

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

10X GENOMICS, INC.,
Petitioner,

v.

RAINDANCE TECHNOLOGIES, INC.,
Patent Owner.

Case IPR2015-01558
Patent 8,658,430 B2

Before MICHAEL P. TIERNEY, *Vice Chief Administrative Patent Judge*,
TINA E. HULSE and ELIZABETH M. ROESEL, *Administrative Patent Judges*.

ROESEL, *Administrative Patent Judge*.

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

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, 10X Genomics, Inc. (“Petitioner”) challenges the patentability of claims 1–17 of U.S. Patent No. 8,658,430 B2 (Ex. 1001, “the ’430 patent”), assigned to RainDance Technologies, Inc. (“Patent Owner”).

We have jurisdiction under 35 U.S.C. § 6. This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–17 of the ’430 patent are unpatentable.

I. BACKGROUND

A. Procedural History

On July 8, 2015, Petitioner filed a Petition requesting *inter partes* review of claims 1–17 of ’430 patent. Paper 2 (“Pet.”). On November 2, 2015, Patent Owner filed a Preliminary Response. Paper 11 (“Prelim. Resp.”).

On January 19, 2016, we instituted *inter partes* review of claims 1–17. Paper 13 (“Institution Decision” or “Dec.”).

On February 2, 2016, Patent Owner filed a request for rehearing of our Institution Decision. Paper 15. On February 24, 2016, we denied rehearing. Paper 18 (“Rehearing Decision” or “Rhg. Dec.”)

On April 25, 2016, Patent Owner filed a Patent Owner Response. Paper 21 (“PO Resp.”). On July 14, 2016, Petitioner filed a Reply to Patent Owner’s Response. Paper 26 (“Pet. Reply”).

Petitioner submitted a Declaration of Wilhelm T.S. Huck, Ph.D. with the Petition. Ex. 1002. On April 13, 2016, Patent Owner cross-examined Dr. Huck and filed a transcript of the deposition testimony as Exhibit 2015.

With the Patent Owner Response, Patent Owner submitted a Declaration of Todd Squires, Ph.D. (Ex. 2012) and a Declaration of Darren Link, Ph.D. (Ex. 2014). Petitioner cross-examined Drs. Squires and Link and filed transcripts of the deposition testimony as Exhibit 1030 and Exhibit 1037.

Petitioner submitted a Second Declaration of Wilhelm T.S. Huck, Ph.D. with the Reply. Ex. 1036. On August 23, 2016, Patent Owner again cross-examined Dr. Huck and filed a transcript of the deposition testimony as Exhibit 2017. On August 31, 2016, Patent Owner filed a Motion for Observations on the Cross-Examination of Dr. Huck. Paper 37. On September 7, 2016, Petitioner filed a Response to Patent Owner's Motion for Observations on the Cross-Examination of Dr. Huck. Paper 40.

An oral hearing was held September 27, 2016. A transcript of the hearing was entered in the record. Paper 45 ("Tr.").

B. Related Proceedings

The parties identify *RainDance Technologies, Inc. v. 10X Genomics, Inc.*, 1:15-cv-00152-RGA (D. Del. Feb. 12, 2015) as a related matter involving the '430 patent. Pet. 51; Paper 19.

C. The '430 Patent (Ex. 1001)

The '430 patent relates to a method for droplet formation. Ex. 1001, 16:20 (claim 1). As summarized in the Abstract,

[T]he invention provides methods for manipulating droplet size that include forming droplets of aqueous fluid surrounded by an immiscible carrier fluid, and manipulating droplet size during the forming step by adjusting pressure exerted on the aqueous fluid or the carrier fluid.

Id. (Abstract); *id.* at 2:28–32 (same). According to the '430 patent, the method can be conducted in microfluidic channels of a microfluidic chip.

Id. at 2:45–46, 3:7–8. As explained in the background section of the '430 patent, microfluidic devices are useful for performing biological, chemical, and diagnostic assays. *Id.* at 1:26–27. Such devices include a substrate that is etched or molded to form channels for carrying one or more sample fluids and an immiscible carrier fluid. *Id.* at 1:27–31.

An exemplary device for droplet formation is shown in Figures 1 and 2 of the '430 patent:

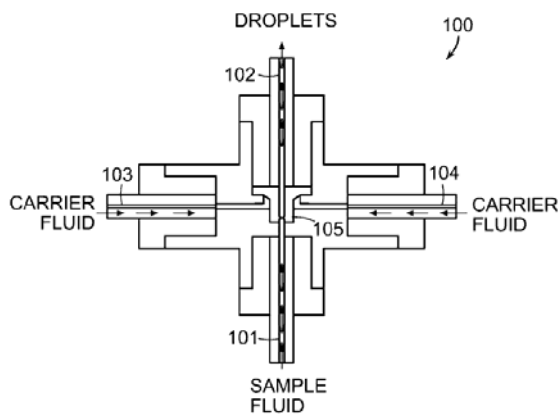


FIG. 1

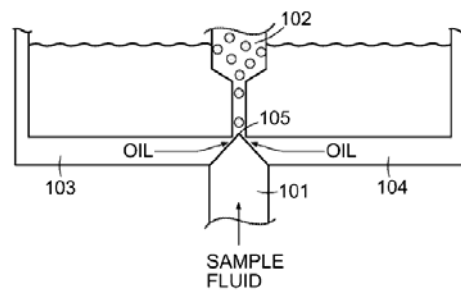


FIG. 2

Figures 1 and 2 are drawings showing a device for droplet formation. *Id.* at 3:33–34, 4:22–23, 4:28–30. As shown in Figure 1, device 100 includes inlet channel 101, outlet channel 102, and carrier fluid channels 103 and 104, all four of which meet at junction 105. *Id.* at 4:23–25. A sample fluid flows through inlet channel 101, and a carrier fluid that is immiscible with the sample fluid flows through channels 103 and 104. *Id.* at 4:26–28. Droplets are formed at junction 105, where the sample fluid interacts with the carrier fluid to form droplets of sample fluid surrounded by immiscible carrier fluid, which are received by outlet channel 102. *Id.* at 4:31–36. According to the '430 patent, the sample fluid is typically an aqueous buffer solution, and the

carrier fluid can be a non-polar solvent, such as fluorocarbon oil. *Id.* at 4:37–46.

D. Illustrative Claim

Claim 1 of the '430 patent, the sole independent claim, is reproduced below:

1. A method for droplet formation, the method comprising the steps of:
 - providing a plurality of aqueous fluids each in its own aqueous fluid channel in fluid communication with one or more immiscible carrier fluid channels;
 - forming droplets of aqueous fluid surrounded by an immiscible carrier fluid in the aqueous fluid channels;
 - applying a same constant pressure to the carrier fluid in each of the immiscible carrier fluid channels; and
 - adjusting pressure in one or more of the aqueous fluid channels, thereby to produce droplets of aqueous fluid in one or more outlet fluid channels.

Ex. 1001, 16:20–31.

E. Petitioner's Asserted References

Petitioner's patentability challenges are based on the following references:

Link et al., US 2008/0014589 A1, published Jan. 17, 2008 (Ex. 1004, "Link"); and

Nam-Trung Nguyen et al., *Optical Detection for Droplet Size Control in Microfluidic Droplet-Based Analysis Systems*, 117 SENSORS AND ACTUATORS B 431–36 (2006) (Ex. 1006, "Nguyen").

F. Instituted Grounds

1. Whether claims 1–7 and 12–17 are unpatentable under 35 U.S.C. § 102 as anticipated by Link;
2. Whether claims 1–7 and 10–17 are unpatentable under 35 U.S.C. § 103 as obvious over Link; and
3. Whether claims 8 and 9 are unpatentable under 35 U.S.C. § 103 as obvious over Link in view of Nguyen.

II. DISCUSSION

A. *Claim Construction*

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable interpretation in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). Under that standard, we generally give claim terms their ordinary and customary meaning, as understood by a person 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). We construe claim terms only to the extent necessary to resolve the controversy. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Construction of claims 1–3 is discussed below in connection with patentability of those claims over Link. Except for the terms of claims 1–3 discussed below, we determine that it is not necessary to provide an explicit construction of any other claim term for purposes of this decision.

B. Person of Ordinary Skill in the Art

Petitioner describes a person of ordinary skill in the art in July 2011 in terms of educational background, experience, and fields of scientific knowledge. Pet. 3–4 (citing Ex. 1002 ¶ 12). For example, Petitioner asserts that a person of ordinary skill in the art would have had a Ph.D. in chemistry, biochemistry, mechanical engineering, or a related discipline, with at least two years of experience in using, designing or creating microfluidic devices. *Id.* at 3. Petitioner further asserts that a person of ordinary skill in the art would have known how to research the scientific literature in fields relating to microfluidics, including fluid dynamics, microscale reactions, chemistry, biochemistry, and mechanical engineering, and to consult with team members having specialized skills in these fields. *Id.* at 4.

Patent Owner does not specifically contest Petitioner’s assertions regarding the level of ordinary skill in the art.

We accept Petitioner’s assertions regarding the level of ordinary skill in the art, as set forth in the paragraph bridging pages 3 and 4 of the Petition. Our finding is supported by Dr. Huck’s testimony (Ex. 1002 ¶ 12), as well as the prior art references cited by Petitioner, which reflect the level of skill in the art asserted by Petitioner. *See, e.g.*, Ex. 1004 ¶¶ 160, 316 (discussing use of aqueous droplets in microfluidic devices as “nanoreactors” for chemical and biochemical reactions and assays); Ex. 1006, 2 (discussing principles of fluid dynamics relevant to droplet formation in microfluidic devices);

Ex. 1009,¹ 2032 (review article addressing fluid dynamics of microfluidic droplets, including for “lab on a chip” applications in which chemical or biochemical reactions are performed in droplets). *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art, itself, can reflect the level of skill in the art).

