United States Court of Appeals for the Federal Circuit

BIO-RAD LABORATORIES, INC.,
Appellant

v.

INTERNATIONAL TRADE COMMISSION,
Appellee

10X GENOMICS INC.,
Intervenor

2020-1785

Appeal from the United States International Trade Commission in Investigation No. 337-TA-1100.

Decided: April 29, 2021

BRIAN C. CANNON, Quinn Emanuel Urquhart & Sullivan, LLP, Redwood Shores, CA, argued for appellant. Also represented by KEVIN P.B. JOHNSON; DAVID LEON BILSKER, ANDREW EDWARD NARAVAGE, NATHAN SUN, San Francisco, CA; SEAN GLOTH, II, New York, NY; S. ALEX LASHER, Washington, DC.

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Before TARANTO, CHEN, and STOLL, *Circuit Judges*.

TARANTO, *Circuit Judge*.

10X Genomics Inc. filed a complaint against Bio-Rad Laboratories, Inc. with the International Trade Commission, alleging that Bio-Rad's importation and sale of microfluidic systems and components used for gene sequencing or related analyses violated section 337 of the Tariff Act of 1930, 19 U.S.C. § 1337. Invoking the statute's bar on importation and sale "of articles that . . . (i) infringe a valid and enforceable United States patent," 19 U.S.C. § 1337(a)(1)(B), 10X alleged that Bio-Rad infringed certain claims of several of 10X's patents, including U.S. Patent Nos. 9,689,024, 9,695,468, and 9,856,530. The Administrative Law Judge (ALJ) determined that Bio-Rad violated the statute with respect to all three patents. Specifically, the ALJ found that Bio-Rad infringed the patent claims now at issue and also that 10X practiced the claims, the latter fact satisfying the requirement of a domestic industry "relating to the articles protected by the patent," *id.* § 1337(a)(2). In addition, the ALJ rejected Bio-Rad's defense that it could not be liable for infringement because it co-owned the asserted 10X patents under assignment provisions that two of the named inventors signed when they were employees of Bio-Rad (and its predecessor), even though the inventions claimed were not made until after the employment. The

Commission affirmed the ALJ's determinations, though it modified some of the ALJ's reasoning. We affirm.

I

A

The first two of the three patents at issue on appeal, *i.e.*, the '024 patent and '468 patent, share a specification.[1] Both patents are entitled "Methods for Droplet-Based Sample Preparation." And both list Benjamin Hindson, Serge Saxonov, and Michael Schnall-Levin as the co-inventors. On the record and arguments before us, we take as a given that the conception date for the claims at issue was no earlier than in January 2013.

The shared specification describes methods of preparing samples that can include "fragmenting molecules, isolating molecules, and/or attaching unique identifiers to particular fragments of molecules." '024 patent, col. 1, lines 34–37. The material of interest (analyte)—which may be polynucleotides (*e.g.*, DNA segments), cells, or other material—can be subdivided into "an assembly of partitions (e.g., microwells, droplets) that are loaded with microcapsules." *Id.*, col. 4, lines 24–27. Each partition, or a microcapsule in it, may contain a sample of the analyte and a reagent, the latter of which may be a unique identifier that enables tracking partition content in further processing. *Id.*, col. 4, lines 29–44.

In one embodiment, of central importance to the present matter, "a microcapsule may be a gel bead." *Id.*, col. 9, lines 28–34. Analytes or reagents may be coupled to the interior or to the outer surface of the gel bead. *See id.*,

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[1] Before the Commission, 10X also alleged infringement of a fourth patent, U.S. Patent No. 9,644,204, but the ALJ rejected the allegation, the Commission affirmed, and 10X has not appealed that ruling.

col. 9, lines 35–42. The analytes or reagents may then be released from the microcapsule via a stimulus, or "trigger," which take the form of, *e.g.*, chemical agents, enzymes, light, heat, or magnetic fields. *Id.*, col. 22, lines 4–21.

One example of a reagent is a "molecular barcode" that can serve as a unique identifier. *See id.*, col. 12, lines 9–14. Molecular barcodes can be used to identify and track individual molecules of (say) the nucleic acid segments. *See id.* For example, if multiple samples are analyzed simultaneously by pooling them, *see id.*, col. 12, lines 31–39, and the analytes from each sample are tagged with a barcode, analytes from different samples can be identified and tracked in the pooled sample, *id.*, col. 12, lines 36–39. "Oligonucleotide barcodes . . . may be particularly useful in nucleic acid sequencing." *Id.*, col. 12, lines 43–44.

