the accessory orifice without becoming detached from the remainder of the molten plastic. Pet. 24–27 (citing Ex. 1003 ¶ 34, Fig. 14; Ex. 1007 ¶¶ 60–63). Patent Owner argues that “there is insufficient structure on Van Schaftingen to ensure that enough plastic is forced through the orifice and shaped to form a rivet.” PO Resp. 24–25 (citing Ex. 2001 ¶¶ 76–78).

Supporting Patent Owner’s argument, Professor Osswald testifies that Ishimaru fails to teach or suggest a feature that is “critical to the [’327] patent”: “some structure on the accessory or mold [to] assist in forcing molten plastic through the orifice.” Ex. 2001 ¶ 77. According to Professor Osswald, “[w]ithout this structure . . . or tooling that provides localized compression,” the plastic will be squeezed out from under the accessory in the opposite direction of the hole. *Id.* Because Ishimaru does not teach such a structure, Professor Osswald testifies that “Ishimaru’s actual design would result in a small amount of plastic entering the reverse-tapered hole,” and this plastic would not form “the necessary ‘rivet-like’ shape.” *Id.* ¶ 78. But this limitation of claim 1 does not require any “structure on the accessory or mold [to] assist in forcing molten plastic through the orifice,” only forcing some molten plastic through the orifice, and even Professor Osswald testifies that Ishimaru’s method results in some molten plastic entering the orifice. *Id.*

Moreover, as discussed above, Ishimaru teaches pressing an accessory having a reverse-tapered orifice into a molten plastic fuel tank wall in order to cause sufficient plastic to penetrate the reverse-tapered orifice to ensure that, when the plastic solidifies, the plastic and orifice will cooperate to secure the accessory to the wall. Ex. 1003 ¶ 34, Fig. 14. For the protruding plastic to secure the accessory to the wall, the protruding plastic must not separate from the wall. Also, there is evidence that a person of ordinary skill in the art would have understood how to design the manufacturing process so that Ishimaru's goal of securely attaching the accessory to the wall would be accomplished. Ex. 1007 ¶ 62 (explaining that the amount of plastic flowing into the orifice "is a natural result of the pressure applied to the molten plastic by the accessory being pushed against the molten plastic and the opposing mold wall"); Ex. 1009 ¶ 18 ("It is conventional in molding processes to limit how hard the molds, dies, parts, and molten plastic press against one another to achieve the desired physical characteristics in the manufactured product."). As for Patent Owner's argument that Van Schaftingen discloses "insufficient structure . . . to ensure that enough plastic is forced through the orifice and shaped to form a rivet," the reason that Van Schaftingen does not disclose how to carry out the stake-fastening process described in Ishimaru is that Van Schaftingen is concerned with welding the accessories to the tank wall rather than with stake-fastening them. Ex. 1004 ¶ 39. Accordingly, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests this limitation of claim 1.

(4) *“Shaping the protruding molten plastic to provide a self-formed plastic rivet, and allowing the molten plastic to solidify”*

Petitioner argues that Ishimaru teaches or suggests shaping the protruding molten plastic to provide a self-formed plastic rivet, then allowing the molten plastic to solidify. Pet. 27–29 (citing Ex. 1003 ¶¶ 34, 40; Ex. 1007 ¶¶ 64–67). As discussed above, we construe the phrase “shaping the protruding molten plastic to provide a self-formed plastic rivet” as “manipulating or allowing the protruding molten plastic to form a protrusion of plastic in-situ from molten plastic from the wall of the tank.” Ishimaru teaches causing part of the tank wall “to penetrate the through-hole” in the accessory to ensure that the accessory is “more securely attached to the outer wall.” Ex. 1003 ¶ 34. Regardless of whether Petitioner is correct that the “more secure[.]” attachment of Ishimaru requires the plastic to fill a portion of Ishimaru’s reverse-tapered orifice or whether Patent Owner is correct that only a small portion of plastic will protrude into the center of the orifice, it is clear that Ishimaru teaches allowing the molten plastic of the tank wall to form a protrusion in-situ from the tank wall. *Compare* Pet. 29 (depicting molten plastic filling or even over-filling the reverse-tapered orifice of Ishimaru), *with* PO Resp. 23 (depicting a small amount of plastic forming a protrusion into, but not filling, the reverse-tapered orifice of Ishimaru).

Patent Owner argues that Ishimaru does not teach any method of stopping the molten plastic from filling the entire reverse-tapered orifice. PO Resp. 25–26 (citing Ex. 2001 ¶ 70). As discussed above, however, Dr. Kazmer testifies that a person of ordinary skill in the art would understand how to design the manufacturing process so that Ishimaru’s goal

of securely attaching the accessory to the wall would be accomplished. Ex. 1007 ¶ 62; Ex. 1009 ¶ 18. Patent Owner does not explain how a person of ordinary skill in the art would have achieved Ishimaru's stated goal with the small amount of plastic, not filling any portion of the reverse-tapered orifice, that Patent Owner argues is present in Ishimaru's method. PO Resp. 25–26 (citing Ex. 2001 ¶ 70). Moreover, the testimony of Professor Osswald that Patent Owner cites does not contradict Dr. Kazmer's testimony. Instead, Professor Osswald states only that Ishimaru itself fails to disclose a "structure (whether part of the sub tank or a counterform) that would stop the flow of plastic," without discussing Dr. Kazmer's testimony that the knowledge of how to carry out Ishimaru's process was within the skill of a person of ordinary skill in the art. Ex. 2001 ¶ 70. Accordingly, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests this limitation of claim 1.

(5) "Whereby the size and shape of the orifice and/or of the solidified plastic are such that the accessory is mechanically fastened to the tank by at least some of the solidified plastic"

Petitioner argues that Ishimaru teaches an orifice and solidified plastic that are of a size and shape such that they cooperate to fasten Ishimaru's sub-tank to the tank wall mechanically. Pet. 30 (citing Ex. 1003 ¶ 34; Ex. 1007 ¶¶ 68–70). Ishimaru teaches a reverse-tapered orifice, "with the diameter becoming smaller in the direction of the outer wall." Ex. 1003 ¶ 34. Assuming the solidified plastic fills this orifice, either completely or up to some distance from the outer wall, the solidified plastic would have a greater diameter further from the wall than closer to the wall, causing it to overhang the narrowest portion of the orifice. Ex. 1007 ¶¶ 68–70. This

would cause the plastic and the orifice to cooperate to attach the sub-tank to the tank wall mechanically. Moreover, Ishimaru teaches that the purpose of its orifice and solidified plastic is to “even more securely attach[]” the sub-tank “to the outer wall.” Ex. 1003 ¶ 34. Accordingly, there is evidence to support Petitioner’s argument.