Based upon their stated qualifications, we consider both Dr. Huck and Dr. Squires qualified to opine from the viewpoint of a person of ordinary skill in the art regarding the subject matter of the ’430 patent. Ex. 1002 ¶¶ 6–10; Ex. 1003 (Huck CV); Ex. 2012 ¶¶ 6–14; Ex. 2013 (Squires CV).

C. Patentability of Claims 1–7 and 10–17 over Link

1. Link (Ex. 1004)

Link is incorporated by reference in the ’430 patent, is commonly owned with the ’430 patent, and has a common inventor. Ex. 1001, 16:6–10; see PO Resp. 16.² The ’430 patent relies on Link to teach various aspects of the claimed invention, including: methods of forming aqueous droplets that are surrounded by an immiscible carrier fluid (Ex. 1001, 4:13–15); fluidic circuits arranged and controlled to produce an interdigitation of droplets of different sizes flowing through a channel (*id.* at 7:34–37); methods for performing polymerase chain reaction (“PCR”) in droplets (*id.* at 9:39–41); techniques for causing droplets to merge (*id.* at 9:55–58, 10:25–27); droplet formation modules arranged and controlled to produce an

¹ C. Baroud et al., *Dynamics of Microfluidic Droplets*, 10 LAB ON A CHIP 2032–45 (2010).

² Link qualifies as prior art to the challenged claims under 35 U.S.C. § 102(b) because its publication date, January 17, 2008, is more than one year before the filing date of the earliest application of which the ’430 patent claims priority benefit.

interdigitation of sample droplets and PCR reagent droplets flowing through a channel (*id.* at 10:7–11); detection modules and methods of detecting amplification products in droplets (*id.* at 12:11–13); droplet sorting (*id.* at 14:19–20); methods of releasing contents from the droplets (*id.* at 12:25–27); and microfluidic chips for performing biological, chemical, and diagnostic assays (*id.* at 14:50–52).

Link discloses microfluidic devices and methods of using such devices to generate aqueous phase droplets encapsulated by an inert immiscible oil stream. Ex. 1004 ¶ 86. An embodiment of a microfluidic device is shown in Link Figure 1, which is reproduced below with annotations added by the Board:

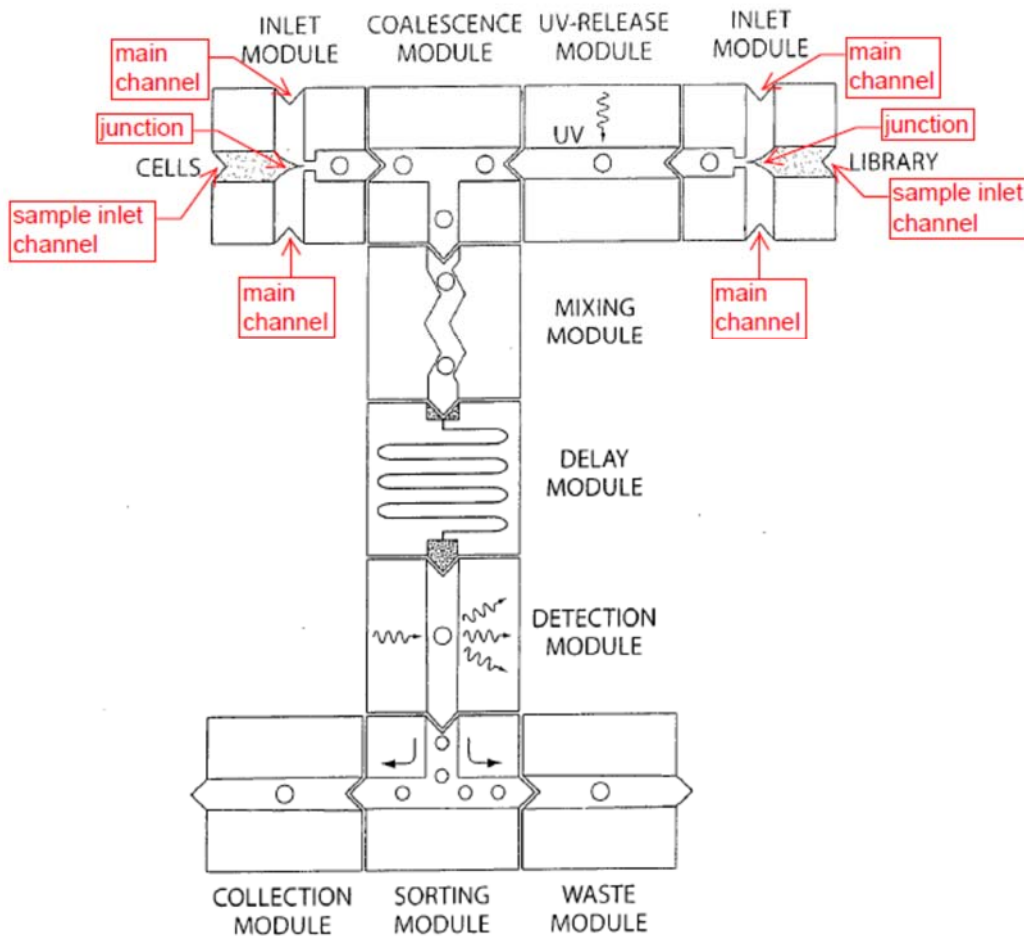


Fig. 1

Figure 1, depicted above, is a schematic illustration of a microfluidic device having multiple interacting modules. Ex. 1004 ¶¶ 49, 86. As shown in Figure 1, the device has two inlet modules where droplets are formed. *Id.* ¶¶ 10, 88, 129, 173, 174. Each inlet module comprises a junction between a main channel and a sample inlet channel, such that the sample is introduced into the main channel and forms a plurality of droplets. *Id.* at Fig. 1, ¶¶ 10, 173, 174. In Figure 1 above, our annotations identify the “main channel,” “junction,” and “sample inlet channel,” as described by Link. *Id.* ¶ 173; see

also page 36, *infra* (addressing Patent Owner’s argument (PO Resp. 40) regarding the “main channel” in Link).

Figures 2–6 of Link illustrate embedded microfluidic nozzles for forming sample droplet emulsions on a microfluidic substrate. *Id.* ¶¶ 50–54, 131. Link Figures 2A and 4 are essentially the same as Figures 1 and 2 of the ’430 patent, which are reproduced above. Link discloses methods for forming sample droplets using the devices shown in Figures 2A and 4. *Id.* at ¶¶ 130–133, 166, 173. Droplets are formed at a nozzle provided at the junction of an aqueous sample fluid channel and one or two oil channels. *Id.* at Figs. 2A, 4, ¶¶ 131, 173.

2. *Independent Claim 1*

a. *First Two Steps*

There is no dispute that Link discloses a method for droplet formation comprising the first two steps of claim 1 of the ’430 patent. *See* PO Resp. 18; Pet. Reply 1. We find that these steps are expressly disclosed by Link. Our finding is supported, for example, by Link paragraph 10, which discloses the following steps:

- (a) providing a microfluidic substrate including at least two inlet channels adapted to carry at least two dispersed phase sample fluids and at least one main channel adapted to carry at least one continuous phase fluid; (b) flowing a first sample fluid through a first inlet channel which is in fluid communication with the main channel at a junction, wherein the junction includes a first fluidic nozzle designed for flow focusing such that the first sample fluid forms a plurality of highly uniform, monodisperse droplets of a first size in the continuous phase; (c) flowing a second sample fluid through a second inlet channel which is in fluid communication with the main channel at a junction, wherein the junction includes a second fluidic nozzle designed for flow focusing such that the second sample

fluid forms a plurality of highly uniform, monodisperse droplets of a second size in the continuous phase . . .

Ex. 1004 ¶ 10; *see also id.* at Fig. 1, claim 1 (same). Link further discloses that the “dispersed phase sample fluids” may be aqueous fluids and that the “continuous phase fluid” can be an immiscible carrier fluid, such as oil. *Id.* ¶ 86 (creation of “aqueous phase droplets completely encapsulated by an inert immiscible oil stream”), ¶ 114 (“the discontinuous phase can be an aqueous solution and the continuous phase can a hydrophobic fluid such as an oil”); *see also* Pet. 17–21.

Link paragraph 10 thus discloses providing a plurality of aqueous fluids (“at least two dispersed phase sample fluids”), each in its own aqueous fluid channel (“a first inlet channel” and “a second inlet channel”) in fluid communication with one or more immiscible carrier fluid channels (“in fluid communication with the main channel” which is “adapted to carry at least one continuous phase fluid”), and forming droplets of aqueous fluid surrounded by an immiscible carrier fluid in the aqueous fluid channels (“said first sample fluid forms a plurality of . . . droplets . . . in said continuous phase” and “the second sample fluid forms a plurality of . . . droplets . . . in the continuous phase”). Ex. 1004 ¶ 10.

b. Pressure Limitations

The parties’ dispute focuses on the last two steps of claim 1, which we refer to as the “pressure limitations” or “pressure steps.” These steps recite:

applying a same constant pressure to the carrier fluid in each of the immiscible carrier fluid channels; and

adjusting pressure in one or more of the aqueous fluid channels, thereby to produce droplets of aqueous fluid in one or more outlet fluid channels.

Ex. 1001, 16:27–32.

c. Parties' Contentions

We instituted review of claims 1–7 and 10–17 based on obviousness in view of Link. Dec. 21. As explained in the Institution Decision and the Rehearing Decision, the Petition implicitly challenges claim 1 based on obviousness. Dec. 17–18, 21; Rhg. Dec. 3–4. More specifically, Petitioner cites Link paragraphs 38, 110, 132, 164–166, and 173–174, claim 16, and Figures 2A, 2B, and 3 as teaching the pressure limitations of claim 1. Pet. 21–24 (claim chart). Relying on the testimony of its expert, Petitioner contends that the pressure limitations of claim 1 would have been obvious in view of Link and would have been arrived at by a person of ordinary skill in the art as a matter of routine optimization of a results-effective variable (regulating pressure in the aqueous fluid channel or the immiscible carrier fluid channel) by selecting from among a finite number of predictable options based upon a cost-benefit analysis and design choice. Pet. 21–28, 37–40, 46–51; Pet. Reply 15–20; Ex. 1002 ¶¶ 42, 106–115; Ex. 1036 ¶¶ 33, 41, 75–91.