10X asserted independent claim 1 and dependent claims 5, 17, 19, and 22 of the '024 patent against Bio-Rad. Claim 1 recites:

> 1. A method for sample preparation, comprising:
>
> a) providing a droplet comprising a porous gel bead and a target nucleic acid analyte, wherein said porous gel bead comprises at least 1,000,000 oligonucleotide molecules comprising barcode sequences, wherein said oligonucleotide molecules are releasably attached to said porous gel bead, wherein said barcode sequences are the same sequence for said oligonucleotide molecules;
>
> b) applying a stimulus to said porous gel bead to release said oligonucleotide molecules from said porous gel bead into said droplet, wherein upon release from said porous gel bead, a given oligonucleotide molecule from said oligonucleotide mole-

> cules attaches to said target nucleic acid analyte; and
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> c) subjecting said given oligonucleotide molecule attached to said target nucleic acid analyte to nucleic acid amplification to yield a barcoded target nucleic acid analyte.

Id., col. 33, line 56, through col. 34, line 7.

With respect to the '468 patent, 10X asserted independent claim 1 and dependent claims 6, 7, 9, and 21 against Bio-Rad. Claim 1 recites:

> 1. A method for droplet generation, comprising:
>
> (a) providing at least 1,000,000 oligonucleotide molecules comprising barcode sequences, wherein said barcode sequences are the same sequence for said at least 1,000,000 oligonucleotide molecules, wherein said at least 1,000,000 oligonucleotide molecules are releasably attached to a bead, wherein said bead is porous;
>
> (b) combining said at least 1,000,000 oligonucleotide molecules and a sample comprising a nucleic acid analyte each in an aqueous phase at a first junction of two or more channels of a microfluidic device to form an aqueous mixture comprising said at least 1,000,000 oligonucleotide molecules attached to said bead and said sample; and
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> (c) generating a droplet comprising said at least 1,000,000[ ]oligonucleotide molecules attached to said bead and said sample comprising said nucleic acid analyte by contacting said aqueous mixture with an immiscible continuous phase at a second junction of two or more channels of said microfluidic device.

'468 patent, col. 33, line 56, through col. 34, line 9.

The third patent asserted by 10X here is the '530 patent, entitled "Methods and Systems for Processing Polynucleotides." It lists Benjamin Hindson, Serge Saxonov, and Michael Schnall-Levin as three of six inventors. It is undisputed that the conception date for the inventions of this patent is no earlier than the January 2013 date for the '024 and '468 patents.

Although the '530 patent does not share a specification with the other two patents at issue here, the subject matter of the asserted claims is related to that of the asserted '024 and '468 patent claims. 10X asserted independent claim 1 and dependent claims 4, 11, 14, 19, 26, and 28 of the '530 patent. Claim 1 recites:

> 1. A method for nucleic acid preparation or analysis, comprising:
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> (a) providing:
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> (i) at least 1,000 gel beads;
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> (ii) releasably attached to each of said at least 1,000 gel beads, at least 1,000 barcode molecules comprising identical barcode sequences that are distinct from barcode sequences of at least 1,000 barcode molecules releasably attached to any other gel bead of said at least 1,000 gel beads; and
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> (iii) a plurality of cells each comprising a plurality of polynucleotide molecules;
>
> (b) generating a plurality of droplets, wherein at least 1,000 droplets of said plurality of droplets each comprise:
>
> (i) a single gel bead from said at least 1,000 gel beads; and

> (ii) a single cell from said plurality of cells; and
>
> (c) in each of said at least 1,000 droplets, using said plurality of polynucleotide molecules from said single cell and barcode molecules of said at least 1,000 barcode molecules from said single gel bead to generate a plurality of barcoded polynucleotide molecules,
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> wherein said barcode molecules become detached from said gel bead.

'530 patent, col. 47, line 58, through col. 49, line 4.

B

By mid-2010, two of the named inventors of the 10X patents—Dr. Hindson and Dr. Saxonov—were working for a company called QuantaLife, Inc., which Dr. Hindson had co-founded. Each of them signed an agreement (Dr. Hindson in 2009, Dr. Saxonov in 2010) that provided, as relevant here:

> (a) Employee agrees to disclose promptly to the Company the full details of any and all ideas, processes, recipes, trademarks and service marks, works, inventions, discoveries, marketing and business ideas, and improvements or enhancements to any of the foregoing ("IP"), that Employee conceives, develops or creates alone or with the aid of others during the term of Employee's employment with the Company . . . .
>
> (b) Employee shall assign to the Company, without further consideration, Employee's entire right to any IP described in the preceding subsection, which shall be the sole and exclusive property of the Company whether or not patentable.

