

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TENNANT COMPANY,
Petitioner,

v.

OXYGENATOR WATER TECHNOLOGIES, INC.,
Patent Owner.

IPR2021-00625
Patent RE45,415 E

Before KRISTINA M. KALAN, CHRISTOPHER M. KAISER, and
WESLEY B. DERRICK, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

Granting Patent Owner's Motion to Seal (Paper 37)
37 C.F.R. §§ 42.55

I. INTRODUCTION

Tennant Company (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 13, 14, and 17–27 of U.S. Patent No. RE45,415 E (Ex. 1101, “the ’415 patent”). Oxygenator Water Technologies, Inc. (“Patent Owner”) filed a Preliminary Response to the Petition (Paper 8).

We instituted an *inter partes* review of claims 13, 14, and 17–27 of the ’415 patent on the grounds of unpatentability alleged in the Petition. Paper 9 (“Dec.”). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 34 (private version), Paper 35 (public version) (“PO Resp.”). Petitioner filed a Reply. Paper 42 (“Reply”). Patent Owner filed a Sur-Reply. Paper 45 (“Sur-Reply”). Patent Owner filed a Motion to Seal. Paper 37. We held an oral hearing on May 20, 2022, and a transcript of the hearing is included in the record. Paper 52 (“Tr.”).

This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has not shown by a preponderance of the evidence that claims 13, 14, and 17–27 of the ’415 patent are unpatentable.

A. *Related Proceedings*

The parties identify *Oxygenator Water Technologies, Inc. v. Tennant Company*, No. 0:20-cv-00358-ECT-HB (D. Minn.) as a related matter. Pet. 86–87; Paper 5, 1.

B. *The ’415 Patent*

The ’415 patent is a reissue of U.S. Patent No. 7,670,495 and is titled “Flow-Through Oxygenator.” Ex. 1101, codes (54), (64). The ’415 patent “relates to the electrolytic generation of microbubbles of oxygen for

increasing the oxygen content of flowing water,” and “also relates to the use of superoxygenated water to enhance the growth and yield of plants;” its flow-through model “is useful for oxygenating water for hydroponic plant culture, drip irrigation and waste water treatment.” *Id.* at 1:24–30.

The ’415 patent explains that the “production of oxygen and hydrogen by the electrolysis of water is well known,” in which hydrogen gas and basic water are produced at the cathode during electrolysis, and oxygen gas and acidic water are produced at the anode. *Id.* at 2:5–6, 2:9–11, 2:21–23.

The ’415 patent explains that pumps to supply oxygen have high power requirements and produce acidic and basic water, which can be detrimental to live animals. *Id.* at 2:47–50. In view of this, the ’415 patent expresses a need for “quiet, portable, low voltage means to oxygenate water” and for oxygenator models suitable to be placed in-line in water distribution devices and for hydroponic culture. *Id.* at 2:52–54, 2:60–62.

The ’415 patent describes “an oxygen emitter which is an electrolytic cell which generates very small microbubbles and nanobubbles of oxygen in an aqueous medium, which bubbles are too small to break the surface tension of the medium, resulting in a medium supersaturated with oxygen.” *Id.* at 2:66–3:3. Figure 1B of the ’415 patent is reproduced below.

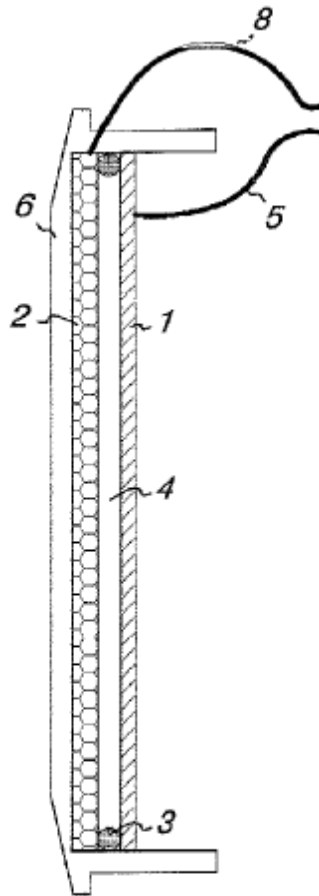


Fig. 1B

Figure 1B depicts oxygen emitter 6 that includes anode 1, cathode 2, and non-conducting spacer 3 having gap 4 for the passage of gas and the mixing of anodic and cathodic water. *Id.* at 3:46, 4:60–67, 5:2.

The '415 patent states that “to form microbubbles and nanobubbles, the anode and cathode are separated by a critical distance.” *Id.* at 3:13–14. The '415 patent defines “critical distance” as “the distance separating the anode and cathode at which evolved oxygen forms microbubbles and nanobubbles.” *Id.* at 4:1–3. The '415 patent describes the critical distance

as ranging “from 0.005 inches to 0.140 inches” and that the “preferred critical distance is from 0.045 to 0.060 inches.” *Id.* at 3:14–16. With regard to Figure 1B’s embodiment, the ’415 patent states:

The spacer thickness is critical as it sets the critical distance. It must be of sufficient thickness to prevent arcing of the current, but thin enough to separate the electrodes by no more than 0.140 inches. Above that thickness, the power needs are higher and the oxygen bubbles formed at higher voltage will coalesce and escape the fluid. Preferably, the spacer is from 0.005 to 0.075 inches thick. At the lower limits, the emitter tends to foul more quickly. Most preferably, the spacer is about 0.050 inches thick.

Id. at 5:4–13.

C. Illustrative Claim

Claim 13 is the sole independent claim of the challenged claims.

Claim 13 is representative and is reproduced below:

13. A method for producing an oxygenated aqueous composition comprising:
flowing water at a flow rate no greater than 12 gallons per minute through an electrolysis emitter comprising an electrical power source electrically connected to an anode electrode and a cathode electrode contained in a tubular housing,
causing electricity to flow from the power source to the electrodes, and,
producing the composition comprising a suspension comprising oxygen microbubbles and nanobubbles in the water, the microbubbles and nanobubbles having a bubble diameter of less than 50 microns, wherein:
the anode electrode is separated at a critical distance from the cathode such that the critical distance is from 0.005 inches to 0.140 inches;
the power source produces a voltage no greater than about 28.3 volts and an amperage no greater than about 13 amps,

the tubular housing has an inlet and an outlet and a tubular flow axis from the inlet to the outlet;
the water flows in the inlet, out the outlet, is in fluid connection with the electrodes, and the water flowing into the inlet has a conductivity produced by the presence of dissolved solids such that the water supports plant or animal life.

Ex. 1101, 11:20–45.

D. Instituted Grounds of Unpatentability

We instituted *inter partes* review of claims 13, 14, and 17–27 of the '415 patent on the following grounds:

Ground	Reference(s)/Basis	35 U.S.C. § ¹	Claim(s) Challenged
1	Wikey ²	§ 102	13, 18–23, 25
2	Wikey, AFD ³	§ 103	13, 18–23, 25
3	Wikey, AFD, the general knowledge, experience, and common sense of a POSITA,	§ 103	13, 18–23, 25

¹ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), included revisions to 35 U.S.C. §§ 102 and 103 that became effective on March 16, 2013. Because the '415 patent issued from an application filed before March 16, 2013, we apply the pre-AIA version of §§ 102 and 103.

² US 3,891,535, issued June 24, 1975 (Ex. 1112).

³ M. Hargrove & M. Hargrove, *Aquariums for Dummies*, IDG Books Worldwide, Inc. (1999) (Ex. 1114).

Ground	Reference(s)/Basis	35 U.S.C. § ¹	Claim(s) Challenged
	as reflected in Wendt, ⁴ Han, ⁵ Glembotsky, ⁶ and Burns ⁷		
4	Wikey, Clark ⁸	§ 103	26, 27
5	Wikey, Clark, AFD	§ 103	26, 27
6	Wikey, Clark, AFD, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns	§ 103	26, 27
7	Davies ⁹	§ 102	13, 14, 17–23, 25
8	Davies, Hough ¹⁰	§ 103	13, 14, 17–23, 25
9	Davies, Erickson ¹¹	§ 103	13, 14, 17–23, 25

⁴ H. Wendt & G. Kreysa, *Electrochemical Engineering: Science and Technology in Chemical and Other Industries*, Springer-Verlag Berlin Heidelberg, 81–127 (1999) (Ex. 1117).

⁵ M. Han et al., *Development of a New Method of Measuring Bubble Size*, Water Sci. and Tech.: Water Supply Vol. 2 No. 2, 77–83 (2002) (Ex. 1137).

⁶ V. Glembotsky et al., *Size of gas bubbles forming during electroflotation*, 5 Elektronnaia Obrabotka Materialov 66–68 (1973) (Ex. 1123). Petitioner provides a certified English translation of Glembotsky (Ex. 1124).

⁷ S. Burns et al., *Application of Digital Image Analysis for Size Distribution Measurement of Microbubbles*, Imaging Technologies: Techniques and Civil Engineering Applications Engineering Foundation (1997) (Ex. 1131).

⁸ US 4,039,439, issued Aug. 2, 1977 (Ex. 1106).

⁹ US 4,917,782, issued Apr. 17, 1990 (Ex. 1105).

¹⁰ US 6,171,469 B1, issued Jan. 9, 2001 (Ex. 1141).

¹¹ US 5,324,398, issued June 28, 1994 (Ex. 1107).

Ground	Reference(s)/Basis	35 U.S.C. §¹	Claim(s) Challenged
10	Davies, Erickson, Hough	§ 103	13, 14, 17–23, 25
11	Davies, Erickson, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns	§ 103	13, 14, 17–23, 25
12	Davies, Erickson, Hough, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns	§ 103	13, 14, 17–23, 25
13	Davies, Schoeberl ¹²	§ 103	24
14	Davies, Schoeberl, Hough	§ 103	24
15	Davies, Erickson, Schoeberl	§ 103	24
16	Davies, Erickson, Schoeberl, Hough	§ 103	24
17	Davies, Erickson, Schoeberl, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns	§ 103	24
18	Davies, Erickson, Schoeberl, Hough, the general knowledge, experience, and common sense of a POSITA,	§ 103	24

¹² US 5,439,576, issued Aug. 8, 1995 (Ex. 1108).

Ground	Reference(s)/Basis	35 U.S.C. § ¹	Claim(s) Challenged
	as reflected in Wendt, Han, Glembotsky, and Burns		
19	Davies, Peters ^{13, 14}	§ 103	26, 27
20	Davies, Peters, Hough	§ 103	26, 27
21	Davies, Peters, Erickson	§ 103	26, 27
22	Davies, Peters, Erickson, Hough	§ 103	26, 27
23	Davies, Peters, Erickson, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns	§ 103	26, 27
24	Davies, Peters, Erickson, Hough, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns	§ 103	26, 27

¹³ US 3,984,303, issued Oct. 5, 1976 (Ex. 1109).