Patent Owner contends that none of the cited paragraphs of Link disclose the pressure limitations of claim 1. PO Resp. 18–39. Patent Owner further contends that Petitioner's analysis ignores the full range of design choices, that a cost-benefit analysis would not have led to the pressure limitations, that there would have been no reasonable expectation of successfully using pressure differences to control droplet size in a multi-junction device, and that Link teaches away from using a same constant pressure in each of the oil channels. PO Resp. 41–59.

d. Legal Standard for Obviousness

A claim is unpatentable for obviousness, 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 at the time the invention was made to a person having ordinary skill in the art. 35 U.S.C. § 103(a). In applying section 103, we assess the scope and content of the prior art, the level of ordinary skill in the relevant art, the differences between the claimed invention and the prior art, and whether the claimed invention would have been obvious to one of ordinary skill in the art in light of those differences. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

“[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). On the other hand, “the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a [factfinder] can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418.

When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.

Id. at 421.

e. Adjusting Step

We find that the final step of claim 1— “adjusting pressure in one or more of the aqueous fluid channels, thereby to produce droplets of aqueous fluid in one or more outlet fluid channels”—is disclosed by Link (Ex. 1004) paragraphs 166, 173, and 174 and Figure 1, when considered as a whole.

Our finding is supported by Link paragraph 166, which discloses “adjusting the pressure on the main and sample inlet channels” in order to regulate the size and periodicity of the droplets generated at the inlet module. Ex. 1004 ¶ 166. Our finding is also supported by Link paragraph 173, which discloses formation of droplets at an inlet module comprising a junction between the sample inlet channel and the main channel. *Id.* ¶ 173. Further support is found in Link paragraph 174, which describes embodiments having “two or more inlet modules,” and Link Figure 1, which shows an embodiment having two inlet modules. *Id.* ¶ 174, Fig. 1.

There is no dispute that Link’s sample inlet channels are aqueous fluid channels, as recited in claim 1. *See* Ex. 2012 ¶ 74 (describing “sample aqueous fluid inlet channel” in Link); *see also* Ex. 1004 ¶¶ 173, 174 (sample aqueous solutions are introduced through sample inlet channel of inlet module). Although Link paragraph 166 refers to the “inlet module” in the singular, we find that a person of ordinary skill in the art would have understood the disclosure of Link paragraph 166 as applicable to each of the inlet modules described in paragraph 174 and shown in Link Figure 1. *See* Ex. 1002 ¶ 126 (Link discloses “using a microfluidic device with multiple inlet modules” and “that the size of droplets can be controlled by altering the pressure at those inlets,” citing paragraph 166).

We find that Link’s disclosure of “adjusting the pressure on the . . . sample inlet channels” at the inlet module (Ex. 1004 ¶ 166) coupled with Link’s disclosure of embodiments having “two or more inlet modules” (*id.* ¶ 174) teach one of ordinary skill in the art the adjusting step, i.e., “adjusting pressure in one or more of the aqueous fluid channels, thereby to produce droplets of aqueous fluid in one or more outlet fluid channels.”

f. Applying Step

The difference between the method of claim 1 and the method of droplet formation disclosed in Link relates to the step of “applying a same constant pressure to the carrier fluid in each of the immiscible carrier fluid channels.” Ex. 1001, 16:17–28. More specifically, we find that, although Link teaches controlling pressures applied to the carrier fluid and aqueous fluid channels to regulate droplet size and periodicity (Ex. 1004 ¶ 166), Link does not expressly disclose applying a “same constant pressure” to the carrier fluid in each of the immiscible carrier fluid channels, as recited in the penultimate step of claim 1.

For the reasons discussed below, we find that the preponderance of the evidence supports that a person of ordinary skill in the art would have found it obvious to implement Link’s disclosures by applying a same constant pressure to the carrier fluid in each of the immiscible carrier fluid channels. This step of claim 1 includes two aspects: (1) applying a same pressure, and (2) applying a constant pressure. We discuss each aspect below.

i. Same Pressure

The parties agree that the phrase, “applying a same constant pressure to the carrier fluid in each of the immiscible carrier fluid channels,” requires

that the same pressure be applied to all of the immiscible carrier fluid channels, e.g., oil channels, in a device. Pet. 11 (“the pressure is distributed equally across all channels”); PO Resp. 15 (“same constant pressure” requires that “all oil channels in the system have the same pressure applied to them”). The parties’ interpretation is consistent with the plain language of the claim, which states that the “same . . . pressure” is applied “to the carrier fluid in each of the immiscible carrier fluid channels.” We, therefore, adopt the parties’ agreed interpretation.

We find that, in view of Link’s disclosure of embodiments having two inlet modules (Ex. 1004 ¶¶ 10, 174, Fig. 1) and Link’s disclosure to regulate droplet size and periodicity by controlling pressures at the inlet module (*id.* ¶ 166), it would have been obvious to a person of ordinary skill in the art to apply the same pressure to the carrier fluid at each inlet module.

The record establishes that there were a finite number of identified, predictable ways of applying pressure to the carrier fluid in a device with multiple droplet-forming junctions, such as Link Figure 1. There are two kinds of evidence on this point: the first concerns the number of pressure sources for the carrier fluid channels, and the second concerns the pressures applied to each carrier fluid channel.

Regarding the number of pressure sources, the preponderance of the evidence establishes that a person of ordinary skill in the art would have had two choices: use separate pressure sources for each of the carrier fluid channels or use a common pressure source for all of the carrier fluid channels. There is no dispute that the second choice satisfies the “same . . . pressure” requirement of claim 1. See PO Resp. 1 (in the ’430 patent, “a

common regulator for the flow of oil . . . applies a same constant pressure to each of the oil channels across the entire device”).

Our finding is supported by the testimony of Petitioner’s expert, Dr. Huck. Dr. Huck avers that regulating pressure in either the aqueous fluid channels or immiscible carrier fluid channels are “the two ways in which pressure could be regulated to control droplet size.” Ex. 1002 ¶¶ 111, 115. In response to questions from Patent Owner as to whether Link discloses the same oil syringe for multiple oil lines, Dr. Huck explained that a person of ordinary skill in the art “can decide how many syringes he or she would use.” Ex. 2015, 196:12–197:3. In his reply declaration, Dr. Huck testifies that “a POSA would have been aware of systems in which a single carrier fluid source provided carrier fluid for multiple channels.” Ex. 1036 ¶ 41. Dr. Huck’s testimony establishes that the options available for applying pressure to the carrier fluid were finite in number and that one known option would have been to use a common pressure source for all of the carrier fluid channels.

Our finding is further supported by Patent Owner’s admission and the testimony of its expert. Dr. Squires testifies that, “[p]rior to the ’430 patent, one way to have a microfluidic system with multiple microfluidic circuits . . . would be to use ‘separate pressure regulators for each aqueous stream and each carrier fluid stream’ in each fluidic circuit.” Ex. 2012 ¶ 47 (quoting Ex. 1001, 1:66–67). At the hearing, Patent Owner conceded that a person of ordinary skill in the art would have been aware that a multi-junction device could be simplified by having one carrier fluid source for all of the circuits. Tr. 35:17–24. Taken together, the evidence establishes that separate pressure sources for each of the carrier fluid channels or a common

pressure source for all of the carrier fluid channels were two known ways of applying pressure to the carrier fluid in a multi-junction device.

As discussed above, there is no dispute that use of a common pressure source for carrier fluid satisfies the “same . . . pressure” requirement of claim 1. The use of separate pressure sources for each channel also satisfies the “same . . . pressure” requirement, provided that each source applies the same pressure.

Regarding the pressures applied to the carrier fluid channels, the preponderance of the evidence establishes that a person of ordinary skill in the art would have had at least two choices: apply the same pressure to all of the carrier fluid channels or apply different pressures to each of the carrier fluid channels. Our finding is supported by the undisputed testimony of Dr. Huck that, in Link Figure 1, the pressure applied to the four immiscible carrier fluid channels “can be the same.” Ex. 2015, 206:18–22; *see* PO Resp. 39 (quoting Dr. Huck’s testimony and citing no contrary evidence).

Accordingly, we find that the “same . . . pressure” aspect of the “applying” step represents one of a finite number of identified ways of applying pressure to the carrier fluid in a multi-junction device, such as shown in Link Figure 1. As further discussed below, a person of ordinary skill in the art would have had a reason to choose this option, and it would have led to predictable results.

ii. Constant Pressure

We find that, based on Link’s disclosures regarding pressure-driven pumps or syringes for driving carrier fluid flows into multiple channels (Ex. 1004 ¶¶ 38, 164, 166, claim 16) and controlling pressures at the inlet module to regulate droplet size and periodicity (*id.* ¶ 166), it would have

been obvious to a person of ordinary skill in the art to apply a constant pressure to the carrier fluid.

The record establishes that there were a finite number of identified, predictable ways of controlling the pressures applied to the carrier fluid and aqueous fluid in order to regulate the size and periodicity of the droplets at the inlet module. A person of ordinary skill in the art could have implemented Link's paragraph 166 teaching by: (1) keeping the carrier fluid pressure constant and adjusting the aqueous fluid pressure; (2) keeping the aqueous fluid pressure constant and adjusting the carrier fluid pressure; or (3) adjusting both the carrier fluid pressure and the aqueous fluid pressure. Ex. 1004 ¶ 166; Ex. 1002 ¶¶ 111, 115 (regulating the pressure in either the aqueous fluid channels or immiscible carrier fluid channels are "the two ways in which pressure could be regulated to control droplet size"); Ex. 1036 ¶ 33 (identifying three options listed above). We identified these options in our Institution Decision. Dec. 11. After considering the full record developed during trial, we see no reason to deviate from our prior finding.