J.A. 3199, 3209.

In 2011, Bio-Rad acquired QuantaLife, and Drs. Hindson and Saxonov became Bio-Rad employees. In October of that year, they each signed an agreement that provided, as relevant here:

> All inventions (including new contributions, improvements, designs, developments, ideas, discoveries, copyrightable material, or trade secrets) which I may solely or jointly conceive, develop or reduce to practice during the period of my employment by Bio-Rad shall be assigned to Bio-Rad.

J.A. 3193, 3195.

Drs. Hindson and Saxonov left Bio-Rad in April 2012, and together they formed 10X in July 2012. J.A. 10042. By August 2012, 10X filed the first of several provisional patent applications that focused on using microcapsules in capsule partitions or droplet partitions (referred to as capsule-in-capsule and capsule-in-droplets architecture, respectively) for barcoding. *See* J.A. 1215. By January 2013, the 10X inventors had conceived of a different architecture: "gel bead in emulsion" (GEM). *See* J.A. 1215–20, 10178. The GEM architecture involves "partitioning nucleic acids, DNA or RNA, in droplets together with gel beads that are used to deliver the barcodes into the droplet," where the "barcodes are released from the gel beads using a stimulus." J.A. 269 (internal quotation marks omitted); *see also* J.A. 1215–16, 1233. The asserted 10X patent claims all involve this architecture.

After 10X began selling its products, including the GemCode and Chromium products, Bio-Rad released its own ddSEQ™ system, whose ordinary use, 10X alleges, practices its patents. *See* J.A. 543–44. The ddSEQ system uses oligonucleotide molecules that are attached to a gel bead and can be released from the bead via a stimu-

lus. J.A. 161.[2] The stimulus used by Bio-Rad's system is an enzyme complex that cleaves the oligonucleotides from the gel bead. J.A. 161.

C

The ALJ ruled for 10X in the respects relevant to the appeal (while resolving other issues not presented on appeal). J.A. 138–298. The ALJ found that ordinary use of Bio-Rad's ddSEQ system infringes the asserted claims of the '024, '468, and '530 patents, that the same is true of 10X's products, and that both the infringing-articles and domestic-industry requirements of section 337 are met. J.A. 159–72, 200–07, 232–59.[3] The ALJ also rejected Bio-Rad's contention, based on the assignment provisions, that it co-owned these patents and therefore could not infringe them. J.A. 277–93. When Bio-Rad petitioned for review of the ALJ's Initial Determination, the Commission decided to review it in part. *See* Certain Microfluidic Systems and Components Thereof and Products Containing Same; Commission Determination To Review in Part a Final Initial Determination Finding a Violation of Section 337 and To Extend the Target Date; Schedule for Filing Written Submissions, 84 Fed. Reg. 56,835, 56,835 (Oct. 23, 2019) (notice). On February 12, 2020, the Com-

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[2] We use the singular "system," even though there are several accused versions of ddSEQ. The versions at issue do not differ in a way that is material on appeal.

[3] The asserted claims are method claims, and the ALJ also found the requirements of indirect infringement met. J.A. 168–72, 204–05, 246–53. Those findings are not challenged on appeal. Although the claims are method claims, in this matter we lose no needed precision by sometimes referring to a system or product as practicing a claim or meeting claim requirements or infringing a claim or patent.

mission affirmed the ALJ's determinations regarding infringement, the domestic-industry requirement, and ownership. J.A. 29–137.

1

With respect to the '024 patent, the ALJ determined that Bio-Rad's ddSEQ system practices all challenged claims of the '024 patent, including, as relevant on appeal, the second step of the method in claim 1, which requires "*applying a stimulus to said porous gel bead* to release said oligonucleotide molecules from said porous gel bead." '024 patent, col. 33, line 65–67 (emphasis added); J.A. 159–72. Bio-Rad contended that its system does not meet that claim limitation because the stimulus used in its system acts on the oligonucleotides rather than the gel bead. The ALJ disagreed, finding that "the oligonucleotides are part of the gel bead," so that "[a]ny stimulus applied to the oligonucleotide is therefore also applied to the gel bead." J.A. 164–65 (citing J.A. 4870 (Bio-Rad expert testifying that "the enzyme enters the entire volume of the bead"); and then citing J.A. 10074). On review, the Commission affirmed the ALJ's determination, without any modification relevant to this appeal. J.A. 37.