¹⁴ Petitioner cites Clark instead of Peters for Grounds 19–24 in the summary on pages 5–6 of the Petition. However, Petitioner cites Peters in its detailed challenges for Grounds 19–24 on pages 79–83 of the Petition. Therefore, as noted in the Institution Decision (Dec. 8 n.14), and without any clarification otherwise from the parties, we view Petitioner as relying on Peters in Grounds 19–24 instead of Clark.

Petitioner relies on the declaration testimony of Dr. Mario Tremblay.

Ex. 1103. Patent Owner relies on the declaration testimony of Dr. Ralph E. White. Ex. 2109; Ex. 2116 (private version); Ex. 2117 (public version).

II. ANALYSIS

A. *Legal Standards*

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). A “prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements ‘arranged as in the claim.’” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)). If a prior art device in its normal and usual operation would necessarily perform the claimed method, then the method is arguably inherently anticipated by the prior art device. *In re King*, 801 F.2d 1324, 1326 (Fed. Cir. 1986). A “prior art reference may anticipate when the claim limitation or limitations not expressly found in that reference are nonetheless inherent in it.” *Mehl/Biophile Int’l Corp. v. Milgraum*, 192 F.3d 1362, 1365 (Fed. Cir. 1999).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Obviousness is resolved based on underlying factual determinations, including: (1) the scope and content of

the prior art; (2) differences between the prior art and the claims at issue; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness, i.e., secondary considerations.¹⁵ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Subsumed within the *Graham* factors are the requirements that all claim limitations be found in the prior art references and that the skilled artisan would have had a reasonable expectation of success in combining the prior art references to achieve the claimed invention. *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1361 (Fed. Cir. 2007).

Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). Petitioner must demonstrate unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2019); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)).

B. Level of Ordinary Skill in the Art

Petitioner asserts:

A person of ordinary skill in the art (POSITA) would have had a degree in chemistry, chemical engineering, or a similar discipline

¹⁵ Patent Owner presents evidence and arguments about objective indicia of nonobviousness, namely, copying. PO Resp. 64–68. Because we determine that Petitioner has not demonstrated a sufficient basis for obviousness of the challenged claims, we need not reach Patent Owner’s evidence and arguments relating to objective indicia.

and at least two years of experience with electrolysis systems. Ex. 1103, ¶ 14. Alternatively, a POSITA could have equivalent experience in industry or research, such as designing, developing, testing, or implementing electrolysis systems. *Id.* Also, as noted in the '415 patent, a POSITA “can readily fabricate any of the emitters shown in FIG. 4 or 5 or can design other embodiments that will oxygenate flowing water.” Ex. 1101, 9:20–22.

Pet. 16.

Patent Owner states, for “purposes of this proceeding, PO does not challenge Petitioner’s proposed level of ordinary skill.” PO Resp. 53 n.6.

Neither party argues that the outcome of this case would differ based on our adoption of any particular definition of one of ordinary skill in the art. Accordingly, we adopt Petitioner’s definition, because it is consistent with the cited prior art. We further note that the prior art itself demonstrates the level of skill in the art at the time of the invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that “specific findings on the level of skill in the art . . . [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))).

C. Claim Construction

We apply the claim construction standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b). Under *Phillips*, claim terms are afforded “their ordinary and customary meaning.” *Phillips*, 415 F.3d at 1312. The “ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the

invention.” *Id.* at 1313. Only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In the Petition, Petitioner refers us to definitions for certain terms in the ’415 patent’s “Definitions” section, namely, “critical distance,” “microbubble,” “nanobubble,” and “supersaturated.” Pet. 17–18 (quoting Ex. 1101, 4:1–6, 4:10–18). Otherwise, Petitioner does not propose express claim constructions in the Petition, although it addresses Patent Owner’s proposed constructions in its Reply, as discussed below. Reply 2–5.

Patent Owner represents that the parties agree that the construction of “nanobubble” should include the language “a bubble with a diameter less than that necessary to break the surface tension of the water.” PO Resp. 10–11. Patent Owner disputes Petitioner’s requested inclusion of additional language requiring that “nanobubbles remain suspended in the water, giving the water an opalescent or milky appearance.” *Id.* at 11.

Petitioner argues that the ’415 patent defines both “microbubble” and “nanobubble.” Reply 2 (quoting Ex. 1101, 4:10–15). The quoted portion of the ’415 patent is reproduced below:

“Microbubble” means a bubble with a diameter less than 50 microns.

“Nanobubble” means a bubble with a diameter less than that necessary to break the surface tension of water. Nanobubbles remain suspended in the water, giving the water an opalescent or milky appearance.

Ex. 1101, 4:10–15.

Petitioner notes that the '415 patent's definition of "microbubble" has a numerical bound but the definition of "nanobubble" does not. *Id.* at 3.¹⁶

Because patentee has acted as its own lexicographer, and because Petitioner agrees that the definition provided in the specification is the preferred construction, we adopt the construction of "nanobubble" provided in the specification. *Cont'l Cirs. LLC v. Intel Corp.*, 915 F.3d 788, 796 (Fed. Cir. 2019) (citing *Phillips*, 415 F.3d at 1316) ("When the patentee acts as its own lexicographer, that definition governs."). Namely, we construe "nanobubble" as "a bubble with a diameter less than that necessary to break the surface tension of water." Ex. 1101, 4:12–13. We decline to add any additional language to our construction, as proposed by Petitioner, because the additional quoted sentence in the specification appears to describe an effect of nanobubbles on the appearance of water when nanobubbles are present, rather than define the nanobubbles themselves.

On this record, we determine that no other claim terms require express construction.

D. Summary of Relevant Prior Art

1. Wikey (Ex. 1112)

Wikey is titled "Aquarium Water Treatment Apparatus." Ex. 1112, code (54). Wikey's Figure 1 is reproduced below.

¹⁶ While not set forth as part of an explicit claim construction, Petitioner's declarant elsewhere opines that nanobubbles have a diameter of roughly 100 nanometers (0.1 microns). Ex. 2172, 69:11–25; Sur-Reply 2.

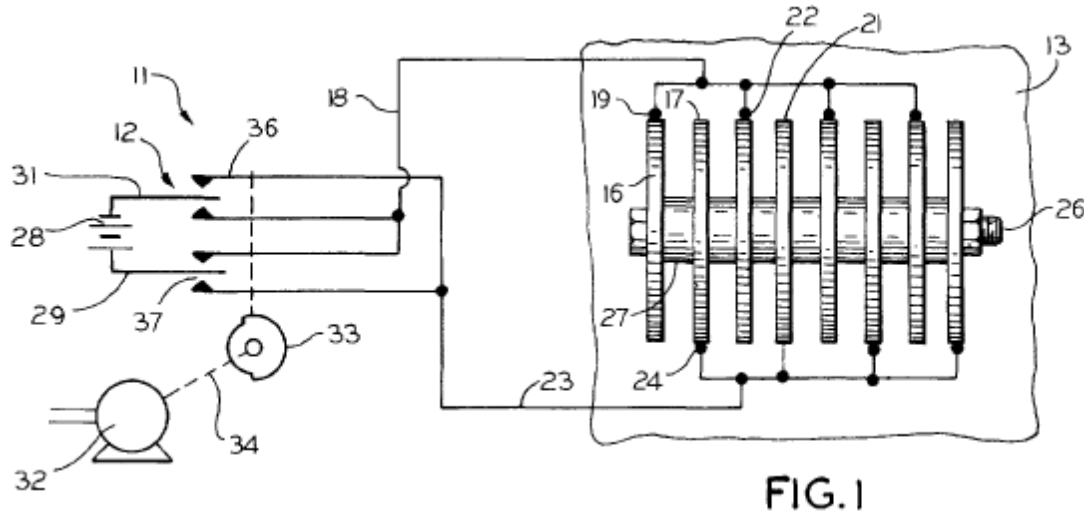


Figure 1 depicts water treatment apparatus 11 “for aerating and treating water in fish tanks, aquariums and the like.” *Id.* at 1:60–61, 1:66–2:1. Power supply 12, which can be a DC source, feeds power to electrode units 13 that are under water. *Id.* at 2:1–4, 2:23–24. Electrode units 13 include electrodes 16 and 17 that are oppositely polarized plates. *Id.* at 2:4–11. The plates are mounted on insulated rod 26 and separated from each other by insulated washers 27. *Id.* at 2:18–20. Apparatus 11 also includes a means for periodically changing the polarity of the electrodes, such as motor 32 that drives cam 33 and switches 36, 37. *Id.* at 2:26–33.

Wikey discloses that in “a preferred embodiment of the invention, the plates are maintained at a distance of 1/64 inch apart by the insulators and a 6 volt D.C. source is utilized.” *Id.* at 2:39–41. Wikey further teaches that the amperage between the plates depends on plate size and the conductivity of water but nonetheless, “the relative amperage of the preferred embodiment is in the order of ½ amp.” *Id.* at 2:42–46. Wikey states that, with a “platinum coated titanium plate, the bubbles of gas including oxygen are extremely small.” *Id.* at 2:49–51.

Wikey's Figure 3 is reproduced below.

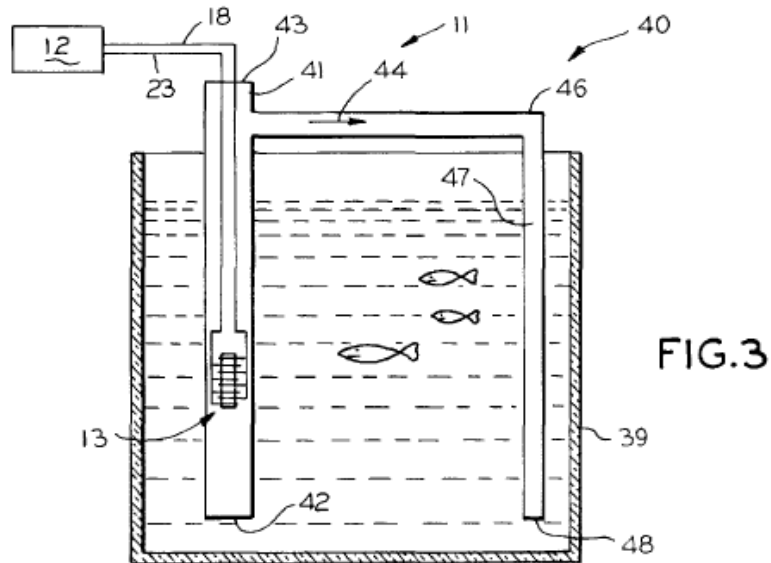


Figure 3 shows a further refinement of apparatus 11. *Id.* at 1:64–65. A circulating device, such as vertical tube 41, surrounds electrolysis unit 13. *Id.* at 3:6–8. Bottom 42 of tube 41 “is open to enable the flow of water therein” and top 43 of tube 41 “is also open and extends above the normal level of water in the tank.” *Id.* at 3:10–13. Wikey teaches:

A pumping action in tube 41 is caused by the electrolysis action of apparatus 13. In fact, the level of the water in tube 41 increases until water is flowing in the direction shown by arrows 44 in the horizontal tube 46 and back down through second vertical tube 47. The water that flows through the three tubes is forced therethrough by the electrolysis action and because of the electrolysis action contains a plethora of oxygen bubbles. The hydrogen that is released in tube 41 escapes into the atmosphere at opening 43. The water containing the oxygen bubbles passes back down through tube 47 which is open at the bottom portion 48 thereof to enable aerated water to flow therethrough and supply oxygen to the lower levels of the tank.