We find that Link teaches applying a constant pressure to the carrier fluid by disclosing pressure-driven pumps or syringes for driving carrier fluid flows into multiple channels. Ex. 1004 ¶¶ 38, 164, 166, claim 16. Our finding is supported by the express disclosures of Link, *id.*, as well as the expert testimony.

Link discloses that both the dispersed phase (i.e., aqueous) fluid and the continuous phase (i.e., carrier) fluid can be "pressure driven" (*id.* ¶ 38, claim 16), and that "pressure drive[n] flow control, e.g., utilizing valves and pumps" can be used "to manipulate the flow . . . into one or more channels

of a microfluidic device” (*id.* ¶ 164). The expert testimony demonstrates that this pressure driven flow, as disclosed by Link, is correctly understood as the application of a constant pressure. Dr. Squires explains that one “class of well-known pressure-driven flows in microfluidics, employs pressure sources . . . which impose a specified pressure *P* to the fluid, upon which the fluid flows with flow rate *Q*.” Ex. 2012 ¶ 43. As noted by Dr. Huck (Ex. 1036 ¶¶ 13, 32, 60), Dr. Squires’ testimony acknowledges that constant pressure regulators were known in the art for driving the flow of carrier fluid in microfluidics. Ex. 2012 ¶ 43. The opinions of Dr. Huck and Dr. Squires are consistent with Exhibit 1005, which discloses “pressure-driven pumping for microfluidic applications,” including a pump capable of generating constant pressures on the oil and water channels for droplet formation. Ex. 1005,³ Title, Abstract, 046501-5, Fig. 3(d), 046501-9.

Link also discloses “pressurized syringes” for feeding into the main and sample inlet channels, i.e., the carrier fluid (oil) channels and aqueous fluid channels. Ex. 1004 ¶ 166; *see also id.* ¶¶ 56, 139 (disclosing “oil syringes”). Dr. Huck explains that these pressurized syringes can be either positive displacement (i.e., constant flow rate) or pressure-controlled (i.e., constant pressure) type devices. Ex. 2015, 225:7–20.

We find that Dr. Squires’ testimony (Ex. 2012 ¶ 43), Dr. Huck’s testimony (Ex. 1036 ¶¶ 13, 32, 60; Ex. 2015, 225:7–20), and Moscovici

³ M. Moscovici et al., *Electrical Power Free, Low Dead Volume, Pressure-Driven Pumping for Microfluidic Applications*, 4 BIOMICROFLUIDICS 046501-1 to 046501-9 (2010) (“Moscovici”). Moscovici was cited in the Petition and Dr. Huck’s initial declaration as teaching well-known pressure sources. Pet. 11, 14, 47; Ex. 1002 ¶¶ 31, 36, 132.

(Ex. 1005), collectively demonstrate that Link would have been understood by a skilled artisan as disclosing a pump or syringe for applying a constant pressure to the carrier fluid in each of the immiscible carrier fluid channels of a microfluidic device. Ex. 1004 ¶¶ 38, 164, 166, claim 16.

Accordingly, we find that the “constant pressure” aspect of the “applying” step represents one of a finite number of identified ways to implement Link’s paragraph 166 teaching regarding controlling pressures at the inlet module to regulate droplet size and periodicity. As further discussed below, a person of ordinary skill in the art would have had a reason to choose this option, and it would have led to predictable results.

g. Motivation

The record establishes at least two reasons or motivations for a person of ordinary skill in the art to implement Link’s teachings by applying a same constant pressure to the carrier fluid in each of the carrier fluid channels.

A first reason or motivation would have been to reduce cost and complexity by enabling the use of a single pressure regulator for all of the carrier fluid channels. Ex. 1002 ¶¶ 111, 115; Ex. 2012 ¶¶ 47, 143; Tr. 11:11–20, 16:3–13 (Petitioner), 35:17–24 (Patent Owner).

Dr. Huck testifies that a person of ordinary skill in the art would have used a cost/benefit analysis to determine which type of channel regulation would be most useful for controlling droplet size. Ex. 1002 ¶¶ 111, 115. Patent Owner’s declarants both acknowledge that cost and complexity would have been relevant considerations in determining how to regulate pressure in a microfluidic system. Ex. 2012 ¶¶ 47, 143; Ex. 2014 ¶ 12. Patent Owner and Dr. Squires concede that “a person of ordinary skill in the art would have preferred less regulators to more regulators (*i.e.*, less cost to more

cost).” PO Resp. 47; Ex. 2012 ¶ 143; *see also* Tr. 35:17–19 (Patent Owner: “one thing you could do to try simplify this is have one carrier fluid source for all of the circuits”).

The desire to reduce cost and complexity would thus have provided a reason for a person of ordinary skill in the art to use a single pressure regulator for all of the carrier fluid channels. As discussed above, there is no dispute that use of a single pressure source for all carrier fluid channels satisfies the “same . . . pressure” requirement of claim 1. PO Resp. 1.

A second reason or motivation for applying a same constant pressure to the carrier fluid in each of the carrier fluid channels would have been to produce a plurality of droplets of uniform size at each of two inlet modules, thereby enabling the user to compare reaction products between various droplets of the same size. Ex. 1002 ¶¶ 17, 110, 114; Ex. 2012 ¶ 74.

Dr. Huck testifies that a person of ordinary skill in the art would have been aware that, “when generating droplets in microfluidic devices, it was important to generate droplets of uniform size” and that such uniform size is “necessary” for applications involving “comparisons between reaction products in individual droplets.” Ex. 1002 ¶ 17; *see also id.* ¶¶ 110, 114 (“uniform droplets are desired when comparing reaction products between various droplets”). Dr. Squires explains that microfluidic devices having a plurality of inlet modules, as disclosed in Link, “can be used, for example, to compare reaction products between various droplets of the same size.” Ex. 2012 ¶ 74.

Link teaches, and the experts agree, that microfluidic devices having two inlet modules can be used to produce a plurality of highly uniform, monodisperse (i.e., same-sized) droplets at each module. Ex. 1004 ¶¶ 10,

115, 117; Ex. 1002 ¶¶ 17, 110, 114; Ex. 2012 ¶ 74. To produce a plurality of highly uniform, monodisperse, same-sized droplets at each of two inlet modules, the variables affecting droplet size would need to be the same at each inlet module, and such variables would need to be held constant while the droplets are being produced. See Ex. 2012 ¶ 88 (identifying variables affecting droplet size). Link teaches, and the experts agree, that one variable that affects droplet size is pressure on the carrier fluid. *Id.* ¶ 166; Ex. 2012 ¶ 88; Ex. 1002 ¶¶ 108, 113. The evidence thus establishes that, to produce a plurality of highly uniform, monodisperse, same-sized droplets at each of two inlet modules, as disclosed by Link, Ex. 1004 ¶¶ 10, 115, 117, a person of ordinary skill in the art would have applied the same pressure at each inlet module and would have held the applied pressure constant while the droplets are being produced.

Accordingly, we find that the desire to generate a plurality of same-sized droplets at each of two inlet modules, Ex. 1002 ¶¶ 17, 110, 114; Ex. 2012 ¶ 74, would have provided a second reason or motivation for a person of ordinary skill in the art to implement Link's teachings by applying a same constant pressure to the carrier fluid in each of the carrier fluid channels.

h. Predictability and Reasonable Expectation of Success

We find that a person of ordinary skill in the art would have had a reasonable expectation of being able to practice successfully the pressure steps of claim 1 based on Link's teachings and that practicing these steps would have led to predictable results.

Link shows that, by controlling the pressures applied to the oil and water sources, droplets of aqueous fluid surrounded by an immiscible carrier

fluid can predictably be produced at a junction between the carrier fluid and aqueous fluid channels. Ex. 1004 ¶¶ 10, 166, 173. Although Link and the '430 patent both teach that droplet size can be manipulated by adjusting the pressures applied to the aqueous fluid and/or the carrier fluid (Ex. 1001, Abstract; Ex. 1004 ¶ 166), the measure of success required by claim 1 is less demanding: “to produce droplets of aqueous fluid in one or more outlet fluid channels.” Ex. 1001, 16:30–31. *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367 (Fed. Cir. 2016) (The “correct inquiry” is whether there is “a motivation to combine accompanied by a reasonable expectation of achieving what is claimed in the patent-at-issue.”).

Our findings regarding predictability and a reasonable expectation of success are reinforced by evidence relied upon by Patent Owner. Patent Owner reproduces Exhibit 1012,⁴ Figure 4 (annotated), which shows predicted and actual droplet sizes at various oil and water pressures at a droplet-forming junction:

⁴ T. Thorsen, et al., *Dynamic Pattern Formation in a Vesicle- Generating Microfluidic Device*, 86 PHYS. REV. LETT. 4163–66 (2001) (“Thorsen”). Patent Owner refers to Thorsen as “the Quake reference,” using the name of another co-author. PO Resp. 50. We note that Figure 4 of Thorsen is also disclosed as Figure 21 of Quake et al. (US 2002/0058332 A1, published May 16, 2002) (Ex. 1007).