Patent Owner argues that Ishimaru does not teach using the orifice and solidified plastic to attach its sub-tank mechanically because the only purpose of the small amount of plastic that penetrates Ishimaru’s reverse-tapered orifice is to assist the welding process. PO Resp. 26–27 (citing Ex. 2001 ¶¶ 76–78). Professor Osswald testifies that Ishimaru is “not concerned with or reliant upon a rivet for mechanical fastening as this is achieved by press-molding (*i.e.*, welding) the accessory to the wall of the tank.” Ex. 2001 ¶¶ 76–78. But this testimony contradicts the text of Ishimaru, which states that the purpose of its reverse-tapered orifice and the “part of the preform” that is “caused to penetrate the through-hole” is to “even more securely attach[]” the sub-tank “to the outer wall.” Ex. 1003 ¶ 34. To the extent Patent Owner’s cited evidence contradicts the text of Ishimaru, it is unreliable.

Professor Osswald also testifies that Ishimaru cannot result in any mechanical attachment between the accessory and the tank wall because it is missing any “structure on the accessory or mold [to] assist in forcing molten plastic through the orifice.” Ex. 2001 ¶ 77. But the ’327 patent makes clear that, although such a structure is preferable, no such structure is necessary to carry out the claimed method. Ex. 1001, 3:45–55 (“The orifice may have any shape,” although it “will preferably be tailored in such a way as to make it easier to force the material through the orifice.”). Moreover, the scope of

claim 1 is not limited by a preferred embodiment that appears in the written description. *Superguide Corp. v. DirecTVEnter., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004).

Because the preponderance of the evidence supports Petitioner’s argument, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests this limitation of claim 1.

(6) “*Wherein stake-fastening the accessory into the tank occurs at the time of manufacture of the tank when [molding] a split or at least two-part parison*”

Petitioner argues that Van Schaftingen teaches or suggests attaching an accessory to the wall of a fuel tank at the time the tank is manufactured from a parison that is split into two parts. Pet. 31–32 (citing Ex. 1004 ¶¶ 5, 25; Ex. 1007 ¶¶ 71–73). Patent Owner does not dispute this evidence or argument. PO Resp. 19–27. The evidence supports Petitioner’s argument. Van Schaftingen teaches that a “particularly preferred technique” for carrying out its method of manufacturing a fuel tank “is that in which the parison is cut twice over its entire length, that is to say along two separate lines, so as to produce two separate sheets.” Ex. 1004 ¶ 25. Van Schaftingen also teaches placing an accessory between the separate sheets, then anchoring the accessory “to the internal wall of the [fuel tank].” *Id.* ¶¶ 31–34. Accordingly, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests this limitation of claim 1.

(7) “*Wherein the accessory comprises a material selected from the group consisting of metal, polyacetal, polyoxymethylene, polyamide, glass-[fiber]-reinforced polyamide, and polybutylene terephthalate*”

Petitioner argues that Ishimaru teaches attaching accessories made of metal to the inside of the outer wall of its fuel tank. Pet. 32–33 (citing Ex. 1003 ¶¶ 12, 20, 32). Petitioner also argues that a person of ordinary skill in the art would have understood that Ishimaru’s stake-fastening method could be used to attach an accessory made of any material, without regard for the similarity of that material and the material of the tank wall. *Id.* (citing Ex. 1007 ¶¶ 74–78). Patent Owner does not dispute this evidence or argument. PO Resp. 19–27. The evidence supports Petitioner’s argument. Ishimaru teaches attaching accessories to the inside wall of the fuel tank, including metallic cut-off valves. Ex. 1003 ¶¶ 12, 20. And Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that Ishimaru’s stake-fastening method could be applied to Ishimaru’s metallic cut-off valve. Ex. 1007 ¶ 76. Accordingly, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests this limitation of claim 1.

Because, as discussed above, the combination of Van Schaftingen and Ishimaru teaches or suggests the subject matter of claim 1, and because a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Ishimaru, as Petitioner contends, we conclude that Petitioner has shown by a preponderance of the evidence that claim 1 would have been obvious over the combination of Van Schaftingen and Ishimaru.

b. Claim 7

Claim 7 depends from claim 1 and adds a limitation requiring that the accessory that is stake-fastened into the plastic fuel tank “is a ventilation device.” Ex. 1001, 8:3–4. Petitioner argues that both Van Schaftingen and Ishimaru teach incorporating ventilation devices into a fuel tank. Pet. 34–35 (citing Ex. 1003 ¶ 20; Ex. 1004 ¶ 32; Ex. 1007 ¶¶ 79–82). We agree, and Patent Owner does not dispute Petitioner’s argument or evidence regarding claim 7. PO Resp. 19–27.

Van Schaftingen teaches that the accessories it incorporates into its fuel tank can include “ventilation devices.” Ex. 1004 ¶ 32. Ishimaru teaches attaching to the fuel tank a cut-off valve, which “is a valve that lets the air that builds up in the upper part of the fuel tank . . . escape when fuel is pumped into the fuel tank.” Ex. 1003 ¶ 20. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 7 would have been obvious over the combination of Van Schaftingen and Ishimaru.

c. Claim 9

Claim 9 is quite similar to claim 1. *Compare* Ex. 1001, 7:19–43, *with* Ex. 1001, 8:8–34. These claims differ only in that claim 9 recites two additional limitations. First, claim 9 requires that the plastic fuel tank be made of multiple layers, “comprising a thermoplastic layer and either a fuel-impermeable layer or fuel-impermeable surface treatment.” Ex. 1001, 8:8–11. Second, claim 9 requires that the step of “forcing some of the molten plastic through the orifice of the accessory” be completed “without rupturing the fuel-impermeable layer or fuel-impermeable surface treatment of the multilayer plastic fuel tank wall.” *Id.* at 8:15–20.