Id. at 3:13–27.

2. *Davies (Ex. 1105)*

Davies is titled “Electrolytic Liquid Purification Process and Apparatus.” Ex. 1105, code (54). Davies “relates to a process and apparatus for electrolytically treating water and other liquids” and “for treating water to be used for drinking purposes or for human body contact.” *Id.* at 1:7–10.

Davies’s Figure 2 is reproduced below.

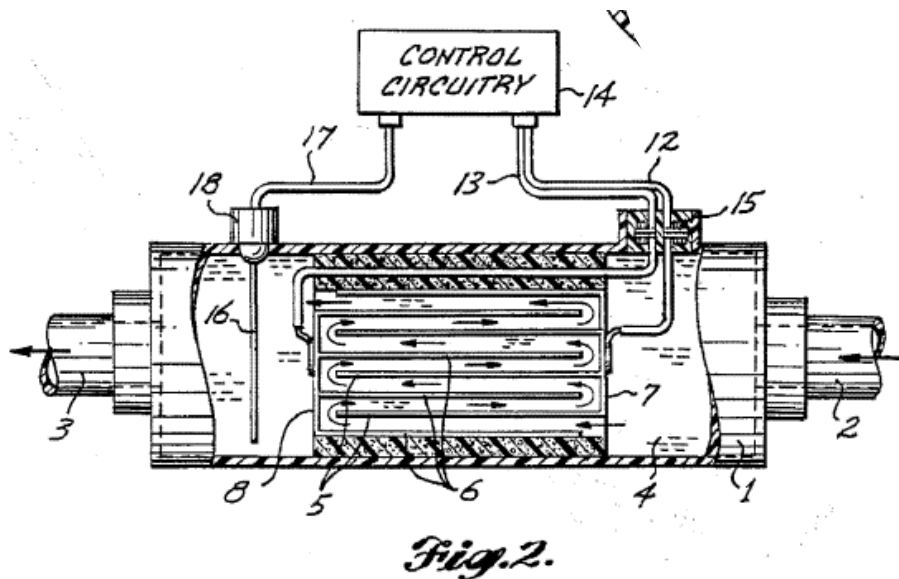


Figure 2 is a side view of a clarifying electrolytic cell. *Id.* at 1:66–2:1. The electrolytic cell includes cylindrical casing 1 connected to liquid supply pipe 2 and liquid discharge pipe 3. *Id.* at 2:60–63. Davies describes interior chamber 4 that includes “a stack of electrode plates including two components or plate sets disposed in interstratified or interleaved relationship” and that Figure 2 shows grouped anode plates 5 and grouped cathode plates 6 in an interleaved relationship. *Id.* at 2:63–68. Specifically, “anode plates 5 project in parallel, equally-spaced, cantilever fashion from an end connecting plate 7” and “cathode plates 6 project in parallel, equally-spaced, cantilever fashion from an end connecting plate 8.” *Id.* at 2:68–3:4.

Davies's Figure 3 is reproduced below.

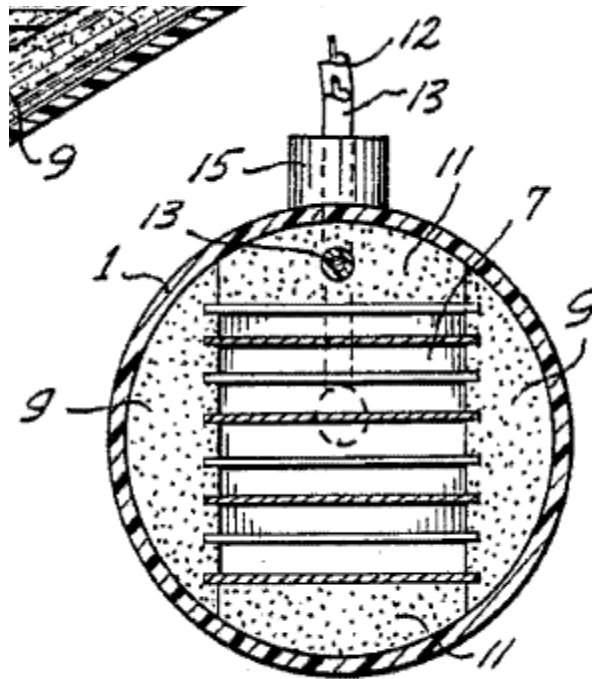


Fig.3.

Davies describes the opposite edges of electrode plates 5, 6 being held by mounting blocks 9 located at opposite sides of the electrode stack to hold electrode plates 5, 6 “firmly in accurately spaced relationship.” *Id.* at 3:5–13. Spaces above and below the stack of plates 5, 6 are closed by filler blocks 11. *Id.* at 3:19–20.

Davies describes interleaving anode plates 5 and cathode plates 6 so a free end of each cantilevered plate is spaced from the adjacent end plate a distance that is approximately equal to the spacing between adjacent plates to form a series of return bends and provide a sinuous passage from the entrance end of the casing to the exit end through the plate stack. *Id.* at 3:25–32. Davies teaches that for “most purposes the plate width should be in the range of 3 to 5 inches (7.62 to 12.7 cm) and the spacing between

adjacent plates should be one-eighth to one-quarter of an inch (3.5 to 7 mm),” and that it is “desirable for the space between adjacent plates to be small so as to provide a short path for travel of electricity between the plates.” *Id.* at 3:43–49. Davies further teaches:

The time during which the liquid is subjected to the electric field between the anode and cathode plates can be regulated by selection of the length of the path between the liquid and the plates which is determined by the length of the plates, and by the velocity of the liquid flowing through the interplate passage. Preferably the length of the plates 5 and 6 is in the range of 5 inches to 10 inches (12.7 to 25.4 cm) and the velocity of the water may be 8 to 20 feet (2.4 to 6 m) per minute so that the water will be in contact with the plates for a period of 15 to 40 seconds.

Id. at 3:49–59.

Davies discloses that the cell can be powered by a 110 volt or a 220 volt alternating current source, which can be transformed to a low voltage, such as 12 volts or 24 volts. *Id.* at 4:26–30, 8:68–9:5. Davies also describes using direct current electricity, such as a 12 volt battery. *Id.* at 5:65–68. Davies describes installing the cell in a household water system via connection to the cold water supply for a sink or a wash bowl. *Id.* at 4:66–5:1.

Davies’s Figure 11 is reproduced below.

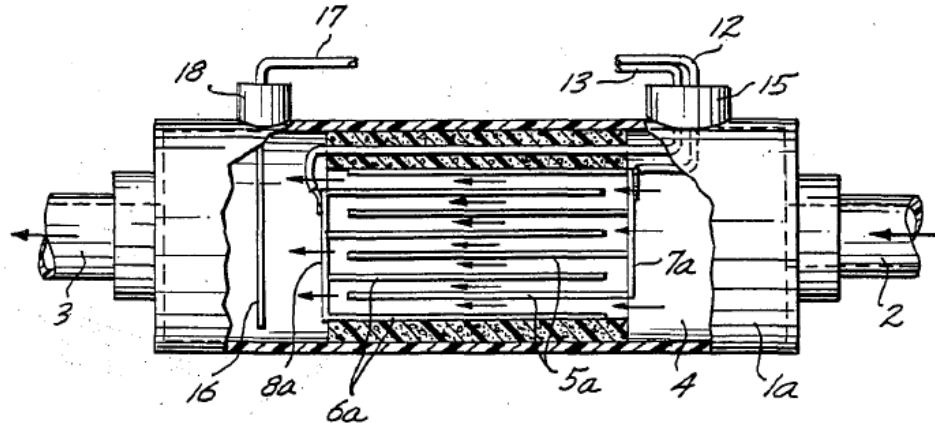


Fig. 11.

Figure 11 depicts an alternate type of clarifying electrolytic cell. *Id.* at 2:17–20. Davies teaches that anode plates 5a and cathode plates 6a “can be of the same size as the anode plates 5 and the cathode plates 6, as shown in FIGS. 1, 2, 3 and 4.” *Id.* at 6:43–47. However, anode plates 5a project in cantilever fashion from central connecting strap 7a, and cathode plates 6a project in cantilever fashion from connecting strap 8a. *Id.* at 6:47–52. Davies describes substantially straight parallel flow paths between plates 5a, 6a from inlet 2 to outlet 3. *Id.* at 6:63–68. Davies further describes using an electrolytic cell to maintain an aquarium’s liquid in clean condition. *Id.* at 7:36–40. Davies teaches that a filter is not necessary in such an arrangement due to recirculation of water in the aquarium by a pump through the cell. *Id.* at 7:41–43.

E. Asserted Anticipation of Claims 13, 18–23, and 25 by Wikey (Ground 1)

1. Arguments

Petitioner argues that Wikey anticipates claims 13, 18–23, and 25. Pet. 19–38; Reply 5–12. Patent Owner argues that Wikey does not anticipate. PO Resp. 18–32; Sur-Reply 1–15.

With respect to claim 13, Petitioner asserts that every element of claim 13 is found in Wikey, as follows:

[pre] A method for producing an oxygenated aqueous composition comprising (Pet. 22; *id.* at 19–29 (summarizing Wikey’s method of producing “a suspension comprising microbubbles and nanobubbles in the water”));¹⁷

[13a] flowing water at a flow rate no greater than 12 gallons per minute through an electrolysis emitter (Pet. 30 (relying on Ex. 1112, 3:10–11; Ex. 1103 ¶¶ 32, 61, 68, 69));

[13b] comprising an electrical power source electrically connected to an anode electrode and a cathode electrode contained in a tubular housing, causing electricity to flow from the power source to the electrodes, and, (Pet. 30–31 (relying on Ex. 1112, 2:22–24, 2:1–11, 3:1–8, Fig. 3; Ex. 1103 ¶¶ 29–30));

[13c] producing the composition comprising a suspension comprising oxygen microbubbles and nanobubbles in the water, the microbubbles and nanobubbles having a bubble diameter of less than 50 microns, (Pet. 31–32 (relying on Ex. 1112, 2:39–41, 2:47–52, 3:18–21; Ex. 1103 ¶¶ 34–35, 61, 68));

[13d] wherein: the anode electrode is separated at a critical distance from the cathode such that the critical distance is from 0.005 inches to 0.140 inches; (Pet. 32 (relying on Ex. 1112, 2:39–41; Ex. 1103 ¶ 34));

[13e] the power source produces a voltage no greater than about 28.3 volts and an amperage no greater than about 13 amps, (Pet. 32 (relying on

¹⁷ We express no opinion on whether the preamble is limiting.