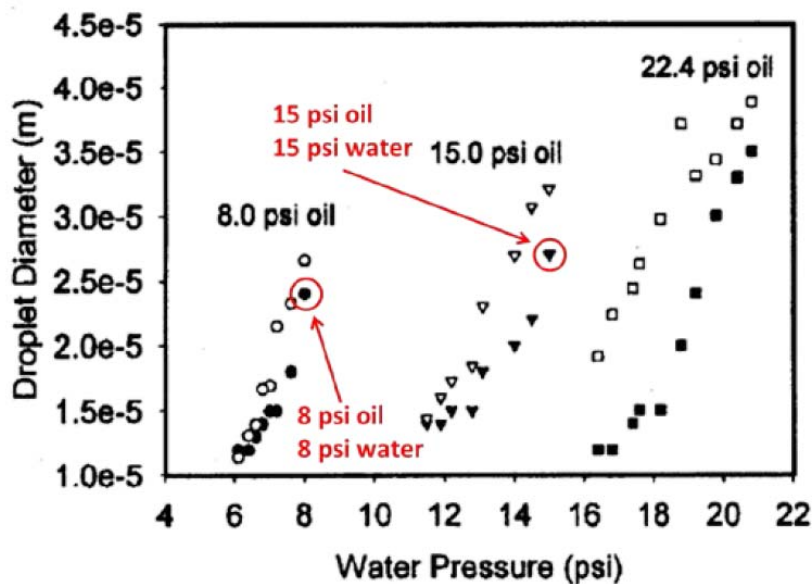


FIG. 4. Predicted vs actual drop size at different water and oil/surfactant pressures. The predicted sizes were calculated using Eq. (1). Open symbols, predicted size; solid symbols, experimental.

PO Resp. 50. The data show that, ten years before the filing date of the '430 patent, scientists predicted that droplet size could be controlled by applying a constant oil pressure, e.g., 8.0, 15.0, or 22.4 psi, and adjusting water pressure, e.g., from approximately 6 to 22 psi. Ex. 1012, Fig. 4. The predictions were confirmed by experimental results that closely track the predicted droplet size trends. *Id.* (identifying solid symbols as experimental results and open symbols as predicted size). Thorsen provides strong evidence that applying a constant oil pressure and adjusting water pressure to control droplet size was predictable and that a person of ordinary skill in the art would have had a reasonable expectation of being able to practice successfully the pressure steps of claim 1 of the '430 patent. *Id.*; Ex. 1036 ¶ 88; *see also* Ex. 1038 ¶ 16 (Dr. Squires characterizes Thorsen as a “seminal publication” that “led to an explosive growth in the interest in the field of generating droplets”).

i. Patent Owner's Arguments

Patent Owner argues that the pressure limitations of claim 1 are not disclosed by the portions of Link cited by Petitioner. PO Resp. 18–39.

Regarding Link paragraph 166, Patent Owner argues that it describes controlling pressure at only a single inlet module and provides no suggestion to apply a “same constant pressure” to all carrier fluid channels in a system having multiple microfluidic circuits. PO Resp. 20–21 (citing Ex. 2012 ¶¶ 85–87). Patent Owner's argument does not persuasively rebut Petitioner's evidence. Link discloses microfluidic devices having two or more inlet modules, and the disclosures of Link paragraph 166 would have been understood as applying to each of those inlet modules. Ex. 1004 ¶¶ 10, 166, 174, Fig. 1; Ex. 1002 ¶ 126. For the reasons discussed above, we find that it would have been obvious to a person of ordinary skill in the art to implement Link's teachings by applying the same pressure to the carrier fluid at each inlet module.

Next, Patent Owner argues that Link discloses different sources for every oil channel and follows the “conventional wisdom” of regulating each of the individual oil lines. PO Resp. 21–24 (citing Ex. 1004 ¶ 139, Fig. 34; Ex. 2012 ¶¶ 78–80, 87, 90–91). That argument, however, is contradicted by Patent Owner's own assertion. Specifically, Patent Owner agrees with Dr. Huck that “the Link reference leaves ‘open’ whether the oil in all four channels of Figure 1 is coming from the same or multiple sources.” PO Resp. 39 (citing Ex. 2015, 197:19–198:20, 212:11–20). For the reasons discussed above, we find that a common pressure source for all of the carrier fluid channels is among a finite number of identified ways of applying pressure to the carrier fluid in Link Figure 1 and would have been obvious.

Regarding Link paragraph 132, Patent Owner argues that Link’s disclosure of a “constant flow of oil” is incompatible with the claims of the ’430 patent. PO Resp. 24–28 (citing Ex. 2012 ¶¶ 93–101). Petitioner and its expert respond that a “constant flow of oil” equates to a constant pressure absent other changes to the system. Pet. 6; Ex. 1036 ¶¶ 14, 31. After considering the arguments and expert testimony presented by both sides, we agree with Patent Owner that Link’s disclosure of a “constant flow of oil” (Ex. 1004 ¶ 132), does not teach the pressure limitations of claim 1.⁵ Nevertheless, Patent Owner’s argument is not sufficient to rebut Petitioner’s evidence because: (i) Link teaches applying pressure to the carrier fluid using either pressure-driven pumps or positive displacement pumps (Ex. 1004 ¶¶ 164–166), and (ii) the experts agree that pressure-driven pumps maintain a constant pressure (Ex. 2012 ¶ 43; Ex. 1036 ¶¶ 13, 32, 60).

More specifically, Link teaches “positive displacement pressure driven flow is a preferred way of controlling fluid flow.” Ex. 1004 ¶ 165. However, Link also teaches “pressure drive[n] flow control” of carrier fluid utilizing pumps or syringes. *Id.* ¶¶ 38, 164, 166, claim 16. Dr. Squires acknowledges that both constant flow rate (“positive displacement pumping”) and constant pressure (“specified pressure P”) were well-known ways to drive pressure-driven flows in microfluidics. Ex. 2012 ¶¶ 42–43; *see also* Ex. 1036 ¶¶ 13, 32, 60. The preponderance of the evidence

⁵ After considering the full record developed during trial, we do not adopt our preliminary findings in the Institution Decision to the extent they are based on Link’s disclosure of a “constant flow of oil” (Ex. 1004 ¶ 132) and Dr. Huck’s testimony regarding that disclosure (Ex. 1002 ¶¶ 31, 46). Dec. 11–12.

convinces us that Link teaches applying a constant pressure to the carrier fluid, independent of the disclosure of a “constant flow of oil” (Ex. 1004, ¶ 132).

Patent Owner argues that Link paragraphs 164 and 165 “teach away from the claimed invention because they refer to ‘flow control’ or ‘positive displacement pressure driven flow.’” PO Resp. 33. We are not persuaded that Link paragraphs 164 and 165 teach away from the use of a same constant pressure, as recited in claim 1. In view of Dr. Squires’ testimony regarding the well-known ways of conducting pressure-driven flow for microfluidics (Ex. 2012 ¶¶ 42–43), Link’s disclosure of “pressure drive[n] flow control, e.g., utilizing valves and pumps” (Ex. 1004 ¶ 164) teaches toward, not away, from the claimed invention. We note that the ’430 patent uses similar language—“pressure driven pumping”—when comparing two types of pressure driven flow. Ex. 1001, 5:48–52. Link’s disclosure of a preferred embodiment that does not meet the claim (“positive displacement pressure driven flow,” Ex. 1004 ¶ 165), does not amount to a teaching away. *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013) (“A reference does not teach away, . . . if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.”) (quoting *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009)); *Merck & Co., Inc. v. Biocraft Labs., Inc.*, 874 F.2d 804, 807 (Fed. Cir. 1989) (“[I]n a section 103 inquiry, ‘the fact that a specific [embodiment] is taught to be preferred is not controlling, since all disclosures of the prior art, including unpreferred embodiments, must be considered.’” (quoting *In re Lamberti*, 545 F.2d 747, 750 (CCPA 1976))).

We have considered Patent Owner’s remaining arguments regarding Link paragraphs 38, 88, 110, 111–12, 131–32, 164–65, 173, and claim 16, (PO Resp. 28–35), and none persuasively rebuts the evidence we rely upon to support a finding that the pressure limitations of claim 1 would have been obvious in view of Link.

Patent Owner argues that the method of claim 1 is not obvious in view of Link for a number of reasons. PO Resp. 41–59.

Patent Owner contends that Dr. Huck “ignores the full range of design choices” available to a person of ordinary skill in the art because there are numerous parameters (in addition to pressure) that affect droplet size. PO Resp. 42–45 (emphasis omitted); Ex. 2012 ¶¶ 88, 125, 128 (identifying variables). Patent Owner’s argument is not persuasive to rebut Dr. Huck’s testimony that regulating the pressure in either the aqueous fluid channels or immiscible carrier fluid channels are “the two ways in which pressure could be regulated to control droplet size.” Ex. 1002 ¶¶ 111, 115. The fact that Link discloses additional parameters that may affect droplet size does not undermine the significance of Link’s teaching that droplet size may be regulated by controlling the pressure difference between the oil and water sources at the inlet module. Ex. 1004 ¶ 166; Ex. 1036 ¶ 79. The claimed invention manipulates droplet size in the same way as taught by Link—by controlling pressure. That other variables may also affect droplet size does not make the claimed invention less obvious. This is not a case “where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful.” *In re O’Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988).

Patent Owner argues that the number of design choices “is far more complicated” when there are multiple coupled junctions and that Link does not guide the skilled artisan to the “specific solution of the ’430 patent.” PO Resp. 45–46 (citing Ex. 2012 ¶¶ 131–132). Patent Owner’s argument and evidence are insufficient to counter Petitioner’s evidence. We find that the presence of multiple coupled junctions does not make the design choices insurmountably complex, as argued by Patent Owner. There is no dispute that Link Figure 1 shows multiple coupled junctions in the form of two inlet modules feeding into a common main channel. Ex. 1004, Fig. 1; Ex. 2012 ¶ 75. To implement Link’s paragraph 166 teaching, a person of ordinary skill in the art would need to make the binary choice posited by Dr. Huck at each of Link’s two inlet modules. Ex. 1002 ¶¶ 111, 115. Two binary choices is not an overly complicated set of decisions for a person having the level of skill set forth above. Ex. 1036 ¶ 81.