Petitioner argues that both Van Schaftingen and Ishimaru teach a multilayer plastic fuel tank “comprising a thermoplastic layer and either a fuel-impermeable layer or fuel-impermeable surface treatment.” Pet. 35–37 (citing Ex. 1003 ¶¶ 19, 22; Ex. 1004 ¶¶ 14, 45; Ex. 1007 ¶¶ 85–86). We agree, and Patent Owner does not dispute this argument or evidence. PO Resp. 19–27.

Van Schaftingen teaches a fuel tank made of a laminated, multilayer material comprising two polyethylene layers with an ethylene-vinyl alcohol copolymer layer between them. Ex. 1004 ¶ 45. Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that the polyethylene layers are made of thermoplastic material and that ethylene-vinyl alcohol copolymer layer is fuel-impermeable. Ex. 1007 ¶ 85. In addition, Ishimaru teaches making its fuel tank of a laminated multilayer structure with a central “gas barrier layer” made of ethylene-vinyl alcohol copolymer and a layer of high-density polyethylene on each side of the gas barrier layer. Ex. 1003 ¶ 19. Again, Dr. Kazmer testifies that the high-density polyethylene layers are thermoplastic and that the ethylene-vinyl alcohol copolymer layer is fuel-impermeable. Ex. 1007 ¶ 86.

With respect to the limitation requiring forcing molten plastic through the accessory orifice “without rupturing the fuel-impermeable layer or fuel-impermeable surface treatment of the multilayer plastic fuel tank wall,” Petitioner argues that a person of ordinary skill in the art would have understood that Ishimaru’s multilayer structure would be carried through the orifice intact because “the molten plastic flow . . . is naturally laminar given that the molten plastics are highly viscous and so their inertial forces are low compared to their viscous forces.” Pet. 38–40 (citing Ex. 1007 ¶¶ 90–97).

We agree, and Patent Owner does not dispute this argument or evidence. PO Resp. 19–27. Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that Ishimaru’s fuel tank “would lack utility” if its fuel-impermeable layer were ruptured by the manufacturing process. Ex. 1007 ¶ 91. Dr. Kazmer also testifies that, because of the viscous flow of the plastic layers, Ishimaru’s multilayer structure would be preserved in the forcing of a portion of the tank wall through the orifice in the sub-tank. *Id.* ¶¶ 94–95.

The remaining limitations of claim 9 are identical to claim 1, and Van Schaftingen and Ishimaru teach or suggest those limitations for the reasons explained above with respect to claim 1. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 9 would have been obvious over the combination of Van Schaftingen and Ishimaru.

d. Claim 15

Claim 15 differs from claim 7 only in that it depends from claim 9 instead of claim 1. *Compare* Ex. 1001, 8:3–4, *with* Ex. 1001, 8:51–52. For the reasons discussed above with respect to claims 1, 7, and 9, we conclude that Petitioner has shown by a preponderance of the evidence that claim 9 would have been obvious over the combination of Van Schaftingen and Ishimaru.

C. Asserted Obviousness over Van Schaftingen, Ishimaru, and Harvey

Petitioner argues that the subject matter of claims 1, 7, 9, and 15 would have been obvious to a person of ordinary skill in the art given the teachings of Van Schaftingen, Ishimaru, and Harvey. Pet. 42–45.

1. *Harvey*

Harvey “relates to a method for the deformation of sheet material to form either solid or hollow projections extending therefrom.” Ex. 1006, 1:16–18. Figure 4 of Harvey is reproduced below:

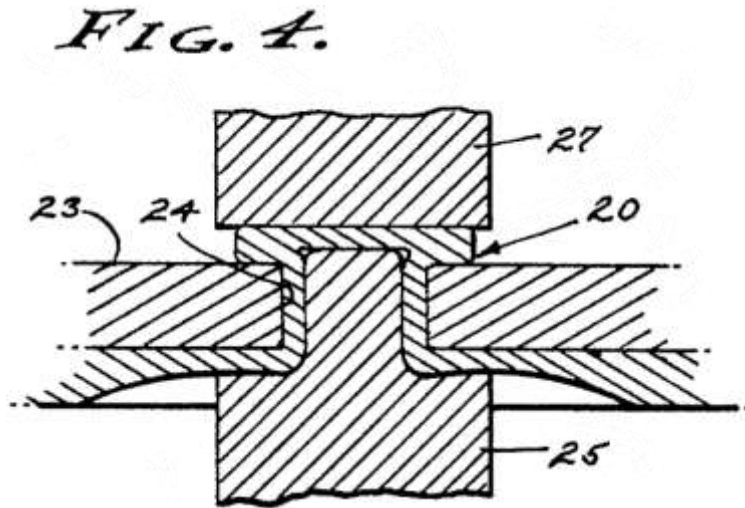


Figure 4 of Harvey depicts a “cross section of the apparatus used to flatten the head of [a] projection,” with “the resultant rivet being used to fasten another member to the sheet.” *Id.* at 3:9–12. Sheet 23 with aperture 24 is riveted to a sheet. *Id.* at 4:5–7. This is “accomplished by the insertion of tool 25 into hollow projection 20 whereupon a hammer or tool 27 compresses and flattens the head of the projection to form a rivet.” *Id.* at 4:8–11. The sheet in which the projection is formed may be made of “thermoplastic synthetic resin,” in which case, “it is preferable to preheat the sheet to the softening point of the resin before shaping.” *Id.* at 2:67–3:3.

2. *Analysis*

Petitioner argues that the combined teachings of Van Schaftingen, Ishimaru, and Harvey teach or suggest every limitation of claims 1, 7, 9, and 15. Pet. 42–44. As discussed above, we find that the combination of Van Schaftingen and Ishimaru teaches or suggests all the limitations of

claims 1, 7, 9, and 15. Accordingly, the combination of Van Schaftingen, Ishimaru, and Harvey teaches or suggests all the limitations of these claims.

Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the teachings of Harvey with those of Van Schaftingen and Ishimaru because doing so would result in a “flattened rivet head that more securely attaches the accessory to the tank.” Pet. 44–45 (citing Ex. 1007 ¶¶ 163–170). Harvey does teach a way of achieving such a rivet shape, and there is evidence to support Petitioner’s argument that the flattened rivet head would result in a more secure accessory-to-wall attachment. Ex. 1006, Fig. 4; Ex. 1007 ¶ 170. Patent Owner disagrees and argues for several reasons that a person of ordinary skill in the art would not have combined the teachings of Harvey with those of Van Schaftingen and Ishimaru. PO Resp. 27–29 (Ex. 2001 ¶¶ 81, 83–84).

Patent Owner’s first argument is that “Harvey does nothing to enhance Petitioners’ alleged obviousness case and offers nothing more than Ishimaru.” PO Resp. 27. But the evidence of record supports a finding that Harvey’s flattened rivet head—a feature not present in Ishimaru’s fastening method—would have been understood to attach accessories more securely to the tank wall. Ex. 1007 ¶ 170.

Patent Owner next argues that “Harvey requires tooling on both the mold and the core” and that “Petitioners gloss over this critical part of the proposed combination.” PO Resp. 27. Petitioner does not argue for the incorporation of Harvey’s entire method into the combination of Van Schaftingen and Ishimaru. Instead, Petitioner argues only that Harvey teaches or suggests “using a counterform to shape the protruding molten plastic into a rivet.” Pet. 42. Thus, Petitioner need not explain why it would

have been obvious to incorporate Harvey's mold-side tool 25 in addition to Harvey's counterform 27.

With respect to the incorporation of Harvey's counterform 27, Patent Owner argues that "there is no structure in Van Schaftingen that could incorporate" this tool. PO Resp. 27–28. But Van Schaftingen teaches positioning a "structure . . . supporting the accessories to be incorporated into the tank" inside the parison before the parison is molded into a fuel tank. Ex. 1004 ¶ 46. In addition, the positioning of this structure makes use of a robot, and the entire molding operation makes use of a mold that closes around the outside of the parison. *Id.* Thus, there are at least two places—on Van Schaftingen's "structure" and on Van Schaftingen's "robot"—that Harvey's counterform 27 might be placed inside Van Schaftingen's parison. *See* Ex. 1009 ¶ 28.

Patent Owner also argues that "Harvey merely provides a means of making integrally formed projections in metal sheet material," so it cannot be applied to the combination of Van Schaftingen and Ishimaru, in which any projections are formed in plastic material. PO Resp. 28. Harvey explains otherwise. Although Harvey does state that its process "is particularly suitable in deforming sheet stock of . . . metals," Ex. 1006, 2:64–67, it also expressly teaches using its process "in deforming sheets of thermoplastic synthetic resin," *id.* at 2:64–3:3. As discussed above, both Van Schaftingen and Ishimaru teach the use of thermoplastic resin.

Finally, Patent Owner argues that "Harvey is nearly 30 years older than Van Schaftingen," and, "[i]f it were truly an obvious variant of Van Schaftingen's welding method to stake-fasten an accessory within a fuel tank in view of Harvey's disclosure, it stands to reason that this would have

been a part of Van Schaftingen.” PO Resp. 29 (citing Ex. 2001 ¶ 84). In other words, Patent Owner argues that, if it had been obvious to do what Petitioner contends was obvious, someone likely would have done so soon after Harvey was published, and the fact that no one actually did so is evidence of the non-obviousness of the challenged claims. *Id.* We are not persuaded. “The mere age of the references is not persuasive of the unobviousness of the combination of their teachings, absent evidence that, notwithstanding knowledge of the references, the art tried and failed to solve the problem.” *In re Wright*, 569 F.2d 1124, 1127 (CCPA 1977) (relying on a combination of references including a 100-year-old patent). Patent Owner does not direct us to any such evidence; the cited paragraph of Professor Osswald’s declaration merely states that Patent Owner itself “took . . . approximately five years from Van Schaftingen’s disclosure to arrive at its stake-fastening method.” Ex. 2001 ¶ 84. The passage of time alone fails to demonstrate that Patent Owner or the industry as a whole repeatedly tried but failed to solve the problems addressed by the claimed technology. Moreover, Patent Owner’s argument is inconsistent with the teachings of Ishimaru, which contribute as much to Petitioner’s obviousness argument as those of Van Schaftingen and Harvey. Pet. 42–44 (relying on the combination of Van Schaftingen, Ishimaru, and Harvey).

Having considered the arguments of both parties and the evidence of record, we find that a person of ordinary skill in the art would have had a reason to combine the teachings of Harvey with those of Van Schaftingen and Ishimaru. Because, as discussed above, the combination of the three references teaches or suggests the subject matter of the challenged claims, we conclude that Petitioner has shown by a preponderance of the evidence

that claims 1, 7, 9, and 15 would have been obvious over the combination of Van Schaftingen, Ishimaru, and Harvey.

D. Asserted Obviousness over Van Schaftingen and Staargaard

Petitioner argues that the subject matter of claims 1, 7, 9, and 15 would have been obvious to a person of ordinary skill in the art given the teachings of Van Schaftingen and Staargaard. Pet. 46–68.

1. Staargaard

Staargaard relates to “a method of attaching plastic to a metal substrate and a part made by the method.” Ex. 1005, at [57]. The method “can be used in any application where a plastic component is secured with a metal component.” *Id.* ¶ 33. Figure 2 of Staargaard is reproduced below:

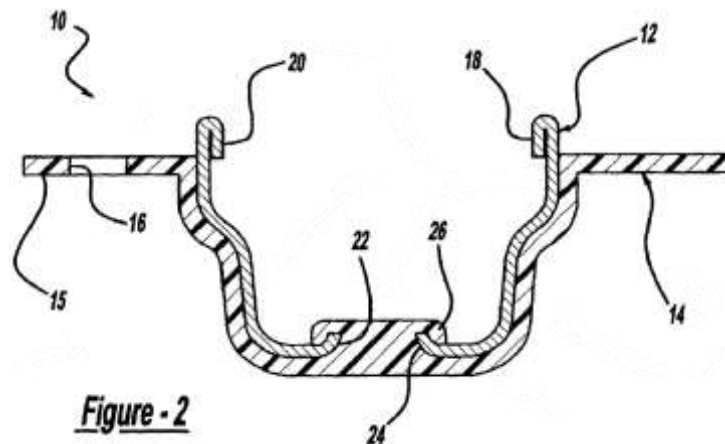


Figure 2 of Staargaard depicts “a cross sectional view” of “a part made in accordance with” Staargaard’s invention. *Id.* ¶¶ 13–14. In Figure 2, “plastic component 14 is disposed through the lower opening 22 in the metal component 12.” *Id.* ¶ 26. The plastic component “further includes a flange 26,” which “extends beyond the edges 24 of the lower opening 22.” *Id.* This “secure[s] or lock[s]” the plastic component “to the metal component.” *Id.* Staargaard teaches molding the plastic component through the metal component using a tool and die. *Id.* ¶ 9. The tool “provides a

mold cavity on one side of the opening 22 in the metal component 12 to permit molding of the flange 26.” *Id.* ¶ 31. Staargaard teaches that the molding of the plastic material through the opening may be accomplished either by injection molding or by blow molding. *Id.* ¶¶ 30, 32.

2. *Analysis*

Petitioner argues that a person of ordinary skill in the art would have had reason to combine the teachings of Van Schaftingen with the teachings of Staargaard and that those combined teachings teach or suggest every limitation of claims 1, 7, 9, and 15. Pet. 46–68. Patent Owner argues that the combination of Van Schaftingen and Staargaard fails to teach several limitations of the challenged claims and that a person of ordinary skill in the art would not have combined the references. PO Resp. 30–37.

a. Claim 1

As Petitioner notes, Pet. 47–63, claim 1 recites a preamble and six limitations: “[a] method for stake-fastening an accessory into a plastic fuel tank, wherein the accessory is equipped with at least one orifice which passes right through the accessory,” “melting at least some of the plastic of which the wall of the tank is made to form molten plastic,” “forcing some of the molten plastic through the orifice of the accessory without becoming detached from the remainder of the molten plastic, thereby forming protruding molten plastic,” “shaping the protruding molten plastic to provide a self-formed plastic rivet, and allowing the molten plastic to solidify,” “whereby the size and shape of the orifice and/or of the solidified plastic are such that the accessory is mechanically fastened to the tank by at least some of the solidified plastic,” “wherein stake-fastening the accessory into the tank occurs at the time of manufacture of the tank when [molding] a split or

at least two-part parison,” and “wherein the accessory comprises a material selected from the group consisting of metal, polyacetal, polyoxymethylene, polyamide, glass-[fiber]-reinforced polyamide, and polybutylene terephthalate.” Ex. 1001, 5:44–6:5.

(1) Preamble and Reason to Combine

Petitioner argues that the combination of Van Schaftingen and Staargaard teaches or suggests the preamble of claim 1 and that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Staargaard. Pet. 47–53. Patent Owner argues that a person of ordinary skill in the art would not have had a reason to combine the teachings of Van Schaftingen with those of Staargaard. PO Resp. 19–22.

Van Schaftingen teaches a “[p]rocess for manufacturing hollow plastic bodies, especially motor-vehicle fuel tanks,” including installing accessories into the tanks by attaching them to the walls of the tanks. Ex. 1004, at [57], ¶¶ 31, 34. The accessories of Van Schaftingen are defined identically to our construction of “accessory,” and examples include “ventilation devices.” *Id.* ¶ 32.

Although Van Schaftingen does not teach or suggest attaching its accessories to the walls of the tanks by stake-fastening, Petitioner argues that Staargaard teaches or suggests stake-fastening metal accessories to plastic components. Pet. 47–49 (citing Ex. 1005 ¶¶ 9, 24–27, 33; Ex. 1007 ¶¶ 109–112). Patent Owner does not dispute this evidence or argument. PO Resp. 30–36. We agree with Petitioner. As discussed above, the stake-fastening process requires a protrusion of solidified plastic that cooperates with the accessory orifice in a way that causes the accessory to become

mechanically fastened to the wall of the fuel tank. Ex. 1001, 7:32–35. Staargaard’s process results in a protrusion of plastic penetrating and flowing over the edge of an orifice in a metal part before hardening to hold the plastic and the metal part together. Ex. 1005 ¶¶ 9, 24–27, 33, Fig. 2. Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests the preamble of claim 1.

In addition, Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Staargaard. Pet. 49–53. There is evidence to support a reason to combine these references. Van Schaftingen teaches attaching accessories to the tank wall but does not describe any means for doing so other than welding. Ex. 1004 ¶ 34. Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that welding is “only suitable when the two materials being welded have similar processing temperatures and are chemically compatible such that they flow and adhere to form a strong weld interface.” Ex. 1007 ¶ 116. According to Dr. Kazmer, “the weld interface will tend to be strongest when the accessory and fuel tank to be fastened are made of the same or similar materials.” *Id.* ¶ 117. Thus, a mechanical attachment process, such as that taught by Staargaard, would have provided a person of ordinary skill in the art with a means of attaching accessories made of a broader range of materials than would Van Schaftingen’s welding process. This would be useful in carrying out the fuel tank manufacturing process of Van Schaftingen because Van Schaftingen teaches using a wide variety of materials in constructing its fuel tank. Ex. 1004 ¶¶ 13–15.

Patent Owner argues that, despite this evidence, a person of ordinary skill in the art would not have combined the teachings of Van Schaftingen

with those of Staargaard to arrive at the invention of the '327 patent. PO Resp. 30–36. First, Patent Owner argues that Staargaard is not analogous art to the '327 patent, because Staargaard does not relate either to fuel tanks or hollow containers. *Id.* at 31 (citing Ex. 2005, 65:11–70:8). We are not persuaded by this argument. Contrary to Patent Owner's argument, *id.* at 30–31, Staargaard is not limited to “the context of car front end modules.” Instead, Staargaard teaches using its process “in any application where a plastic component is secured with a metal component.” Ex. 1005 ¶ 33; *see* Ex. 1005 ¶¶ 9 (describing the invention as “a method of attaching a plastic component to a metal component”), 11 (clarifying that the “specific examples . . . are intended for purposes of illustration only and are not intended to limit the scope of the invention”). Moreover, even if Patent Owner is correct that the field of endeavor of the '327 patent is limited to either fuel tanks or hollow bodies, analogous art includes references that are “reasonably pertinent to the problem with which the inventor was concerned.” *In re Kahn*, 441 F.3d 977, 986–87 (Fed. Cir. 2006) (citing *In re Oetiker*, 977 F.2d 1443, 1447 (Fed. Cir. 1992)). The object of the '327 patent is “to provide a method that allows an accessory based on a material different from that of the tank to be fastened inside a plastic fuel tank.” Ex. 1001, 1:58–60. As a reference pertaining to “a method of attaching a plastic component to a metal component,” Staargaard is concerned with very nearly the same problem as the '327 patent, and it certainly is pertinent to the problem solved by the '327 patent. Ex. 1005 ¶ 9. Thus, we find that Staargaard is analogous art to the '327 patent.