Ex. 1112, 1:40–43, 2:39–41, 2:44–46));

[13f] the tubular housing has an inlet and an outlet and a tubular flow axis from the inlet to the outlet; (Pet. 33 (relying on Ex. 1112, 3:10–18, Fig. 3));

[13g] the water flows in the inlet, out the outlet, is in fluid connection with the electrodes, (Pet. 33 (relying on Ex. 1112, 2:42–44; Ex. 1103 ¶ 31));

[13h] and the water flowing into the inlet has a conductivity produced by the presence of dissolved solids such that the water supports plant or animal life (Pet. 33–34 (relying on Ex. 1112, 3:38–39; Ex. 1103 ¶ 36)).

Petitioner presents additional arguments that Wikey anticipates claims 18–23 and 25. Pet. 34–38.

2. *Analysis*

As we noted in our Institution Decision, Wikey appears to disclose each limitation of claim 13 except “microbubbles and nanobubbles having a bubble diameter of less than 50 microns.” Dec. 24–25; Pet. 30–34. Petitioner argues that Wikey’s apparatus “forms a ‘plethora of oxygen bubbles’ that are ‘extremely small.’” Pet. 31 (citing Ex. 1112, 2:47–52, 3:18–21). Petitioner also argues that the ’415 patent “admits that the claimed critical distance creates microbubbles and nanobubbles” and the “Wikey emitter has the same configuration as claim 13 and therefore produces the same result.” *Id.* at 31–32 (citing Ex. 1101, Abstract; Ex. 1103 ¶¶ 35, 61, 68). Petitioner reconstructed the Wikey apparatus using information provided in Wikey as to physical characteristics, i.e. “electrode spacing of 0.016 inches and a voltage of 6 volts,” and amperage “depending on the size of the electrode plates and the conductivity of the water” that can be “in the order of ½ amp.” *Id.* at 22; Ex. 1112, 2:39–46; Ex. 1103 ¶¶ 33,

49, 56, 61, 68. Petitioner also relied on Wikey’s guidance on electrode plate size in relation to amperage and conductivity of the water, namely, “8 circular electrode plates having a 2-inch diameter” in its reconstructed apparatus. Ex. 1103 ¶ 42.

Although we indicated in our Institution Decision that Petitioner need not test every possible iteration and parameter of a reference to make a successful inherent anticipation case (Dec. 25, citing *Perricone v. Medicis Pharm. Corp.*, 432 F.3d 1368, 1376 (Fed. Cir. 2005)), Petitioner nevertheless must demonstrate either express or inherent anticipation.

Petitioner has accounted for most of the limitations of claim 13 in Wikey, but disclosure of microbubbles and nanobubbles is lacking. Petitioner’s arguments for the express or inherent creation of microbubbles and nanobubbles, on the record developed during trial, are not persuasive.

a. Express Creation of Microbubbles and Nanobubbles

Patent Owner argues that Wikey does not expressly teach the creation of microbubbles or nanobubbles, and is not directed to the formation of microbubbles or nanobubbles. PO Resp. 19. We agree with Patent Owner that Wikey does not expressly disclose microbubbles or nanobubbles, and that the Petition “does not even contend that Wikey expressly discloses that its device creates microbubbles or nanobubbles.” *Id.* (citing Pet. 31–32); *compare* Tr. 14:14–23 (Petitioner stating “Wikey does explicitly disclose the presence of the nanobubbles and microbubbles”) *with id.* at 35:8–17 (Patent Owner characterizing this as “a new argument on appeal” (citing Pet. 31)).

b. Inherent Creation of Microbubbles or Nanobubbles

Patent Owner argues that Petitioner has “failed to prove that Wikey inherently yields microbubbles or nanobubbles,” taking issue with

Petitioner's two main arguments regarding this limitation, which are based on (i) a statement in the abstract of the '415 patent about "critical distance" and (ii) testing of an alleged reproduction of the Wikey reference. PO Resp. 19–20.

i. Abstract's "Critical Distance"

Patent Owner argues that microbubbles and nanobubbles are not inherently created by the electrode gap, i.e., critical distance, disclosed by Wikey. PO Resp. 19–22. More particularly, Patent Owner takes issue with Petitioner's reliance on the '415 patent abstract, which provides that when "the anode and cathode are separated by a critical distance, very small microbubbles and nanobubbles of oxygen are generated." *Id.* at 20; Ex. 1101, code (57). This statement, according to Patent Owner, does not mean that the "electrode gap is the only thing that is relevant to creation of microbubbles and nanobubbles;" instead, one of ordinary skill in the art "would understand while reading it that many things other than spacing of the electrodes are going to have an effect on the bubble size created using devices described in the patent." *Id.* at 21 (citing Ex. 2172, 24:6–31:5; Ex. 2116 ¶¶ 41–43, quoting Ex. 2172, 30:20–31:5 (Dr. Tremblay's testimony)). Patent Owner argues that the '415 patent defines "critical distance" as a "functional distance" that can range from 0.005 inches to 0.140 inches, and that distance is one of a number of interdependent variables in the electrolysis process. *Id.* at 21–22; *see also* Ex. 1102, 169, 196 (prosecution history); Ex. 2116 ¶¶ 45–48.

Petitioner replies that "Petitioner met its *prima facie* burden of showing that Wikey inherently created the claimed 'microbubbles' and 'nanobubbles.'" Reply 6 (citing Dec. 22–25). Petitioner also replies that

claim 13 specifies voltage, current, and flow rate limits that, combined with the critical distance, create microbubbles and nanobubbles, and that Wikey teaches values for each of these variables falling within the claimed ranges. *Id.* at 7. Petitioner also replies that Wikey teaches creating small bubbles of oxygen that do not break the surface tension of the water. *Id.* (citing Ex. 1112, 2:49–5, 13:21–27).

Patent Owner criticizes as improper Petitioner’s argument that the “Board’s decision to institute shifted the burden to PO to prove Wikey . . . did not inherently create nanobubbles.” Sur-Reply 3 (citing *Fan Duel, Inc. v. Interactive Games LLC*, 966 F.3d 1334, 1341–42 (Fed. Cir. 2020)). Ultimately, Patent Owner argues, Petitioner did not make a *prima facie* showing that the prior art references create nanobubbles. *Id.* at 5.

We disagree that our Institution Decision established a *prima facie* case that Petitioner met its burden at the Final Written Decision stage. An affirmative decision on institution is a determination that Petitioner has shown, on the record at that stage in the proceeding, that Petitioner has a reasonable likelihood of prevailing on its arguments as to at least one challenged claim. Dec. 40; 35 U.S.C. § 314(a). To prevail in an instituted *inter partes* review, however, 35 U.S.C. § 316(e) requires Petitioner to meet “the burden of proving a proposition of unpatentability by a preponderance of the evidence.” See *TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (“[T]here is a significant difference between a petitioner’s burden to establish a ‘reasonable likelihood of success’ at institution, and actually proving invalidity by a preponderance of the evidence at trial The Board’s findings in its Final Written Decision were thus not inconsistent with those in its Institution Decision; they were made under a qualitatively

different standard.”). To state that our Institution Decision established a *prima facie* case that Petitioner was correct would be erroneous, as such a position conflates different burdens required of Petitioner and, in doing so, would have us improperly give Petitioner an advantage in the actual trial culminating in a final written decision. *Fan Duel*, 966 F.3d at 1341–42.

We agree with Patent Owner that the ’415 patent itself does not necessarily equate a certain critical distance of electrodes with the formation of nanobubbles or microbubbles, to the exclusion of all other variables. PO Resp. 19–22. As acknowledged by Dr. Tremblay, one of ordinary skill in the art would understand that many other factors align to create an apparatus, such as the one in the ’415 patent, that creates microbubbles and nanobubbles. Ex. 2172, 30:20–31:5. Although Petitioner’s citation to the ’415 patent abstract is not incorrect (Pet. 31–32), we interpret this portion of the specification in context and with testimonial input to conclude that Patent Owner does not “admit” inherency of microbubbles or nanobubbles by this statement.

ii. Testing

Patent Owner argues that Petitioner “never even assessed whether Wikey creates nanobubbles,” and Petitioner’s testing “did not provide any evidence indicating that nanobubbles were produced” by the alleged reproduction of Wikey’s apparatus. PO Resp. 22–27. According to Patent Owner, “Petitioner’s expert testified that [nanobubbles] have a diameter on the order of 0.1 microns” (Sur-Reply 2) but his declaration “states only that testing identified bubbles of 9 microns or larger, and never states that testing identified nanobubbles.” PO Resp. 23–24 (citing Ex. 2172, 69:11–70:4 (Dr. Tremblay stating that the size of a bubble that doesn’t break the surface

tension of water is “[r]oughly 100 nanometers”); Ex. 1103 ¶¶ 61, 64–68, 125–127, 131–133, 148–150, 154–156); Sur-Reply 3; *see also* Ex. 2117 ¶ 71 (Patent Owner’s expert testifying that a bubble “having a diameter less than that necessary to break the surface tension of water” is much smaller than 1 micron (citing Ex. 2193)). Patent Owner contends that Petitioner has demonstrated its ability to test for the presence of nanobubbles, citing Petitioner’s own promotional material in which it provided nanobubble-sized testing to its customers (PO Resp. 24–25 (citing Ex. 2195; Ex. 2172, 68:7–69:6; Ex. 2116 ¶¶ 69–78); Sur-Reply 2–3 (citing Ex. 2195; Ex. 2177, 128:19–129:10), but that for this proceeding Petitioner “chose instead to use equipment with resolution down to only 5 microns,” i.e., equipment not sensitive enough to detect nanobubbles. Sur-Reply 3 (citing Ex. 2172, 69:7–10, 70:1–4, 114:13–117:17, 129:18–25).

Petitioner replies that its tests were conducted appropriately using the same testing and evidence Patent Owner presented in the specification to support the claims. Reply 8 (citing Ex. 1101, 5:50–52). Petitioner also argues that the ’415 patent states in Table III that the apparatus causes water to become “milky, indicating supersaturation” (Ex. 1101, 9:38–50), and also that nanobubbles “remain suspended in water, giving the water an opalescent or milky appearance” (Ex. 1101, 4:14–15). Reply 9. Thus, Petitioner argues, the patent’s lexicography “equates ‘miliness’ with both nanobubbles and supersaturation,” implying that the miliness indicates both the presence of nanobubbles and supersaturation. *Id.*

Patent Owner responds that Petitioner erroneously relies on Example 2, which “specifically states it did not measure nanobubbles.” Sur-Reply 5 (citing Ex. 1101, 5:62–6:2). Patent Owner also responds that

Table III of the '415 patent does not prove the existence of nanobubbles; the specification only says “miliness is indicative of supersaturation,” but does not suggest the converse, i.e., that dissolved oxygen content over 100% proves that the water is milky or contains nanobubbles. *Id.* at 6–7 (quoting Ex. 2172, 76:9–14 (Dr. Tremblay agreeing that dissolved oxygen does not indicate bubbles in the water or say anything about the size of the bubbles); citing Ex. 2172, 77:23–78:21). Patent Owner also challenges Petitioner’s argument that “the specification admits that as long as the other parameters of claim 13 and 18 are met nanobubble creation is inherent” is incorrect because neither “of those claims existed when the specification was filed, so the specification did not suggest those parameters inherently created microbubbles and nanobubbles.” Sur-Reply 7–8.