Patent Owner argues that a cost/benefit analysis would have led a skilled artisan away from the ’430 patent and toward providing separate regulators for each oil and aqueous fluid channel to enable independent control over droplet size and frequency. PO Resp. 47 (citing Ex. 2012 ¶¶ 139–144). According to Patent Owner, a skilled artisan would have thought that use of a single pressure regulator would be “untenable.” because independent control over droplet size would be compromised. *Id.* 47–48 (citing Ex. 1001, 1:59–2:10).

Patent Owner’s argument and evidence do not persuasively rebut Petitioner’s evidence. Patent Owner does not direct us to prior art teachings in Link or elsewhere that “criticize, discredit, or otherwise discourage” controlling pressure in the manner set forth in claim 1. *In re Fulton*, 391

F.3d 1195, 1201 (Fed. Cir. 2004). For example, Patent Owner directs us to no prior art teaching that separate pressure regulators are necessary for independent control over droplet size or that such independent control would be compromised by applying a same constant pressure to the carrier fluid in each of the carrier fluid channels. In fact, Patent Owner's expert acknowledges that "[n]othing in the prior art even identified reducing the number of regulators on the carrier fluid channels as a problem." Ex. 2012 ¶ 143. Dr. Squires' testimony demonstrates that the prior art did not view a single pressure source as problematic or untenable. In this regard, we credit Dr. Huck's testimony that, prior to the '430 patent, the understanding of a skilled artisan was that use of a common oil regulator for all the oil channels would not prevent independent control over droplet size at each of the junctions. Ex. 2015, 287:4–288:11.

Next, Patent Owner argues there would have been no reasonable expectation of successfully tuning droplet size using pressure difference because droplet size cannot be predictably controlled in a multi-junction device using pressure difference. PO Resp. 48–57 (citing Ex. 2012 ¶¶ 77, 78, 89, 123–129, 131, 132; Ex. 1012, Fig. 4). We are not persuaded by Patent Owner's argument, which is based on the wrong measure of success. As discussed above, claim 1 requires that droplets be produced, but does not require tuning droplet size.

Even if control of droplet size were required, the evidence cited by Patent Owner is not persuasive to rebut Petitioner's evidence of obviousness. Patent Owner relies on Thorsen (Ex. 1012) to assert that pressure difference between the aqueous channel and the oil channel is not determinative of droplet size. PO Resp. 50. Even if Patent Owner's assertion is true, we find

that Thorsen Figure 4 supports that droplet size can predictably be controlled by keeping oil pressure constant and adjusting water pressure. That predictability provides a reasonable expectation of success of practicing the pressure limitations of claim 1. Patent Owner also relies on Dr. Huck's testimony that, in July 2011, "a person of ordinary skill in the art would [not] be able to say exactly or predict exactly, without knowing the system fully, how the droplet size would vary with differences in pressure." PO Resp. 52 (citing Ex. 2015, 56:19–57:21). When considered in light of the applicable legal standard, however, that testimony is not sufficient to show unpredictability or the absence of a reasonable expectation of success, as certainty of success is not required. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) ("certainty of success" is not required); *O'Farrell*, 853 F.2d at 903–04 ("Obviousness does not require absolute predictability of success. . . . [A]ll that is required is a reasonable expectation of success.").

Patent Owner argues that the prior art does not disclose or suggest any thought process that would have allowed the skilled artisan to work past the issue of independent control over droplet size in a multi-junction system. PO Resp. 52–56. To the extent that Patent Owner contends the pressure steps of claim 1 solve the problem of independent control, we find that those steps are suggested by Link. To the extent that Patent Owner contends the problem is solved by "proper design" of the fluidic circuits and channel resistances to minimize cross-coupling between the junctions (Ex. 1001, 5:41–44, 5:63–6:1, 15:45–47; PO Resp. 54–55), we find that the '430 patent does not disclose, much less claim, any specific design beyond what is disclosed in Link. *Compare* Ex. 1001, Figs. 1, 2, *with* Ex. 1004, Figs. 2A, 4;

see also Ex. 1036 ¶ 89 (“[A] POSA would have had a reasonable expectation of success because Link teaches using the same microfluidic devices as the ’430 patent, and the ’430 patent introduced no new methods of regulating pressure and no new microfluidic architecture over that taught in Link.”).

Patent Owner contends that Link’s disclosure of a “constant flow of oil” teaches away from the claimed invention, which relies on changing the oil flow rate to manipulate droplet size. PO Resp. 57–59 (citing Ex. 2012 ¶¶ 134–138). Link’s disclosure of a constant flow of oil does not, however, “criticize, discredit, or otherwise discourage” controlling pressure in the manner set forth in claim 1. *Galderma*, 737 F.3d at 738. As discussed above, Link also discloses pressure driven flow control of carrier fluid utilizing pumps or syringes. Ex. 1004 ¶¶ 38, 164, 166, claim 16.

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that the method of claim 1 would have been obvious in view of Link.

3. *Dependent Claim 2*

Claim 2 depends from claim 1 and recites: “the same constant pressure derives from pressure in a reservoir in fluid communication with each of the carrier fluid channels.” Ex. 1001, 16:32–34.

Under a broadest reasonable construction, the phrase, “a reservoir,” in claim 2 means one or more reservoirs. *See Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1342 (Fed. Cir. 2008) (“[A]n indefinite article ‘a’ or ‘an’ in patent parlance carries the meaning of ‘one or more’ in open-ended claims containing the transitional phrase ‘comprising.’”). Applying this construction in context, claim 2 requires that each carrier fluid channel

be in fluid communication with one or more reservoirs, all of which apply a same constant pressure to the carrier fluid. Based on that construction, we do not accept Patent Owner's position that claim 2 requires a common syringe for all of the oil channels in the system. PO Resp. 40.

Petitioner contends that Link discloses the limitations of claim 2 by teaching that pressure is applied to carrier fluid channels using pressurized syringes. Pet. 29–30 (citing Ex. 1004 ¶¶ 38, 132, 164–166).

Patent Owner contends that the syringe disclosed in Link paragraph 132 is a collection syringe, not a syringe for delivery of oil, and that Link paragraph 166 does not disclose using a syringe to feed into a carrier fluid channel. PO Resp. 39–40.

There is no dispute that a syringe is a type of reservoir. *See, e.g.*, Ex. 1004 ¶¶ 131, 132 (“storage well/reservoir (e.g. syringe)”). We find that Link teaches syringes for feeding oil into carrier fluid channels. Our finding is supported by Link paragraph 166, which discloses “adjusting the pressure on the main and sample inlet channels, for example, with pressurized syringes feeding into those inlet channels.” Ex. 1004 ¶ 166.

We find that Link's disclosure of “pressurized syringes” in paragraph 166 would have been understood by a person of ordinary skill in the art as “a reservoir in fluid communication with each of the carrier fluid channels,” as recited in claim 2. *See* Ex. 1004 ¶¶ 132, 166; Ex. 1002 ¶¶ 53–56; Ex. 1036 ¶¶ 70, 71. Our finding is supported by Link paragraph 166, as well as paragraphs 56 and 139, which disclose “oil syringes” that feed into a droplet-forming nozzle. Ex. 1004 ¶¶ 56, 139, 166. Although paragraphs 56 and 139 discuss “off chip” droplet formation, Link discloses similar droplet-forming nozzles embedded in a microfluidic device. *Compare* Ex. 1004

¶ 131 (discussing “embedded microfluidic nozzles” for forming droplets on a microfluidic substrate), *with id.* ¶ 139 (discussing creating sample droplet emulsions ‘off chip’”). Accordingly, we find that a person of ordinary skill in the art would have understood Link as disclosing pressurized syringes for supplying oil to the carrier fluid channels of a microfluidic device.

We are not persuaded by Patent Owner’s argument that the “main channel” in Link paragraph 166 is “not one of the immiscible carrier fluid channels that supplies oil.” PO Resp. 40. We find that the “main and sample inlet channels” in Link paragraph 166 correspond to the immiscible carrier fluid channels and the aqueous fluid channels recited in claim 1 of the ’430 patent. Our finding (and our labeling of the “main channel” in Link Figure 1 at page 10 above) is supported by Link paragraph 166, which indicates that the main channel is part of the inlet module and has an inlet for oil fed into that channel. Ex. 1004 ¶ 166. Additional support is provided in Link paragraphs 10, 30, and 173 and Figure 1, which collectively show that the “main channel” is part of the inlet module and includes an inlet for oil. *Id.* ¶¶ 10, 30, 173 (“The inlet module generally comprises a junction between the sample inlet channel and the main channel.”). Still further support can be found in Link paragraph 88, which indicates that the channels are in fluid communication with each other and may overlap, and there is no clear boundary where a channel begins or ends. *Id.* ¶ 88.

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that claim 2 would have been obvious in view of Link.

4. *Dependent Claim 3*

Claim 3 depends from claim 1 and recites: “the same constant pressure is applied by a single pressure source to each of the carrier fluid channels.” Ex. 1001, 16:35–37.

The parties agree that claim 3 requires that pressure be applied by a single pressure source, e.g., syringe, to the carrier fluid in multiple carrier fluid channels. PO Resp. 40; Pet. Reply 8; Ex. 1036 ¶ 72. The parties’ agreed construction is supported by the specification of the ’430 patent, which discloses: “The immiscible fluid lines are controlled in a gain control fashion, where one regulator is used to drive and control the flow of immiscible fluid through the entire system.” Ex. 1001, 15:67–16:2. Accordingly, we adopt the parties’ agreed construction of claim 3.