With respect to the '468 patent, too, the ALJ determined that Bio-Rad's ddSEQ system practices all challenged claims. J.A. 200–04. As relevant on appeal, Bio-Rad argued to the Commission that its system does not meet the claim requirement of "combining said at least 1,000,000 oligonucleotide molecules and a sample comprising a nucleic acid analyte . . . at a first junction of two or more channels of a microfluidic device to form an aqueous mixture." '468 patent, col. 33, line 64, through col. 34, line 1. Citing testimony from 10X's expert (Dr. Butte), Bio-Rad contended that the solutions of the oligonucleotide molecules and the sample do not form an aqueous mixture at the first junction, but remain sepa-

rate until later, when droplets form. J.A. 202 (citing J.A. 10104); *see also* J.A. 10104 (Dr. Butte testifying that "it would be a big mess" if the two solutions mixed "without forming a droplet"). The ALJ disagreed and found 10X's proof of satisfaction of this claim requirement persuasive, because 10X's expert explained that the two solutions "come together and then immediately are formed into a droplet." J.A. 203 (quoting J.A. 10104). On review, the Commission affirmed the ALJ's determination, without any modification relevant to this appeal. J.A. 51.

With respect to the '530 patent, the ALJ likewise determined that Bio-Rad's ddSEQ system practices all challenged claims. In a claim construction, the ALJ concluded that claim 1 requires the (second) step of generating "at least 1,000 droplets" to be completed before the (third) step of "generating a plurality of barcoded polynucleotide molecules." J.A. 233. Bio-Rad argued that its system does not meet that requirement because the enzymes in its droplets begin to form barcoded molecules immediately upon droplet formation, *i.e.*, barcoding begins before at least 1,000 droplets are formed. J.A. 240. The ALJ rejected this argument as taking too constrained a view of the claim requirement. Even if the enzymes are active and barcoding begins immediately after a droplet is formed, the ALJ found, there was evidence that the enzymes do not work quickly enough to finish cleaving all barcoded molecules from the gel bead within the droplets before 1,000 droplets are formed. J.A. 241–44. In other words, the barcoding process may *begin* before 1,000 droplets are formed, but claim 1 requires only that the barcoding process may not be *completed* before 1,000 droplets are formed. *See* J.A. 241–44. On review, the Commission affirmed and made clear that the ALJ's construction does not forbid any barcoding to occur in any droplet before at least 1,000 droplets are generated in the second step. *See* J.A. 72–81, 99–100.

Bio-Rad also argued that the domestic-industry requirement was not established for the asserted '530 patent claims because, Bio-Rad urged, 10X's domestic products, on which 10X relied to meet this requirement, do not practice the independent claim 1 (or therefore the other asserted claims). The ALJ found that the 10X products do practice claim 1. J.A. 254–57. On review, the Commission agreed with the ALJ's bottom-line finding that 10X's products practice claim 1, even while concluding that the particular evidence cited by the ALJ did not support the finding. J.A. 82–88. After its own review of the record, the Commission determined that enough barcodes in the 10X products are released after at least 1,000 droplets have been generated: Even if gel beads begin to dissolve immediately after droplet generation, the beads do not dissolve so quickly that fewer than 1,000 of them still have a plurality of barcodes attached upon the completion of droplet formation. J.A. 83–88.

Finally, the Commission rejected Bio-Rad's argument that the asserted '530 patent claims are invalid for indefiniteness. The Commission concluded that Bio-Rad had forfeited the argument by not timely raising it earlier. J.A. 89–94. In the alternative, the Commission concluded that the claims are not indefinite. J.A. 95–100.

2

As an affirmative defense, Bio-Rad argued that it coowns the three 10X patents asserted against it because Drs. Hindson and Saxonov conceived of the ideas embodied in the patents while they were still employed by Bio-Rad (or its predecessor QuantaLife), with which Drs. Hindson and Saxonov had signed assignment agreements. The ALJ rejected the defense. J.A. 282–92. The ALJ concluded that Bio-Rad had not shown that the "inventive concept" of the asserted patents was conceived before the inventors left Bio-Rad. J.A. 282–83. That was decisive, the ALJ concluded, because "[n]o provision of any of the

applicable contracts governs future inventions" merely because the future inventions "are based on or developed from work done during employment." J.A. 285–86. Based on the record, the ALJ found that it was not "more likely than not that conception of the inventive idea in the asserted patents occurred before [the two co-inventors'] departure" from Bio-Rad. J.A. 292.