On this complete record, we find that Petitioner’s testing does not sufficiently demonstrate that Wikey inherently discloses nanobubbles. Pet. 22–29. Petitioner apparently had the ability to test for the express disclosure of nanobubbles in its Wikey-based apparatus, but did not do so. Sur-Reply 2–3. Patent Owner points out that nanobubbles, which Petitioner’s expert indicated were on the order of 0.1 microns, are detectable using available technology that Petitioner knew of and had used in the past. *Id.* However, Petitioner’s expert acknowledged that he did not do any testing that would determine whether nanobubbles were formed. *Id.* at 7 (citing Ex. 2172, 70:1–4).

Petitioner’s reliance on miliness and supersaturation to demonstrate the presence of nanobubbles is also unsupported. Petitioner argues that milky appearance equals supersaturation (Reply 9 (citing Ex. 1101, 9:38–50)), and also that milky appearance equals nanobubbles (*id.* (citing

Ex. 1101, 4:14–15)); the inference Petitioner apparently wants us to draw is that supersaturation equals nanobubbles. Patent Owner, however, persuasively argues that dissolved oxygen content over 100% does not prove the water is milky. PO Resp. 25–26; Sur-Reply 6–7; *see also* Tr. 13:24–26 (Petitioner’s counsel agreeing that “you can have supersaturation without milkiess”). Patent Owner also demonstrates that supersaturation does not necessarily mean that nanobubbles are present. PO Resp. 26; Sur-Reply 7; Ex. 2172, 76:9–14, 77:23–78:21. Thus, Petitioner’s argument based on supersaturation equaling nanobubbles because milkiess equals both breaks down because milkiess does not necessarily equal either.

Accordingly, we determine that Petitioner’s arguments and testing fail to show that Wikey inherently discloses nanobubbles.

iii. Wikey Parameters and Petitioner’s Experiment

Patent Owner also argues that Petitioner’s device and parameters “are not disclosed by Wikey,” and that this shortcoming impacts the results in such a way that Petitioner cannot show that Wikey yields microbubbles, let alone nanobubbles. PO Resp. 27. More particularly, Patent Owner argues that in Petitioner’s purported reproduction of the Wikey device, Petitioner changed the orientation of the electrodes disclosed by Wikey from horizontal to vertical, which poses a problem because vertical orientation of electrodes allows bubbles to rise more uniformly with less collision, whereas horizontal orientation of electrodes likely causes more collision of bubbles and slower travel of bubbles, and, therefore, formation of larger bubbles. *Id.* at 27–28. Thus, “horizontally disposed plates can be expected to create larger bubbles than vertically disposed plates,” and Petitioner’s test results using its reproduction of the Wikey device “failed to show what size bubbles

Wikey inherently creates.” *Id.* at 28. Patent Owner also argues that Petitioner used an incorrect electrode size and current, and Petitioner’s “multiple times wider” electrodes and “ten times higher” amperage both “impact bubble size” and “fail to show that the formation of micro- and nanobubbles is inherent to Wikey.” *Id.* at 28–30.

Petitioner replies that, despite Patent Owner’s notion that rotating the electrodes could cause the bubbles to coalesce into larger bubbles, “[m]ere speculation cannot rebut Petitioner’s *prima facie* showing that the bubbles produced by the Wikey device inherently include ‘microbubbles’ and ‘nanobubbles.’” Reply 10. Petitioner also argues that one of ordinary skill in the art would not expect Wikey’s “schematic” Figure 2 and 3 illustrations to require a particular orientation of electrodes, or a particular size of electrodes. *Id.* at 10–11.

Patent Owner argues that it is not “mere speculation” that the orientation of the electrodes would affect bubble size, as demonstrated by Clark (Ex. 1106, 8:53–63), which “teaches that the electrode arrangement affects bubble size by changing how bubbles collide with each other.” Sur-Reply 12 (citing PO Resp. 27–28; Ex. 2172, 29:14–22 (Dr. Tremblay testifying that orientation of electrodes can affect bubble size)).

Having reviewed the evidence and argument about this aspect of Petitioner’s reproduction of Wikey, we are unpersuaded that Petitioner’s reproduction follows Wikey’s template. Wikey depicts its electrodes in operation as oriented in a particular fashion, namely, horizontally. Ex. 1112, Figs. 2–3. Patent Owner demonstrates that the orientation of the electrodes plays a role in the creation of bubbles. PO Resp. 27–28; Sur-Reply 10–13. Electrodes with a different orientation, such as the vertical orientation tested

by Petitioner, could alter the outcome regarding the creation of nanobubbles. Ex. 2172, 29:14–22. Without demonstrating that its reproduction follows the guidance of Wikey, Petitioner cannot successfully argue that the production of nanobubbles is “inherent.”

For the foregoing reasons, Petitioner has not sufficiently shown that Wikey discloses the microbubbles and nanobubbles limitation of claim 13, either expressly or inherently and, as such, has not sufficiently shown that claim 13 is anticipated by Wikey.

iv. Dependent Claims

Every dependent claim challenged under Petitioner’s Ground 1 includes the microbubbles and nanobubbles limitation of claim 13, and, accordingly, Petitioner does not make its case as to these dependent claims. None of Petitioner’s arguments as to anticipation of the dependent claims by Wikey rectifies the microbubble and nanobubble deficiency. We analyze the parties’ separate arguments for the dependent claims, below.

Regarding claim 18, Petitioner argues that “water temperature is a factor in Wikey.” Pet. 34. Patent Owner argues that Wikey does not teach a method that uses water temperature as a factor in forming the suspension. PO Resp. 30–31. Petitioner replies that “Wikey uses the ‘ambient temperature’ of the water in the same way the ’415 patent does – it performs electrolysis in unheated water that has fish swimming in it.” Reply 11. Patent Owner responds that this claim does not require that water temperature be “measured,” but does require that water temperature be “used,” and that Wikey is silent regarding “use” of water temperature. Sur-Reply 14. For this claim, Petitioner has still failed to show that microbubbles or nanobubbles are present, and Petitioner’s argument that

Wikey “performs electrolysis in unheated water” fails to explain how Wikey meets the claim 18 limitation that “water temperature is a factor for formation of the suspension.”

Regarding claim 21, Petitioner argues that because “Wikey produces microbubbles and nanobubbles,” it “produces a suspension comprising microbubbles and nanobubbles that supersaturate the water.” Pet. 36–37. Patent Owner argues that Wikey does not teach that the bubbles supersaturate the water. PO Resp. 31–32. Petitioner replies that “it is inherent that continuing to run the Wikey apparatus will result in a sufficient accumulation of bubbles to ‘supersaturate’ the water” because the ’415 patent teaches that the claimed microbubbles and nanobubbles remain in suspension for long periods of time. Reply 12 (citing Ex. 1101, Abstract, 4:27–38; Ex. 1103 ¶ 35). Patent Owner responds that this is a new argument, and that there is “no evidence that Wikey’s apparatus inherently works fast enough, or long enough, to supersaturate Wikey’s aquariums.” Sur-Reply 15. We agree that new arguments on reply are not appropriate, and Petitioner has not demonstrated sufficiently that Wikey inherently creates microbubbles or nanobubbles, let alone that Wikey’s device would run fast enough or long enough to supersaturate the water with microbubbles or nanobubbles.

Regarding claim 25, Petitioner argues that “Wikey’s microbubbles and nanobubbles are incapable of breaking the surface tension of the water, as admitted” during prosecution of the ’415 patent and in the ’415 patent itself. Pet. 38. Patent Owner argues that Wikey does not teach the creation of bubbles that are substantially incapable of breaking the surface tension of the water. PO Resp. 32. More particularly, Patent Owner argues that

Petitioner did not test for bubbles with this property, and that Petitioner's bubbles appeared to disappear almost immediately. *Id.* (citing PO Resp. §§ IV.A, V.B.2.b.i, V.B.2.b.ii). Petitioner replies that Wikey teaches that “water containing the oxygen bubbles passes back down through the tube 47” which means the bubbles do not break the surface tension and leave the water. Reply 12 (citing Ex. 1112, 2:49–5, 13:21–27). This argument is linked to our analysis of whether Wikey discloses microbubbles and nanobubbles, above, which we determine it does not. We also agree with Patent Owner that a lack of testing for this property, together with results that apparently disprove the existence of this property, undermine Petitioner's arguments regarding this claim.

On the complete record now before us, we determine that Petitioner has not sufficiently shown that Wikey discloses all the limitations of the claims challenged under Ground 1 (i.e., claims 13, 18–23, 25) and thus has not established by a preponderance of the evidence that claims 13, 18–23, and 25 are unpatentable as anticipated by Wikey.

F. Asserted Obviousness Based on Wikey and Other References (Grounds 2–6)

Petitioner asserts the following obviousness challenges based on Wikey:

- Ground 2: claims 13, 18–23, and 25 over Wikey and AFD (Pet. 39–40);
- Ground 3: claims 13, 18–23, and 25 over Wikey and AFD and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 40–44);

- Ground 4: claims 26 and 27 over Wikey and Clark (Pet. 44–46);
- Ground 5: claims 26 and 27 over Wikey, Clark, and AFD (Pet. 47); and
- Ground 6: claims 26 and 27 over Wikey, Clark, and AFD and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 47).

For Ground 2, Petitioner contends that one of ordinary skill in the art would have been motivated to combine Wikey and AFD because they both relate to “aerating or increasing the oxygen content of water in an aquarium to support plant and animal life” and, based on their “disclosure of similar structures and components to achieve similar goals,” one of ordinary skill in the art would have “understood that the teachings of AFD are applicable to Wikey.” Pet. 39–40. For Ground 3, Petitioner relies on Wendt, Han, Glembotsky, and Burns to illustrate the principle that “water electrolysis produces oxygen bubbles smaller than 50 microns that have the claimed properties.” *Id.* at 43. For Ground 4, Petitioner argues that one of ordinary skill in the art would have been “motivated, and found it obvious, to combine” Wikey and Clark, because they both address the same field and disclose similar structures. *Id.* at 45–46. Petitioner refers back to its rationales for Grounds 2 and 4 for Ground 5, and its rationale for Grounds 3 and 5 in Ground 6. *Id.* at 47.

Patent Owner argues that “Petitioner’s obviousness arguments all fail because Petitioner does not articulate any motivations in support of the proposed obviousness combinations,” and more particularly, “Petitioner

does not identify any reason a POSA would have been motivated to modify the prior art to produce microbubbles or nanobubbles.” PO Resp. 53. Patent Owner also argues that Petitioner fails to explain why or how one of ordinary skill in the art would modify Wikey, and “does not even attempt to suggest a POSA would have had a reasonable expectation that the modification would have achieved that objective.” *Id.* at 55. Patent Owner argues that the Reply presents new arguments, and:

Even with Petitioner’s new arguments, Petitioner’s obviousness grounds remain deficient for at least four general reasons. First, the Petition did not identify any motivation to make the identified combination. Second, the Petition did not explain how the secondary references would be combined with the primary reference. Third, the petition did not explain why a POSA would have had a reasonable expectation of success in making the relevant combination. Finally, many of the Petitioner’s alleged combinations do not even attempt to resolve the primary references’ failure to meet certain claim elements.