Patent Owner argues next that a person of ordinary skill in the art could not “implement Staargaard with Van Schaftingen without completely

reinventing and redesigning Van Schaftingen.” PO Resp. 32 (citing Ex. 2001 ¶¶ 91–94). But, as discussed above with respect to the combination of Van Schaftingen, Ishimaru, and Harvey, Van Schaftingen teaches positioning a “structure . . . supporting the accessories to be incorporated into the tank” inside the parison before the parison is molded into a fuel tank. Ex. 1004 ¶ 46. In addition, the positioning of this structure makes use of a robot, and the entire molding operation makes use of a mold that closes around the outside of the parison. *Id.* Thus, to the extent that implementing the combination of the teachings of Van Schaftingen and Staargaard required the addition of tools to Van Schaftingen’s process, there are multiple places, both inside and outside Van Schaftingen’s parison, to position those tools. Accordingly, we determine that integrating Staargaard’s metal-plastic attachment process into Van Schaftingen’s fuel tank manufacturing process was within the ability of a person of ordinary skill in the art.

Next, Patent Owner argues that, because Staargaard refers to the metal component it attaches to a plastic component as a “die,” and because the “die” in Van Schaftingen is part of the mold outside the parison, the combination of the two references could never result in an accessory being attached inside the fuel tank of Van Schaftingen. PO Resp. 32–33 (citing Ex. 1005 ¶ 9; Ex. 2001 ¶¶ 92–94). This mischaracterizes Petitioner’s obviousness argument. That argument relies on the fact that Van Schaftingen teaches attaching accessories to the inside of the tank by welding and the fact that a person of ordinary skill in the art would be motivated to find a mechanical attachment method that could be used to attach Van Schaftingen’s accessories, in the same locations that Van

Schaftingen teaches attaching them, even when those accessories were made of different materials from the tank itself. Pet. 49–53. As discussed above, Staargaard’s “method of attaching a plastic component to a metal component,” Ex. 1005 ¶ 9, would commend itself to the attention of a person of ordinary skill in the art attempting to solve this problem. The fact that Staargaard and Van Schaftingen refer to two different structures by the same name might lead an automaton astray, but understanding that one component could be attached to another in Van Schaftingen in the same way that the metal component was attached to the plastic component in Staargaard was well within the ability of a person of ordinary skill in the art. *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 421 (2007) (“A person of ordinary skill in the art is also a person of ordinary creativity, not an automaton.”); Ex. 1007 ¶ 25 (defining a person of ordinary skill in the art as “a degreed Mechanical or Plastics engineer with three years of experience directly related to plastics product design and molding”); Ex. 2001 ¶ 25 (defining a person of ordinary skill in the art as holding a bachelor’s degree in mechanical engineering or chemical engineering and having “at least two years of experience in manufacturing plastic fuel tanks”). Thus, we are not persuaded that Staargaard’s reference to its metal component as a die would prevent a person of ordinary skill in the art from incorporating the teachings of Staargaard into those of Van Schaftingen.

Patent Owner also argues that, because Van Schaftingen relates to blow molding and Staargaard relates to injection molding, the references cannot be combined. PO Resp. 33–34 (citing Ex. 2001 ¶ 94). This is inconsistent with Staargaard’s statement that its metal-plastic part can be made not only with injection molding but also with “any other suitable

forming technique,” including “blow molding.” Ex. 1005 ¶ 32. Patent Owner argues that blow molding is not a suitable forming technique for carrying out Staargaard’s metal-plastic attachment process. PO Resp. 34 (citing Ex. 2001 ¶¶ 95–96). But this is contrary to the express language of Staargaard. Accordingly, we are not persuaded that a person of ordinary skill in the art would have been unable to incorporate Staargaard’s attachment process into Van Schaftingen’s blow molding process.

Finally, Patent Owner argues that Staargaard does not disclose a stake-fastening method in detail. *Id.* (citing Ex. 2001 ¶¶ 96–97). But Staargaard teaches positioning a tool on one side of an opening in a metal component, then molding a plastic component “through the opening such that the plastic component forms a flange on one side of the opening for securing the plastic component with the metal component.” Ex. 1005 ¶ 9. As discussed above, we agree with Patent Owner that a stake-fastening process is one in which a protrusion of solidified plastic cooperates with the accessory orifice in a way that causes the accessory to become mechanically fastened to the wall of the fuel tank. Ex. 1001, 7:32–35. Every aspect of this definition is taught by Staargaard, except for the attachment being to the wall of a fuel tank, and that is taught by Van Schaftingen. Ex. 1004, at [57], ¶¶ 31–34; Ex. 1005 ¶ 9. Accordingly, we find that a person of ordinary skill in the art would have had a reason to combine the teachings of Staargaard with those of Van Schaftingen and that the combination of those references teaches or suggests the preamble of claim 1.

(2) *“Melting at least some of the plastic of which the wall of the tank is made to form molten plastic”*

Petitioner argues that Staargaard teaches or suggests melting a portion of the fuel tank wall to form molten plastic. Pet. 53–54 (citing Ex. 1005 ¶¶ 30, 32; Ex. 1007 ¶¶ 120–121). We agree, and Patent Owner does not dispute Petitioner’s evidence or argument on this point. PO Resp. 30–36. Staargaard teaches carrying out its attachment process using blow molding. Ex. 1005 ¶ 32. Blow molding requires molten plastic. Ex. 1007 ¶ 121; Ex. 1010, 80:17–19 (“molten plastic is basically understood by somebody in the art” as plastic that “can be shaped” or “formed”), 82:19–20 (“molten plastic . . . [c]ertainly . . . is not defined by a temperature”), 83:18–20 (“as long as the material can be formed and flow, . . . we have a molten plastic”). Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests this limitation of claim 1.