Petitioner contends that Link discloses the limitations of claim 3 by teaching a continuous, pressure-driven flow stream of carrier fluid, pressurized syringes for adjusting pressure on the carrier fluid channel, and a “constant flow of oil” into the carrier fluid channel by applying pressure from a syringe. Pet. 30–31 (citing Ex. 1004 ¶¶ 38, 110, 131–132, 164–166, claim 16; Ex. 1002 ¶¶ 31–32, 57–60). Petitioner also contends that “applying a same constant pressure” (claim 1) “encompasses at least . . . applying pressure from a single source, such as a syringe,” Pet. 11, and implicitly contends that applying pressure in this manner would have been obvious over Link, Pet. 21–28, 37–40, 46–51; Pet. Reply 15–20; Ex. 1002 ¶¶ 42, 106–115.

Patent Owner contends that Link does not suggest using a common syringe for all of the oil channels in the system. PO Resp. 40, 47–48.⁶

For the reasons discussed above, we find that use of a single pressure source for all of the carrier fluid channels was one of a finite number of identified, predictable ways of controlling the pressure applied to the carrier fluid in a multi-junction device, such as shown in Link Figure 1. Ex. 2012 ¶ 47; Ex. 1036 ¶ 41; Tr. 35:17–24; Ex. 2015, 196:12–197:3. See pages 17–19, *supra*. For the reasons discussed above, we also find that a person of ordinary skill in the art would have had a reason to use a single pressure source instead of multiple pressure sources, namely to reduce cost and complexity, and would not have thought such a system “untenable.” Ex. 1002 ¶¶ 111, 115; Ex. 2012 ¶¶ 47, 143; PO Resp. 47–48; Tr. 11:11–20, 16:3–13, 35:17–24. See pages 22–23, 31–32, *supra*.

Our finding regarding claim 3 is further supported by Dr. Huck’s rebuttal testimony that a person of ordinary skill in the art would have been aware of systems in which a single carrier fluid source provided carrier fluid for multiple channels. Ex. 1036 ¶¶ 41–42 (citing Ex. 1031,⁷ 258–259, Fig. 2; Ex. 1032,⁸ Abstract, Fig. 2; Ex. 1033,⁹ Figs. 1–2). Dr. Huck

⁶ Patent Owner argues claims 2 and 3 together. PO Resp. 39–40. Patent Owner’s arguments common to both claims 2 and 3 are addressed in the preceding section.

⁷ W. Li et al., *Simultaneous generation of droplets with different dimensions in parallel integrated microfluidic droplet generators*, 4 *SOFT MATTER* 258–62 (2008).

⁸ Y. Zeng et al., *High-Performance Single Cell Genetic Analysis Using Microfluidic Emulsion Generator Arrays*, 82 *ANAL. CHEM.* 3183–90 (2010).

⁹ N. Damean et al., *Simultaneous measurement of reactions in microdroplets filled by concentration gradients*, 9 *LAB ON A CHIP* 1707–13 (2009).

acknowledges that, in these systems, oil was supplied via controlled flow rate syringes, rather than controlled pressure syringes. Ex. 2017, 333:18–334:15, 335:17–23, 336:18–25. However, Dr. Squires explains that both fixed flow rate and fixed pressure were known ways of conducting pressure driven flow in microfluidic devices. Ex. 2012 ¶¶ 42–44. Accordingly, the evidence establishes that a single pressure source for multiple oil channels was known in the art (Ex. 1036 ¶¶ 41–42; Tr. 35:17–24), and that the single pressure source could be either a fixed flow rate or a fixed pressure type device (Ex. 2012 ¶¶ 42–44).

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that claim 3 would have been obvious in view of Link.

5. *Dependent Claim 17*

Claim 17 depends from claim 1 and recites: “said aqueous fluid channels comprise a plurality of microfluidic circuits, each of which comprises an independent aqueous fluid channel and wherein all members of said plurality of microfluidic circuits comprise a common immiscible carrier fluid channel.” Ex. 1001, 17:6–10.

Petitioner contends that Link discloses the subject matter of claim 17, including two inlet channels (independent aqueous fluid channels) and a main channel (common immiscible carrier fluid channel). Pet. 35–36 (citing Ex. 1004 ¶¶ 9, 10, 49, 88, 114, 173, 174, Fig. 1.)

We find that Link discloses the subject matter of claim 17. Link discloses aqueous fluid channels in the form of sample inlet channels. Ex. 1004 ¶¶ 10, 173, Fig. 1. Link discloses a plurality of microfluidic circuits in the form of one or more inlet modules, each of which comprises a

junction between a sample inlet channel and a main channel. *Id.* ¶ 173, Fig. 1. Link discloses that each microfluidic circuit (inlet module) comprises an independent aqueous fluid channel (sample inlet channel). *Id.* Link discloses that all members of a plurality of microfluidic circuits (inlet modules) comprise a common immiscible carrier fluid channel (main channel). *Id.* ¶ 174, Fig. 1.

Patent Owner argues that Link’s “main channel” is not an immiscible carrier fluid channel. PO Resp. 41. We are not persuaded by this argument for the reasons discussed above in connection with claim 2. *See* page 36, *supra*.

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that claim 17 would have been obvious in view of Link.

6. *Dependent Claims 4–7 and 12–16*

Petitioner asserts that Link discloses each limitation recited in dependent claims 4–7 and 12–16. Pet. 31–35. Patent Owner submits no argument regarding claims 4–7 and 12–16 separate from its arguments regarding claims 1 and 3. We compare claims 4–7 and 12–16 to the disclosures of Link identified by Petitioner and make the following findings.

Claim 4. Claim 4 depends from claim 3 and recites: “the pressure source comprises carrier oil.” Ex. 1001, 16:38–39. We find that Link discloses the subject matter of claim 4. More specifically, Link discloses a pressure source, e.g., pressurized syringes, comprising carrier oil. Ex. 1004 ¶ 38 (“The continuous phase can be a fluorocarbon oil.”), ¶ 166 (pressurized syringes for oil); *see also* ¶¶ 114, 132, 164; *see* Pet. 31.

Claim 5. Claim 5 depends from claim 1 and recites: “the droplets comprising a first aqueous fluid and the droplets comprising a second aqueous fluid are substantially uniform in size.” Ex. 1001, 16:40–42. We find that Link discloses the subject matter of claim 5. More specifically, Link discloses forming droplets of a first aqueous fluid at a first inlet module and forming droplets of a second aqueous fluid at a second inlet module. Ex. 1004 ¶¶ 10, 173, 174, Fig. 1. Link discloses that the droplets, including droplets produced at separate inlet modules, may be monodisperse, i.e., substantially uniform in size. *Id.* ¶¶ 10, 88, 115, 117, 127, 129, 174. Dr. Squires agrees that Link discloses producing same-sized droplets at each inlet module. Ex. 2012 ¶ 74. *See* Pet. 31–32.

Claim 6. Claim 6 depends from claim 1 and recites: “the droplets comprising a first aqueous fluid are a different size than the droplets comprising a second aqueous fluid.” Ex. 1001, 16:43–45. We find that Link discloses the subject matter of claim 6. Ex. 1004 ¶ 10 (“the first sample fluid forms a plurality of highly uniform, monodisperse droplets of a first size . . . the second sample fluid forms a plurality of highly uniform, monodisperse droplets of a second size . . . wherein the size of the droplets of the second sample fluid are smaller than the size of the droplets of the first sample fluid”); *see also id.* ¶¶ 88, 129, 173, 174, Fig. 1. *See* Pet. 32–33.

Claim 7. Claim 7 depends from claims 5 or 6 and recites: “the step of detecting the size of the droplets in one or more of the aqueous fluid channels.” Ex. 1001, 16:46–48. We find that Link discloses the subject matter of claim 7. In particular, Link discloses that the size of the droplets “can be determined, for example, by measuring the average diameter or other characteristic dimension of the droplets . . . using laser light scattering,

microscopic examination, or other known techniques.” Ex. 1004 ¶ 115; see *also id.* ¶ 40 (“one or more detection or analysis steps . . . for evaluating the contents or characteristics of the droplet”), ¶ 125 (differences in dielectric constants for oil and water “can be exploited to determine droplet rate and size for every drop passing through a small section of a microfluidic device”). See Pet. 33.

Claims 12–14. We find that Link discloses the subject matter of claims 12–14. Ex. 1001, 16:62–67. More specifically, Link discloses that the immiscible carrier fluid can be an oil and that the oil may comprise a surfactant, such as a fluorosurfactant. Ex. 1004 ¶¶ 38, 86, 114, 132, 159, 161, Fig. 2, claims 12–14. See Pet. 33–34.

Claims 15 and 16. We find that Link discloses the subject matter of claims 15 and 16. Ex. 1001, 17:1–5. More specifically, Link discloses that the aqueous fluid may comprise nucleic acid and reagents for conducting an amplification reaction, such as a polymerase chain reaction (“PCR”) reaction. Ex. 1004 ¶¶ 24, 316, 348, 354. In fact, the ’430 patent relies on Link to teach methods for performing PCR in droplets. Ex. 1001, 9:39–41. See Pet. 34–35.

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that claims 4–7 and 12–16 would have been obvious in view of Link.

7. *Dependent Claims 10 and 11*

Claims 10 and 11 of the ’430 patent recite:

10. The method of claim 1, wherein pressure is not regulated in at least one of the aqueous carrier channels.

11. The method of claim 1, wherein pressure is regulated in only one of the plurality of aqueous fluid channels.

Ex. 1001, 16:58–61. Petitioner contends that “aqueous carrier channels” in claim 10 would be understood by a person of ordinary skill in the art to mean “aqueous **fluid** channels.” Pet. 14–15, 37 n.4 (emphasis added). Patent Owner does not respond to that contention. Under these circumstances, we hold that Petitioner’s uncontested construction meets the standard for correcting an error in the claim language. *Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1357 (Fed. Cir. 2003) (An error can be corrected “only if (1) the correction is not subject to reasonable debate based on consideration of the claim language and the specification and (2) the prosecution history does not suggest a different interpretation of the claims.”).