Sur-Reply 22–23.

As we noted in our Institution Decision, we were skeptical that Petitioner’s reason to combine arguments were sufficient on the record at that point in the proceeding, under the reasonable likelihood standard. Dec. 27–28. On the complete record, we find that Petitioner’s arguments are insufficient to establish obviousness under the heightened preponderance of the evidence standard for a final written decision. *See TriVascular*, 812 F.3d at 1068. It is still unclear, based on Petitioner’s proffered reasoning, which portions of the cited secondary references would be combined with Wikey, how they would be combined with Wikey, and whether one of ordinary skill in the art would have had a reasonable expectation of success combining them with Wikey. This applies to each of the claims identified in each of

Grounds 2–6. Moreover, all of the obviousness combinations proposed by Petitioner in Grounds 2–6 inherit the microbubbles and nanobubbles problem of Ground 1. Pet. 39–47.

These concerns are not resolved by the Reply, in which the arguments appear to be new (*see, e.g.*, Reply 13–14 (citing Ex. 1103 ¶¶ 70–71, 182); *see also Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1330–31 (Fed. Cir. 2019)), or insufficient in the same manner the Petition’s obviousness arguments were insufficient (*see, e.g.*, Reply 14–15 (citing Ex. 1103 ¶¶ 36, 73–76, 182–186)). Additionally, even if we were to evaluate Petitioner’s Reply argument on the merits, we agree with Patent Owner’s positions, as explained further below. *See* PO Resp. 53–59; Sur-Reply 22–27.

In Ground 2, for example, Patent Owner argues that the Petition “does not suggest AFD would motivate a POSA to add a pump or any other means to create flow outside of the flow already created by Wikey’s electrolysis module.” PO Resp. 55. In its Reply, Petitioner reiterates that Wikey and AFD are in the same field, and AFD “teaches the use of a filtration system to help aerate the water by producing flow and bubbles.” Reply 13. Also in its Reply, Petitioner provides additional reasons to combine, i.e., “a POSITA would have understood that combining a pump or filter with Wikey would yield additional water flow and filtration” and “[c]ombining the Wikey emitter with a conventional pump or mechanical filter of AFD to boost and regulate flow would allow a smaller pump, which would be quieter, more efficient, and ensure the desired aeration/filtration.” *Id.* at 13–14. Petitioner states that this combination “uses Wikey for its intended purpose and goals, demonstrating a clear expectation of success.” *Id.* at 14. Patent Owner

responds that the “Board should ignore this brand new argument” because “the Petition did not make this argument.” Sur-Reply 25. We agree with Patent Owner. The arguments made on Reply were not properly presented in the first instance in the Petition. Pet. 39–40. Our concerns about the arguments in the Petition are not resolved by the Reply’s either new or insufficient arguments. Reply 13–14. Additionally, even if we were to evaluate Petitioner’s Reply argument on the merits, we agree with Patent Owner that, contrary to Petitioner’s Reply argument that the combined system could use a “smaller pump,” Wikey states that it seeks to avoid traditional pumps and “provide an aerating and circulating pump with no moving parts.” Sur-Reply 26 (citing Ex. 1112, 1:37–40; Ex. 2116 ¶ 120).

In Ground 3, Petitioner relies on Wendt, Han, Glembotsky, and Burns (together, the “Treatises”) to illustrate the principle that “water electrolysis produces oxygen bubbles smaller than 50 microns that have the claimed properties.” Pet. 43. Patent Owner argues that in this combination, even “as to bubble size, Petitioner fails to identify any motivation to modify Wikey in view of the additional art” and “does not explain what changes the references would have motivated a POSA to make.” PO Resp. 56.

Petitioner replies that the Treatises are “cited to show how a POSITA would have understood Wikey,” namely, that “water electrolysis systems produce ‘microbubbles’ and ‘nanobubbles’ smaller than 50 microns,” and to show that “it would have been obvious to use Wikey’s apparatus to produce the claimed ‘microbubbles’ and ‘nanobubbles.’” Reply 15–16. Patent Owner reiterates that “Petitioner did not suggest modifying Wikey based on the Treatises to add the step of producing oxygen microbubbles and nanobubbles.” Sur-Reply 26. We agree, and for similar reasons to those

identified in connection with Ground 2, above, find Petitioner's arguments on reply to be either new, or insufficient in the same manner as the arguments in the Petition. Even if we were to consider the merits of the Reply argument, the Reply fails to provide a reason why one of ordinary skill in the art would modify Wikey based on the Treatises to add the step of producing microbubbles and nanobubbles. It is not enough that a skilled artisan could have done so; it is necessary that they would have been motivated to do so, and that is lacking here. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (“[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.”).

In Ground 4, Patent Owner argues that (1) Petitioner does not explain why a POSITA would be motivated to modify Wikey; (2) Clark teaches away from the formation of nanobubbles and is designed to produce bubbles that are no less than 100 microns; (3) Petitioner never considers how exchanging the Wikey electrodes with Clark's peripheral electrodes would affect Wikey's outcome; and (4) both references are from the 1970s. PO Resp. 57–60. Petitioner argues on Reply that one of ordinary skill in the art “would have found it helpful to look to the teachings of Wikey and Clark in combination to understand how to deliver increased oxygen to fish,” and “would have been motivated to replace Wikey's flat electrodes with Clark's electrode arrangement, which Clark teaches creates smaller, more uniform bubbles.” Reply 14–15. For similar reasons to those identified in connection with Grounds 2 and 3, above, we find Petitioner's arguments on reply to be either new, or insufficient in the same manner as the arguments

in the Petition. Even if we were to consider the merits of the Reply argument, it fails to provide a persuasive reason why one of ordinary skill in the art would modify Wikey's electrodes based on Clark's electrodes.

Ground 5 shares the same issues as Grounds 2 and 4, and Ground 6 shares the same issues as Grounds 3 and 5. Pet. 47. In sum, Petitioner does not persuade us, by a preponderance of the evidence, that claims 13, 18–23, and 25–27 of the '415 patent would have been obvious on any of the bases articulated in Grounds 2–6.

G. Asserted Anticipation of Claims 13, 14, 17–23, and 25 by Davies (Ground 7)

1. Arguments

Petitioner argues that claims 13, 14, 17–23, and 25 are anticipated by Davies. Pet. 47–69, Reply 16–22. Patent Owner argues that Davies does not anticipate. PO Resp. 32–52, Sur-Reply 1–8, 15–22.

With respect to claim 13, Petitioner asserts that every element of claim 13 is found in Davies, as follows:

[pre] A method for producing an oxygenated aqueous composition comprising: (Pet. 47–61);

[13a] flowing water at a flow rate no greater than 12 gallons per minute through an electrolysis emitter (Pet. 62 (relying on Ex. 1105, 5:33–36));

[13b] comprising an electrical power source electrically connected to an anode electrode and a cathode electrode contained in a tubular housing, causing electricity to flow from the power source to the electrodes, and, (Pet. 62 (relying on Ex. 1105, 2:58–68, 4:5–10, 4:26–30));

[13c] producing the composition comprising a suspension comprising oxygen microbubbles and nanobubbles in the water, the microbubbles and nanobubbles having a bubble diameter of less than 50 microns, (Pet. 62–63 (relying on Ex. 1102, 107; Ex. 1103 ¶¶ 91, 106, 111–157));

[13d] wherein: the anode electrode is separated at a critical distance from the cathode such that the critical distance is from 0.005 inches to 0.140 inches; (Pet. 63 (relying on Ex. 1105, 3:43–48; Ex. 1103 ¶¶ 84, 100));

[13e] the power source produces a voltage no greater than about 28.3 volts and an amperage no greater than about 13 amps, (Pet. 63 (relying on Ex. 1105, 5:65–68, 9:59–65; Ex. 1103 ¶¶ 124, 127, 130, 132, 147, 150, 153, 156));

[13f] the tubular housing has an inlet and an outlet and a tubular flow axis from the inlet to the outlet; (Pet. 64 (relying on Ex. 1105, 2:60–63, Fig. 11; Ex. 1103 ¶ 87));

[13g] the water flows in the inlet, out the outlet, is in fluid connection with the electrodes, (Pet. 64 (relying on Ex. 1105, Figs. 2, 11; Ex. 1103 ¶¶ 87, 102));

[13h] and the water flowing into the inlet has a conductivity produced by the presence of dissolved solids such that the water supports plant or animal life. (Pet. 64–65 (relying on Ex. 1105, 5:7–11, 5:22–27; Ex. 1103 ¶¶ 89, 104)).

Petitioner also argues that Davies anticipates claims 14, 17–23, and 25. Pet. 65–69.

2. *Analysis*

As we noted in our Institution Decision, Davies does not appear to explicitly disclose the “microbubbles and nanobubbles having a bubble

diameter of less than 50 microns” limitation of claim 13. Dec. 35–36; Pet. 62–63. Petitioner argues that the ’415 patent “admits that the claimed critical distance creates microbubbles and nanobubbles” and because “Davies has the same configuration, Davies is ‘capable of providing the same results.’” Pet. 62 (citing Ex. 1101, Abstract; Ex. 1103 ¶¶ 91, 106).

Patent Owner argues that Davies has a “serpentine” embodiment and a “straight through” embodiment. PO Resp. 32–33. In the serpentine embodiment, Patent Owner argues that Davies does not: (a) disclose the claimed electrode gap between 0.005 and 0.140 inches; (b) teach an amperage no greater than about 13 amps; (c) expressly teach microbubbles and nanobubbles; and (d) inherently yield microbubbles and nanobubbles. *Id.* at 33–46. In the straight-through embodiment, Patent Owner argues that Davies does not: (a) teach a flow rate of less than 12 gallons per minute; (b) disclose the claimed electrode gap between 0.005 and 0.140 inches, an amperage no greater than about 13 amps, or creating microbubbles and nanobubbles; (c) inherently yield microbubbles and nanobubbles; and (d) factor water temperature into the process. *Id.* at 46–49.

Regarding microbubbles and nanobubbles, Patent Owner argues that “Petitioner does not even argue that Davies teaches the creation of microbubbles or nanobubbles,” but “instead relies on inherency to meet this claim element.” PO Resp. 38. Regarding the serpentine embodiment, Patent Owner argues that (i) the creation of microbubbles and nanobubbles would frustrate Davis’s purpose; (ii) as argued in connection with Ground 1, the ’415 patent does not “admit” that microbubbles and nanobubbles are invariably produced; (iii) also as argued in connection with Ground 1, Petitioner did not test for nanobubbles; (iv) Petitioner’s testing “chose a

combination of values to arrive at a device and operation that is never described by Davies,” without providing any rationales for selecting those variables; and (v) Petitioner’s testing failed to provide a control that disclosed how many bubbles were in the water before the water entered the reproduced device, so there is “no reason to conclude his serpentine embodiment created any bubbles at all;” it is possible the bubbles were “simply present in the water before it ever went into the apparatus,” or “the result of the water splashing from the apparatus.” *Id.* at 39–46. Patent Owner also argues that the straight-through embodiment does not inherently create microbubbles and nanobubbles for the same reasons as the serpentine embodiment, and that Petitioner used the wrong flow rate for the straight-through embodiment, which “error in flow rate would have had a significant effect on the production of bubbles.” *Id.* at 47–49 (citing Ex. 2172, 108:15–21 (Dr. Tremblay acknowledging that the reduced flow rate used in the straight-through embodiment was inconsistent with the teachings of Davies)).