(3) *“Forcing some of the molten plastic through the orifice of the accessory without becoming detached from the remainder of the molten plastic, thereby forming protruding molten plastic”*

Petitioner argues that Staargaard teaches or suggests forcing some molten plastic through the accessory orifice without becoming detached from the remainder of the molten plastic. Pet. 54–57 (citing Ex. 1005 ¶¶ 26, 30, Fig. 2; Ex. 1007 ¶¶ 123–128). We agree, and Patent Owner does not dispute Petitioner’s evidence or argument on this point. PO Resp. 30–37. Staargaard teaches causing “plastic component 14” to penetrate through “lower opening 22 in the metal component 12.” Ex. 1005 ¶ 26, Fig. 2.

Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests this limitation of claim 1.

(4) *“Shaping the protruding molten plastic to provide a self-formed plastic rivet, and allowing the molten plastic to solidify”*

Petitioner argues that Staargaard teaches or suggests shaping the protruding molten plastic to provide a self-formed plastic rivet, then allowing the molten plastic to solidify. Pet. 57–59 (citing Ex. 1005 ¶¶ 31–32; Ex. 1007 ¶¶ 129–131). Patent Owner disagrees and argues that neither Van Schaftingen nor Staargaard teaches shaping a self-formed plastic rivet inside a blow-molded fuel tank. PO Resp. 35–36 (citing Ex. 2001 ¶ 97).

As discussed above, Van Schaftingen teaches attaching accessories to the inside wall of a fuel tank, and Staargaard teaches using a particular method to attach any metal component to a plastic component. The disagreement between the parties is thus over whether Staargaard’s method “shap[es] the protruding molten plastic to provide a self-formed plastic rivet” before “allowing the molten plastic to solidify.” As also discussed above, we construe the phrase “shaping the protruding molten plastic to provide a self-formed plastic rivet” as “manipulating or allowing the protruding molten plastic to form a protrusion of plastic in-situ from molten plastic from the wall of the tank.” Accordingly, the “self-formed plastic rivet” need not have any particular shape beyond protruding from the wall of the tank through the orifice in the accessory. In Figure 2 of Staargaard, plastic component 14 that wraps around and below metal component 12 is the equivalent of Van Schaftingen’s tank wall, metal component 12 is the equivalent of Van Schaftingen’s accessory, and a portion of the plastic

component protrudes up, away from the rest of the plastic and through lower opening 22 in the metal component. Ex. 1005 ¶ 24, Fig. 2. Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that all of the plastic molding processes disclosed by Staargaard included cooling the plastic to “allow[] the molten plastic to solidify.” Ex. 1007 ¶ 130.

Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests this limitation of claim 1.

(5) *“Whereby the size and shape of the orifice and/or of the solidified plastic are such that the accessory is mechanically fastened to the tank by at least some of the solidified plastic”*

Petitioner argues that Staargaard teaches an orifice and solidified plastic that are of a size and shape such that they cooperate to fasten Staargaard’s metal component to Staargaard’s plastic component mechanically. Pet. 59–60 (citing Ex. 1005 ¶¶ 9, 26; Ex. 1007 ¶¶ 132–135). We agree, and Patent Owner does not dispute Petitioner’s evidence or argument on this point. PO Resp. 30–37. Staargaard discloses ensuring that “the plastic component 14 is secured or locked to the metal component 12” by “sandwich[ing]” the edges of the metal component “between the flange 26” formed from the protruding plastic “and the outer portion of the plastic component disposed about the metal component 12.” Ex. 1005 ¶ 26. In Staargaard’s connection method, “[i]n other words, the flange 26 extends outwardly of the edge . . . on one side of the opening 22 . . . and the plastic material of component 14 extends beyond the edge . . . on the opposite side of the opening 22 in the metal component 12.” *Id.* Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests this limitation of claim 1.

(6) *“Wherein stake-fastening the accessory into the tank occurs at the time of manufacture of the tank when [molding] a split or at least two-part parison”*

Petitioner argues that Van Schaftingen teaches or suggests attaching an accessory to the wall of a fuel tank at the time the tank is manufactured from a parison that is split into two parts. Pet. 31–32, 61–62 (citing Ex. 1004 ¶¶ 5, 25; Ex. 1007 ¶¶ 71–73, 136–140). Patent Owner does not dispute this evidence or argument. PO Resp. 30–37.

The evidence supports Petitioner’s argument. Van Schaftingen teaches that a “particularly preferred technique” for carrying out its method of manufacturing a fuel tank “is that in which the parison is cut twice over its entire length, that is to say along two separate lines, so as to produce two separate sheets.” Ex. 1004 ¶ 25. Van Schaftingen also teaches placing an accessory between the separate sheets, then anchoring the accessory “to the internal wall of the [fuel tank].” *Id.* ¶¶ 31–34. Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests this limitation of claim 1.

(7) *“Wherein the accessory comprises a material selected from the group consisting of metal, polyacetal, polyoxymethylene, polyamide, glass-[fiber]-reinforced polyamide, and polybutylene terephthalate”*

Petitioner argues that Staargaard teaches attaching a metal part to its plastic part. Pet. 62–63 (citing Ex. 1005 ¶ 19). Petitioner also argues that a person of ordinary skill in the art would have understood that Staargaard’s stake-fastening method could be used in Van Schaftingen’s fuel tank manufacturing process to attach an accessory made of any material, without regard for the similarity of that material and the plastic material of the tank

wall. *Id.* (citing Ex. 1007 ¶¶ 141–143). Patent Owner does not dispute this evidence or argument. PO Resp. 30–37.