Relying on the testimony of its expert, Petitioner contends that the limitations of claims 10 and 11 would have been obvious in view of Link. Pet. 37–40 (citing Ex. 1002 ¶¶ 108, 110–111, 113–115). Patent Owner presents no argument regarding claims 10 and 11 separate from the arguments regarding claim 1.

We find that regulating pressure in either the aqueous fluid channel or immiscible carrier fluid channel is a results-effective variable that affects droplet size, and the limitations of claims 10 and 11 are among a finite number of identified, predictable options available to a person of ordinary skill for regulating pressure to control droplet size in a microfluidic device having multiple aqueous fluid channels, as disclosed in Link.

Our finding is supported by the undisputed testimony of Dr. Huck that regulating pressure in either the aqueous fluid channel or immiscible carrier fluid channel is a results-effective variable for droplet size. Ex. 1002 ¶¶ 108, 113. Dr. Squires agrees that the pressures applied to the aqueous and carrier

fluids “are ‘results-effective variables’ for regulating droplet size.” Ex. 2012 ¶ 128; *see also id.* ¶¶ 88, 125 (listing variables).

Our finding is further supported by the unrebutted testimony of Dr. Huck that, given the limited options available for regulating the pressure in either the aqueous fluid channels or the immiscible carrier fluid channels, a logical option for a person of ordinary skill in the art reading Link would have been to choose not to regulate the pressure in at least one of the aqueous fluid channels or to regulate the pressure in only one of the plurality of the aqueous fluid channels, and instead control droplet size by regulating the pressure in the remaining immiscible carrier fluid channels that interact with the unregulated aqueous fluid channel(s). Ex. 1002 ¶¶ 110–111, 114–115 (citing Ex. 1004 ¶¶ 10, 111, 115, 117, 129, 166, 336, 347, 450; Ex. 1015,¹⁰ 294; Ex. 1016,¹¹ 7350).

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that the methods of claims 10 and 11 would have been obvious in view of Link.

D. Patentability of Claims 8 and 9 over Link and Nguyen

1. Nguyen (Ex. 1006)

Nguyen discloses a microfluidic device for droplet formation and detection. Ex. 1006, Title, Abstract, Fig. 1, 432, 436. According to Nguyen, “[s]ince the droplet’s size and its other properties are important for the actual

¹⁰ Y. Tan, et al., *Design of microfluidic channel geometries for the control of droplet volume, chemical concentration, and sorting*, 4 LAB ON A CHIP 292–98 (2004) (“Tan 2004”).

¹¹ H. Song, et al., *Reaction in Droplets in Microfluidic Channels*, 45 ANGEWANDTE CHEM. INT. ED. 7336–56 (2006) (“Song”).

application, a detection system for the micro-droplets is vital for providing a feedback signal to the droplet formation process.” *Id.* at 431. Similar to Link, Nguyen teaches that droplets are formed at a junction between an aqueous fluid channel and a carrier fluid channel. *Compare* Ex. 1004 ¶ 10, Fig. 4, *with* Ex. 1006, 432, Fig. 1. Nguyen discloses an optical detection system positioned downstream of the droplet-forming junction, where the size and shape of the droplets is recorded as a function of time. Ex. 1006, 432, Fig. 1. According to Nguyen, the disclosed device “has a potential for feedback control in a droplet-based microfluidic device” and “[c]urrently, droplet size, shape, and formation frequency can be measured accurately.” *Id.* at 436.

2. *Dependent Claims 8 and 9*

Claims 8 and 9 of the ’430 patent recite:

8. The method of claim 7, further comprising the step of changing the pressure applied to the carrier fluid and/or the pressure applied to the one or more of the aqueous fluid channels based on the detecting step.

9. The method of claim 6, further comprising the step of changing the pressure applied to a first of the aqueous fluid channels based on the detecting step, thereby to change the size of the droplets in the first aqueous fluid channel and not in other aqueous fluid channels.

Ex. 1001, 16:49–57. Petitioner contends that “the detecting step” in claim 9 would be understood by a person of ordinary skill in the art as requiring detecting the size of droplets in a microfluidic device. Pet. 14 (citing Ex. 1001, 2:48–49, 16:46–48 (claim 7)). Patent Owner does not respond to that contention. Under these circumstances, we hold that Petitioner’s

uncontested construction meets the standard for correcting an error in the claim language. *Novo Indus.*, 350 F.3d at 1357.

Relying on the testimony of its expert, Petitioner contends that the limitations of claims 8 and 9 would have been obvious in view of Link and Nguyen. Pet. 40–46 (citing Ex. 1004 ¶¶ 116–127). Regarding claim 8, Petitioner contends that it would have been obvious to modify the droplet formation method of Link to include Nguyen’s feedback mechanism to control droplet size by changing the pressure applied to the carrier fluid and/or the pressure applied to one or more of the aqueous fluid channels. *Id.* at 41–44. Regarding claim 9, Petitioner contends that it would have been obvious to adjust droplet size in one aqueous channel and not another to either increase or decrease the size of droplets generated in that channel relative to the size of droplets in another channel—thereby generating droplets of different sizes that could then be coalesced. *Id.* at 44–46.

Patent Owner criticizes Nguyen as disclosing a “crude technique,” as pertaining to “only a single droplet-forming junction,” and as lacking examples. PO Resp. 17–18. Aside from these criticisms, however, Patent Owner presents no argument regarding claims 8 and 9 separate from the arguments regarding claim 1.

As already discussed, Link discloses controlling droplet size by adjusting the pressure applied to the carrier fluid and/or the pressure applied to one or more of the aqueous fluid channels. Ex. 1004 ¶¶ 166, 173, 174, Fig. 1. For example, Link discloses that the pressure on one or more of the aqueous fluid channels may be changed by “raising or lowering an output well.” *Id.* ¶ 172; see Ex. 1002 ¶ 117. Link discloses a microfluidic substrate having two or more inlet modules, where the droplets produced at one inlet

module are a different size than droplets produced at another inlet module. Ex. 1004 ¶¶ 10, 88, 129, 173, 174, Fig. 1. Link also discloses that using a microfluidic substrate to produce monodisperse, i.e., same-sized, droplets of high uniformity is desirable for certain applications. *Id.* ¶ 117. In addition, Link discloses detecting the size of the droplets. *Id.* ¶¶ 115, 125.

Patent Owner asserts that claims 7 to 9 of the '430 patent are directed to “the use of droplet size as a feedback mechanism.” PO Resp. 15. We find that Nguyen teaches the use of droplet size as a feedback mechanism. More specifically, Nguyen teaches detecting the size of droplets and providing feedback control to the droplet formation process based on the detected droplet size. Ex. 1006, 431, 432, 436.

We credit the unrebutted testimony of Dr. Huck that a person of ordinary skill in the art would have had a reason to modify Link’s droplet formation method to include a droplet size feedback mechanism, as disclosed in Nguyen. Ex. 1002 ¶¶ 120, 125. As a rationale, Dr. Huck states that a person of ordinary skill in the art would have realized that a feedback system that measures droplet size would have been an efficient way of adjusting droplet size because it provides automated operation, facilitates generation of uniform droplets (desired for some applications), and facilitates generation of different-sized droplets (desired for other applications). *Id.* (citing Ex. 1004 ¶ 129, 450; Ex. 1006, 431, 432, 433–434, 436, Fig. 10; Ex. 1015, 294; Ex. 1016, 7350; Ex. 1017, 901, 908).

We also credit Dr. Huck’s testimony that a person of ordinary skill in the art would have had a reasonable expectation of success in combining Link’s droplet formation method with Nguyen’s feedback control mechanism because both references teach controlling droplet formation by

regulating pressure-driven flow rates and both references teach measuring droplet size by laser light scattering. *Id.* ¶¶ 122, 127 (citing Ex. 1004 ¶¶ 110, 166, 172, 177; Ex. 1006, 431, 432, 433–434, 435, 436, Fig. 10.).

Based on the unrebutted testimony of Dr. Huck and the cited disclosures of Link and Nguyen, we find that one of ordinary skill in the art would have had a reason to combine the droplet formation and pressure control methods disclosed by Link with the droplet formation, detection, and feedback methods disclosed by Nguyen. We further find that the combined teachings of Link and Nguyen would have led one of ordinary skill in the art to the droplet formation methods recited in claims 8 and 9. More specifically, we find that the combined teachings of Link and Nguyen would have led a person of ordinary skill in the art to adjust the pressure applied to the carrier fluid and/or the pressure applied to one or more of the aqueous fluid channels based on the detected droplet size. Ex. 1004 ¶¶ 115, 117, 166, 173, 174; Ex. 1006, 431, 436. We also find that the combined teachings of Link and Nguyen would have led a person of ordinary skill in the art to adjust the pressure applied to one aqueous fluid channel based on the detected droplet size, in order to produce different-sized droplets in two different inlet modules. Ex. 1004 ¶¶ 10, 88, 115, 129, 173, 174, Fig. 1; Ex. 1006, 431, 436.

Accordingly, we hold that Petitioner has established by a preponderance of the evidence that the methods of claims 8 and 9 would have been obvious in view of Link and Nguyen.

E. Patentability of Claims 1–7 and 12–17 over Link

For the reasons discussed above, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 1–7 and 12–17

of the '430 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Link. It is therefore unnecessary for us to address whether claims 1–7 and 12–17 are unpatentable under 35 U.S.C. § 102 as anticipated by Link.

III. CONCLUSION

1. Petitioner has demonstrated by a preponderance of the evidence that claims 1–7 and 10–17 of the '430 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Link.

2. Petitioner has demonstrated by a preponderance of the evidence that claims 8 and 9 of the '430 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Link and Nguyen.

IV. ORDER

Accordingly, in consideration of the foregoing, it is hereby:

ORDERED that claims 1–17 of the '430 patent are held unpatentable under 35 U.S.C. § 103(a); and

FURTHER ORDERED that, because this is a final written decision, any party 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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