Petitioner replies that (i) microbubbles and nanobubbles are inherent “regardless of whether Davies was ‘focused’ on them; (ii) its Ground 1 arguments regarding admissions apply; (iii) its Ground 1 arguments regarding testing apply; (iv) its earlier arguments regarding ranges for electrode dimensions apply, in that the physical size of electrodes is a predictable art; and (v) there is no discussion of a “control” photograph in the ’415 patent specification. Reply 18–19.

Patent Owner responds that, despite the Response outlining “reasons why Davies—which is not designed to make bubbles at all—does not inherently create microbubbles, much less nanobubbles,” Petitioner’s Reply

“did not resolve those issues.” Sur-Reply 18–19. Patent Owner first argues that even if Dr. White acknowledged that Davies’s electrolysis would create oxygen and hydrogen, this does not mean it would create bubbles rather than dissolved oxygen, let alone microbubbles or nanobubbles. *Id.* at 19 (citing Ex. 1147, 194:16–197:22, 50:17–51:3). Second, Patent Owner argues that Petitioner’s argument about the predictability of the physical size of electrodes is irrelevant to anticipation. *Id.* at 19–20 (citing *Galderma Labs., L.P. v. Teva Pharms. USA, Inc.*, 799 Fed. Appx. 838, 846 (Fed. Cir. 2020) for the proposition that inherency was not shown because the expert admitted that variations in formula parameters can affect the results). Third, Patent Owner argues that Petitioner’s argument about the ’415 patent lacking a control is inapposite, because Petitioner must compare the prior art to the claims, not the specification. *Id.* at 20.

On this complete record, we find that Davies does not inherently disclose microbubbles or nanobubbles as required by independent claim 13. As discussed above in connection with Ground 1, we are not persuaded that the ’415 patent “admits” to production of microbubbles and nanobubbles when the electrodes are separated by a critical distance. *See supra* Section II.E.2.b.i. As such, Petitioner’s arguments regarding the separation distance of Davies’ electrodes are insufficient to show that Davies discloses production of microbubbles or nanobubbles. *See, e.g.*, Pet. 63. Regarding testing the device constructed according the parameters set forth in Davies, Petitioner apparently had the ability to test directly for nanobubbles in both the serpentine and straight-through Davies-based testing devices, but did not do so. *See supra* Section II.E.2.b.ii; Sur-Reply 2–3. Patent Owner points out that nanobubbles, which Petitioner’s expert indicated were on the order

of 0.1 microns, are detectable using available technology that Petitioner knew of and had used in the past. Sur-Reply 2–3. However, Petitioner’s expert acknowledged that he did not do any testing that would determine whether nanobubbles were formed. Sur-Reply 7 (citing Ex. 2172, 70:1–4). We agree with Patent Owner that the lack of a control disclosing how many bubbles were in the water before it entered the Davies reproductions makes it “impossible to know whether any of the detected particles by either device were created by the ‘reproduction’ or existed beforehand.” PO Resp. 45. Also, we are not persuaded that the straight-through embodiment experiments were conducted at the appropriate flow rate, for the reasons given by Patent Owner. *Id.* at 48–49.

Every dependent claim challenged under Petitioner’s Ground 7 includes the microbubbles and nanobubbles limitation of claim 13, and, accordingly, Petitioner does not make its case as to these dependent claims. None of Petitioner’s arguments as to anticipation of the dependent claims by Davies rectifies the microbubble and nanobubble deficiency. We analyze the parties’ separate arguments for the dependent claims, below.

Regarding claim 18, Petitioner argues that as “with any electrolytic water treatment process, water temperature is a factor in the electrolytic process of Davies.” Pet. 66. Patent Owner argues that “Davies does not otherwise teach any steps to account for or modify the operation based on water temperature,” apart from disclosing that the straight-through embodiment is used in pools and hot tubs. PO Resp. 49. Petitioner replies that Davies uses the “ambient temperature” of the water in “the same way the ’415 patent does – it treats unheated water that has fish swimming in it.” Reply 20. Patent Owner argues that “Petitioner’s argument on this claim

fails for the same reason as it did for Wikey.” Sur-Reply 21. For this claim, Petitioner has still failed to show that microbubbles or nanobubbles are present, and Petitioner’s argument that Davies “treats unheated water” fails to explain how Davies meets the claim 18 limitation that “water temperature is a factor for formation of the suspension.”

Regarding claim 21, Petitioner argues that because “Davies produces microbubbles and nanobubbles,” it “produces a suspension comprising microbubbles and nanobubbles that supersaturate the water.” Pet. 68. Patent Owner refers to its Wikey/Ground 1 arguments that Petitioner has failed to show that the Davies necessarily supersaturates the water. PO Resp. 49. Petitioner replies that “supersaturation is an inherent result of producing ‘microbubbles’ and ‘nanobubbles’ for an extended period of time because they remain suspended in the water” and testing indicates that the Davies embodiments made the water milky. Reply 20–21 (citing Ex. 1101, Abstract, 4:27–38; Ex. 1103 ¶ 35). Patent Owner responds that the “milky” argument is new and should be ignored, as well as based entirely on attorney argument about two images. Sur-Reply 21–22. We agree that new arguments on reply are not appropriate, and that Petitioner’s Reply is unclear about how to interpret the images absent additional testimony.

Regarding claim 22, Petitioner argues that “Davies’ microbubbles and nanobubbles have a diameter less than 0.0006 inches, as admitted” during prosecution of the ’415 patent and in the ’415 patent itself. Pet. 68–69. Patent Owner argues that neither embodiment of Davies teaches bubbles having a diameter less than 0.0006 inches (~15 microns), referring to its earlier arguments that Davies does not create bubbles less than 50 microns. PO Resp. 50–52. Petitioner replies that this dimension is an “inherent

result” of an electrolysis emitter with the preferred parameters, and that Petitioner’s testing “confirms that this limitation is met in the prior art at least to the same extent the ’415 patent discloses it.” Reply 21–22. This argument is linked to our analysis of whether Davies discloses microbubbles or nanobubbles, above, which we determine it does not.

Regarding claim 25, Petitioner argues that “Davies’ microbubbles and nanobubbles are incapable of breaking the surface tension of the water, as admitted” during prosecution of the ’415 patent and in the ’415 patent itself. Pet. 69. Patent Owner argues that Petitioner has not shown that the bubbles created by Davies are substantially incapable of breaking the surface tension of the water, referring to its earlier arguments that Petitioner did not test for bubbles with this property, and that Petitioner’s bubbles appeared to disappear almost immediately. PO Resp. 52 (citing PO Resp. §§ V.B.5, V.B.2.b.ii). Petitioner replies that this element “is inherently present in the prior art.” Reply 22 (citing Ex. 2179, 9, 17). This argument is linked to our analysis of whether Davies discloses that microbubbles or nanobubbles are necessarily formed, above, which we determine it does not. We also agree with Patent Owner that a lack of testing for this property, together with results that apparently disprove the existence of this property, undermine Petitioner’s arguments regarding this claim.

Thus, for the foregoing reasons, Petitioner does not persuade us, by a preponderance of the evidence, that claims 13, 14, and 17–23, and 25 of the ’415 patent are unpatentable as anticipated by Davies.

*H. Asserted Obviousness Based on Davies and Other References
(Grounds 8–24)*

Petitioner asserts the following obviousness challenges based on Davies:

- Ground 8: claims 13, 14, 17–23, and 25 over Davies and Hough (Pet. 70–71);
- Ground 9: claims 13, 14, 17–23, and 25 over Davies and Erickson (Pet. 72–74);
- Ground 10: claims 13, 14, 17–23, and 25 over Davies, Erickson, and Hough (Pet. 74);
- Ground 11: claims 13, 14, 17–23, and 25 over Davies and Erickson and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 74–75);
- Ground 12: claims 13, 14, 17–23, and 25 over Davies, Erickson, and Hough and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 75);
- Ground 13: claim 24 over Davies and Schoeberl (Pet. 75–77);
- Ground 14: claim 24 over Davies, Schoeberl, and Hough (Pet. 77–78);
- Ground 15: claim 24 over Davies, Erickson, and Schoeberl (Pet. 78);
- Ground 16: claim 24 over Davies, Erickson, Schoeberl, and Hough (Pet. 78);

- Ground 17: claim 24 over Davies, Erickson, and Schoeberl and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 78–79);
- Ground 18: claim 24 over Davies, Erickson, Schoeberl, and Hough and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 79);
- Ground 19: claims 26 and 27 over Davies and Peters (Pet. 79–81);
- Ground 20: claims 26 and 27 over Davies, Peters, and Hough (Pet. 82);
- Ground 21: claims 26 and 27 over Davies, Peters, and Erickson (Pet. 82);
- Ground 22: claims 26 and 27 over Davies, Peters, Erickson, and Hough (Pet. 82);
- Ground 23: claims 26 and 27 over Davies, Peters, and Erickson and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 83); and
- Ground 24: claims 26 and 27 over Davies, Peters, Erickson, and Hough and in view of the general knowledge, experience, and common sense of one of ordinary skill in the art, as reflected in Wendt, Han, Glembotsky, and Burns (Pet. 83).

For Ground 8, Petitioner argues that one of ordinary skill in the art would have been motivated to combine Davies and Hough because they both “address the same field” and, based on their “disclosure of similar structures and components to achieve similar goals,” one of ordinary skill in the art would have “been motivated, and found it obvious, to combine them.”

Pet. 71. For Ground 9, Petitioner argues that one of ordinary skill in the art would have been motivated to combine Davies and Erickson because they both “address the same field” and, based on their “disclosure of similar structures and components to achieve similar goals,” one of ordinary skill in the art would have “understood that the systems are easily compatible, and would have found it obvious to combine them.” *Id.* at 73. For Ground 10, Petitioner relies on its Ground 8 and Ground 9 arguments. *Id.* at 74. For Ground 11, Petitioner relies on Wendt, Han, Glembotsky, and Burns to illustrate the principle that “water electrolysis produces those small oxygen bubbles” having “a size less than 50 microns.” *Id.* at 74–75. For Ground 12, Petitioner relies on its Ground 10 and Ground 11 arguments. *Id.* at 75. For Ground 13, Petitioner argues that “Davies and Schoeberl both disclose electrolysis cells for sterilizing water” and that one of ordinary skill in the art would have been “motivated, and found it obvious, to combine them” because they disclose “similar structures and components.” *Id.* at 76. Petitioner adds that it would have been obvious to provide the preferred electrode separation of Schoeberl to the flat sheet electrodes of Davies “to achieve an advantageous laminar flow between the electrodes.” *Id.* at 77. For Grounds 14 and 15, Petitioner refers back to its rationale for Ground 13; for Grounds 16 and 17, Petitioner refers back to its rationale for Ground 15; for Ground 18, Petitioner refers back to its rationale for Ground 16. *Id.*

at 77–79. For Ground 19, Petitioner argues that one of ordinary skill in the art would have been motivated to combine Davies and Peters because they both “address the same field” and one of ordinary skill in the art would have “found it obvious to replace the flat sheet electrodes of Davies with concentric tubular electrodes like those taught by Peters.” *Id.* at 80–81. For Grounds 20 and 21, Petitioner refers back to its rationale for Ground 19. *Id.* at 82. For Grounds 22 and 23, Petitioner refers back to its rationale for Ground 21. *Id.* at 82–83. For Ground 24, Petitioner refers back to its rationale for Ground 22. *Id.* at 83.