The evidence supports Petitioner’s argument. Staargaard teaches attaching a metal component to a plastic component. Ex. 1005 ¶¶ 19, 33. And Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that the stake-fastening method of Staargaard would “allow[] the attachment of accessories made of any suitable material for the accessory because the accessories need not be made of a similar material to the tank.” Ex. 1007 ¶ 141. Accordingly, we find that the combination of Van Schaftingen and Staargaard teaches or suggests this limitation of claim 1.

Because, as discussed above, the combination of Van Schaftingen and Staargaard teaches or suggests the subject matter of claim 1, and because a person of ordinary skill in the art would have had a reason to combine the teachings of Van Schaftingen with those of Staargaard, we conclude that Petitioner has shown by a preponderance of the evidence that claim 1 would have been obvious over the combination of Van Schaftingen and Staargaard.

b. Claim 7

Claim 7 depends from claim 1 and adds a limitation requiring that the accessory that is stake-fastened into the plastic fuel tank “is a ventilation device.” Ex. 1001, 8:3–4. Petitioner argues that Van Schaftingen teaches incorporating ventilation devices into a fuel tank. Pet. 34, 63 (citing Ex. 1004 ¶ 32; Ex. 1007 ¶¶ 79–82). We agree, and Patent Owner does not dispute Petitioner’s argument or evidence regarding claim 7. PO Resp. 30–37. Van Schaftingen teaches that the accessories it incorporates into its fuel tank can include “ventilation devices.” Ex. 1004 ¶ 32. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that

claim 7 would have been obvious over the combination of Van Schaftingen and Staargaard.

c. Claim 9

Claim 9 is quite similar to claim 1. *Compare* Ex. 1001, 7:19–43, with Ex. 1001, 8:8–34. These claims differ only in that claim 9 recites two additional limitations. First, claim 9 requires that the plastic fuel tank be made of multiple layers, “comprising a thermoplastic layer and either a fuel-impermeable layer or fuel-impermeable surface treatment.” Ex. 1001, 8:8–11. Second, claim 9 requires that the step of “forcing some of the molten plastic through the orifice of the accessory” be completed “without rupturing the fuel-impermeable layer or fuel-impermeable surface treatment of the multilayer plastic fuel tank wall.” *Id.* at 8:15–20.

Petitioner argues that Van Schaftingen teaches a multilayer plastic fuel tank “comprising a thermoplastic layer and either a fuel-impermeable layer or fuel-impermeable surface treatment.” Pet. 35–37, 63–64 (citing Ex. 1004 ¶¶ 14, 45; Ex. 1007 ¶¶ 85–86, 146–149). We agree, and Patent Owner does not dispute this evidence or argument. PO Resp. 36–37. Van Schaftingen teaches a fuel tank made of a laminated, multilayer material comprising two polyethylene layers with an ethylene-vinyl alcohol copolymer layer between them. Ex. 1004 ¶ 45. Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that the polyethylene layers are made of thermoplastic material and that ethylene-vinyl alcohol copolymer layer is fuel-impermeable. Ex. 1007 ¶ 85.

With respect to the limitation requiring forcing molten plastic through the accessory orifice “without rupturing the fuel-impermeable layer or fuel-impermeable surface treatment of the multilayer plastic fuel tank wall,”

Petitioner argues that a person of ordinary skill in the art would have understood that, when Van Schaftingen’s multilayer tank wall material was used in Staargaard’s attachment process, the multilayer structure would be carried through the orifice intact because “the molten plastic flow . . . is naturally laminar given that the molten plastics are highly viscous and so their inertial forces are low compared to their viscous forces.” Pet. 65–67 (citing Ex. 1007 ¶¶ 151–156). There is sufficient evidence to support this argument. Dr. Kazmer testifies that a person of ordinary skill in the art would have understood that the fuel-impermeable layer of Van Schaftingen must not be ruptured during the tank manufacturing process because this would not “maintain the integrity and utility of the fuel tank.” Ex. 1007 ¶ 154. Dr. Kazmer also testifies that, because of the viscous flow of the plastic layers, Van Schaftingen’s multilayer structure would be preserved in the forcing of a portion of the tank wall through the orifice in the accessory. *Id.* ¶¶ 153–155.

Patent Owner argues that, because Staargaard has “no need or purpose to includ[e] a barrier layer,” a person of ordinary skill in the art would not understand Staargaard as teaching or suggesting the preservation of a multilayer structure. PO Resp. 36–37 (citing Ex. 2001 ¶¶ 99–101). As discussed above, however, Petitioner does not rely on any disclosure of Staargaard to teach or suggest this limitation. Instead, Petitioner argues that a person of ordinary skill in the art would have understood that the use of Van Schaftingen’s multilayer material as the plastic material in Staargaard’s attachment method would result in the multilayer structure being preserved. As noted above, this argument is supported by the evidence of record.

The remaining limitations of claim 9 are identical to claim 1, and Van Schaftingen and Staargaard teach or suggest those limitations for the reasons explained above with respect to claim 1. Accordingly, we conclude that Petitioner has shown by a preponderance of the evidence that claim 9 would have been obvious over the combination of Van Schaftingen and Staargaard.

d. Claim 15

Claim 15 differs from claim 7 only in that it depends from claim 9 instead of claim 1. *Compare* Ex. 1001, 8:3–4, *with* Ex. 1001, 8:51–52. For the reasons discussed above with respect to claims 1, 7, and 9, we conclude that Petitioner has shown by a preponderance of the evidence that claim 9 would have been obvious over the combination of Van Schaftingen and Staargaard.

CONCLUSION

Upon consideration of the Petition, Response, Reply, Sur-Reply, and the evidence before us, we determine that Petitioner has proven by a preponderance of the evidence that claims 1, 7, 9, and 15 would have been obvious over each of the combinations of (1) Van Schaftingen and Ishimaru; (2) Van Schaftingen, Ishimaru, and Harvey; and (3) Van Schaftingen and Staargaard.

ORDER

It is hereby

ORDERED that Petitioner has proven by a preponderance of the evidence that claims 1, 7, 9, and 15 of U.S. Patent No. 9,399,327 B2 are unpatentable;

FURTHER ORDERED that, pursuant to 35 U.S.C. § 318(b), upon expiration of the time for appeal of this decision, or the termination of any such appeal, a certificate shall issue canceling claims 1, 7, 9, and 15 of U.S. Patent No. 9,399,327 B2; 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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