Patent Owner argues generally that “Petitioner’s obviousness arguments all fail because Petitioner does not articulate any motivations in support of the proposed obviousness combinations,” and more particularly, “Petitioner does not identify any reason a POSA would have been motivated to modify the prior art to produce microbubbles or nanobubbles.” PO Resp. 53. Patent Owner also argues that Petitioner fails to explain why or how one of ordinary skill in the art would modify Davies, and “does not even attempt to suggest a POSA would have had a reasonable expectation that the modification would have achieved that objective.” *Id.* at 55. As noted above, Patent Owner argues that the Reply presents new arguments, and:

Even with Petitioner’s new arguments, Petitioner’s obviousness grounds remain deficient for at least four general reasons. First, the Petition did not identify any motivation to make the identified combination. Second, the Petition did not explain how the secondary references would be combined with the primary reference. Third, the petition did not explain why a POSA would have had a reasonable expectation of success in making the relevant combination. Finally, many of the Petitioner’s alleged

combinations do not even attempt to resolve the primary references' failure to meet certain claim elements.

Sur-Reply 22–23.

As we noted in our Institution Decision, we were skeptical that Petitioner's reason to combine arguments were sufficient on the record at that point in the proceeding. Dec. 39. On the complete record, we find that Petitioner's arguments are insufficient to establish obviousness under the heightened standard for a final written decision. *See Tri Vascular*, 812 F.3d at 1068. It is still unclear, based on Petitioner's proffered reasoning, which portions of the cited secondary references would be combined with Davies, how they would be combined with Davies, and whether one of ordinary skill in the art would have had a reasonable expectation of success combining them with Davies. This pertains to each of the claims identified in each of Grounds 8–24. Moreover, all of the obviousness combinations proposed by Petitioner in Grounds 8–24 inherit the microbubbles and nanobubbles problem of Ground 7.

These concerns are not resolved by the Reply, in which the arguments appear to be new (Reply 22–25; *see also Henny Penny*, 938 F.3d at 1330–31), or insufficient in the same manner the Petition's obviousness arguments were insufficient (*see, e.g.,* Reply 23 (citing Ex. 1103 ¶¶ 80–100, 193)). Additionally, even if we were to evaluate Petitioner's Reply arguments on the merits, we agree with Patent Owner's positions, as explained further below. *See* PO Resp. 53–55, 59–64; Sur-Reply 22–25, 27–28.

In Ground 8, according to Patent Owner, Petitioner “does not even argue that Hough resolves the issues with Davies' disclosure,” provides only conclusory arguments for the combination, and does not explain “what

Hough would motivate a POSA to change about the design of Davies.” PO Resp. 59–60. Petitioner replies that it “cites Hough to show what a POSITA would have understood about Davies’s teachings, not to physically modify Davies.” Reply 22. Because “Petitioner did not cite Hough to ‘physically modify Davies,’” Patent Owner responds, the combination fails “at least because it doesn’t remedy any of the issues identified with respect to Ground 7.” Sur-Reply 27. We agree with Patent Owner that Ground 8 does not remedy the issues with Ground 7. Additionally, despite Petitioner’s argument that it cited Hough merely to show what a POSITA would have understood about Davies’s teachings, this is contrary to Petitioner’s original statement that “a POSITA would have been motivated, and found it obvious to, combine” Davies and Hough “based on their disclosure of similar structures and components to achieve similar goals.” Pet. 71.

In Ground 9, Patent Owner argues that Petitioner fails to identify any motivation to combine, because (1) simply being directed to removing impurities from water does not give rise to a motivation to modify Davies; (2) Erickson suggests a voltage that barely overlaps with the highest voltage permitted by the claims; and (3) Petitioner fails to argue that Erickson resolves most of the deficiencies of Davies in Ground 7. PO Resp. 60–61, 61–62 (referring to Petitioner’s Ground 9 argument for Grounds 10–12). Petitioner does not respond directly to Patent Owner’s arguments for Grounds 9–12. Sur-Reply 27; *see generally* Reply. We agree with Patent Owner that Grounds 9–12 do not remedy the issues with Ground 7.

In Ground 13, Patent Owner argues that Petitioner fails to “identify any motivation” for the combination of Davies and Schoeberl, fails to explain why the distance between Schoeberl’s electrodes would help clarify

water, and fails to account for Schoeberl's focus on a "reduction in the formation of undesired gas bubbles." PO Resp. 62–63 (citing Ex. 1108, 1:44–49); *see also id.* (arguing that Grounds 14–18, which cite Grounds 8, 9, 11, and 13, do not resolve the deficiencies in those grounds). Petitioner replies that Schoeberl's electrode gap "would have motivated a POSITA to try the Schoeberl electrode gap in the Davies device, with a reasonable likelihood of success." Reply 23 (citing Ex. 1103 ¶ 193). Patent Owner responds that Petitioner's Reply did not dispute any of Patent Owner's arguments. Sur-Reply 27. We do not see where the arguments made in the Reply regarding Ground 13 were properly presented in the first instance in the Petition. Pet. 75–77. Our concerns about the arguments in the Petition are not resolved by the Reply's either new or insufficient arguments. Reply 23. Additionally, even if we were to evaluate Petitioner's Reply argument on the merits, there is insufficient articulation of a reason to combine Davies with Schoeberl, or of reasonable expectation of success. Sur-Reply 27.

In Ground 19, Patent Owner argues that Petitioner "does not argue Peters resolves Davies' failures to meet the elements of claim 13 discussed in response to Ground 7" and that neither of these two references "are directed to creating oxygen bubbles in water." PO Resp. 64. Patent Owner also argues that "Petitioner also does not explain why or how a POSA would modify the disclosure of Davies to use the electrode configuration of Peters while still maintaining the allegedly relevant disclosures from Davies." *Id.*; *see also id.* (arguing that Grounds 20–24, which cite Grounds 8, 9, 11, and 19, do not resolve the deficiencies in those grounds). Petitioner replies that one of ordinary skill in the art would have "considered the general

teachings regarding electrode designs of Peters to be applicable to an electrolysis cell for treating water such as the Davies cell” and the “express teachings of Peters thus would have motivated a POSITA to replace Davies’ electrodes with concentric tubular electrodes like those taught by Peters, with a reasonable likelihood of success.” Reply 24–25. Patent Owner responds that Peters “does not address any of Davies’s deficiencies with respect to claim 13” and “the Petition failed to address how or why a POSA would modify Davies to use the configuration of Peters while still maintaining the relevant disclosures from Davies.” Sur-Reply 28. We agree with Patent Owner that Grounds 19–24 do not remedy the issues with Davies and claim 13. Additionally, although Petitioner presents arguments on reply that appear to recharacterize its Petition arguments, we find Petitioner’s arguments on reply to be either new, or insufficient in the same manner as the arguments in the Petition.

In sum, Petitioner does not persuade us that it has established, by a preponderance of the evidence, that claims 13, 14, and 17–27 of the ’415 patent would have been obvious on any of the bases articulated in Grounds 8–24.

III. MOTION TO SEAL

Patent Owner moves to seal Exhibits 2116 (which is an unredacted version of Exhibit 2117), 2129, 2151–2156, 2176, 2177, 2179, 2182–2185, and “an unredacted version of its Patent Owner Response.” Paper 37. Patent Owner represents that these documents “include information Petitioner designated as confidential or filed under seal in the co-pending district court action. Pursuant to the amended protective order in that matter, Patent Owner was therefore required to move to seal these documents.” *Id.*

We previously entered the Protective Order proposed by the parties (Ex. 2113), which differed from the Board's standard protective order. Paper 20. We find Patent Owner's Motion to Seal persuasive. Accordingly, we grant Patent Owner's Motion to Seal.

IV. CONCLUSION

For the reasons discussed above, we determine Petitioner does not meet its burden of establishing, by a preponderance of the evidence, that the challenged claims are unpatentable, as summarized in the following table:

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
13, 18–23, 25	§ 102	Wikey		13, 18–23, 25
13, 18–23, 25	§ 103	Wikey, AFD		13, 18–23, 25
13, 18–23, 25	§ 103	Wikey, AFD, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		13, 18–23, 25
26, 27	§ 103	Wikey, Clark		26, 27
26, 27	§ 103	Wikey, Clark, AFD		26, 27

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
26, 27	§ 103	Wikey, Clark, AFD, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		26, 27
13, 14, 17–23, 25	§ 102	Davies		13, 14, 17–23, 25
13, 14, 17–23, 25	§ 103	Davies, Hough		13, 14, 17–23, 25
13, 14, 17–23, 25	§ 103	Davies, Erickson		13, 14, 17–23, 25
13, 14, 17–23, 25	§ 103	Davies, Erickson, Hough		13, 14, 17–23, 25
13, 14, 17–23, 25	§ 103	Davies, Erickson, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		13, 14, 17–23, 25

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
13, 14, 17– 23, 25	§ 103	Davies, Erickson, Hough, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		13, 14, 17–23, 25
24	§ 103	Davies, Schoeberl		24
24	§ 103	Davies, Schoeberl, Hough		24
24	§ 103	Davies, Erickson, Schoeberl		24
24	§ 103	Davies, Erickson, Schoeberl, Hough		24

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
24	§ 103	Davies, Erickson, Schoeberl, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		24
24	§ 103	Davies, Erickson, Schoeberl, Hough, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		24
26, 27	§ 103	Davies, Peters		26, 27
26, 27	§ 103	Davies, Peters, Hough		26, 27
26, 27	§ 103	Davies, Peters, Erickson		26, 27
26, 27	§ 103	Davies, Peters, Erickson, Hough		26, 27

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
26, 27	§ 103	Davies, Peters, Erickson, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		26, 27
26, 27	§ 103	Davies, Peters, Erickson, Hough, the general knowledge, experience, and common sense of a POSITA, as reflected in Wendt, Han, Glembotsky, and Burns		26, 27
Overall Outcome				13, 14, 17–27

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner does not establish, by a preponderance of the evidence, that claims 13, 14, and 17–27 of U.S. Patent No. RE45,415 E are unpatentable;

ORDERED that Patent Owner’s Motion to Seal is *granted*; and

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FURTHER ORDERED that this is a Final Written Decision;
therefore, 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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