On review, the Commission agreed with the ALJ that Bio-Rad does not co-own the asserted patents. J.A. 104–08. The Commission stated that Bio-Rad's identified "ideas" that Drs. Hindson and Saxonov worked on while at QuantaLife and Bio-Rad were too "generic"; they did not include the specifics required by the 10X patent claims at issue. J.A. 104–05. The Commission added that Bio-Rad's own evidence showed that the inventors, while at Bio-Rad and QuantaLife, worked chiefly on droplet-in-droplet architecture, which is different from the gel-bead architecture to which Drs. Hindson and Saxonov later shifted their focus to make the inventions now at issue.[4] J.A. 105. The Commission also determined that Bio-Rad had not shown that any of the ideas that Drs. Hindson and Saxonov worked on when with Bio-Rad or QuantaLife remained outside the published prior art by the conception date for the patents at issue. J.A. 106. The Commission mentioned that many of the ideas that Bio-Rad identified were disclosed in U.S. Patent No. 9,347,059, which named Dr. Saxonov as an inventor and was assigned to Bio-Rad. J.A. 106 ("Moreover, the existence of the '059 patent demonstrates that Bio-Rad received the benefit of its bargain with respect to the employment agreements. For the ideas that were conceived at

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[4] Droplet-in-droplet architecture uses a droplet as the vehicle to deliver barcodes into another droplet containing the analyte, whereas the asserted claims use a gel bead as the delivery vehicle. *See* J.A. 6216.

QuantaLife or Bio-Rad, Dr. Saxonov did assign his rights."). Finally, the Commission clarified the ALJ's use of the term "'inventive concept'" to mean "'the specific arrangement of elements claimed in the asserted patents.'" J.A. 107–08 (quoting J.A. 283). The Commission reasoned that the inventive concept here was the combining of several elements resulting in gel beads that deliver barcodes into the droplets with nucleic acid samples, in which the barcodes are releasably attached to the gel beads. J.A. 108. For those reasons, the Commission concluded, Bio-Rad had not shown it was entitled to an ownership interest in any of the asserted patents.

Bio-Rad timely appealed. We have jurisdiction under 19 U.S.C. § 1337(c) and 28 U.S.C. § 1295(a)(6).

II

We now generally refer to all determinations on review as those of the Commission, whether or not made by the ALJ or by the full Commission. "We review the Commission's final determinations under the standards of the Administrative Procedure Act." *Guangdong Alison Hi-Tech Co. v. Int'l Trade Comm'n*, 936 F.3d 1353, 1359 (Fed. Cir. 2019); *see also* 19 U.S.C. § 1337(c); 5 U.S.C. § 706. The Commission's factual findings are reviewed for substantial-evidence support and its legal determinations are reviewed de novo. *Guangdong*, 936 F.3d at 1359. "A finding is supported by substantial evidence if a reasonable mind might accept the evidence as adequate to support the finding." *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1330 (Fed. Cir. 2019).

A

Bio-Rad argues that the Commission erred in finding that Bio-Rad infringes the asserted claims of the '024, '468, and '530 patents, in finding that 10X's domestic products practice the asserted claims of the '530 patent,

and in rejecting Bio-Rad's indefiniteness challenge to the asserted claims of the '530 patent. We disagree.

1

Bio-Rad argues that it does not infringe the asserted claims of the '024 patent because its system's stimulus is applied to the oligonucleotide, not the gel bead. Bio-Rad Opening Br. at 41–47. The Commission rejected the contention and found infringement. We review that factual finding for support by substantial evidence. *ATEN Int'l Co. v. Uniclass Tech. Co.*, 932 F.3d 1364, 1367 (Fed. Cir. 2019). We conclude that such support exists.

Claim 1 of the '024 patent requires a "porous gel bead [that] comprises at least 1,000,000 oligonucleotide molecules comprising barcode sequences, wherein *said* oligonucleotide molecules are releasably attached to said porous gel bead." '024 patent, col. 33, lines 58–62 (emphasis added). It further requires "*applying a stimulus to said porous gel bead* to release *said* oligonucleotide molecules from said porous gel bead." *Id.*, col. 33, lines 65–67 (emphases added). The Commission found Bio-Rad's system to satisfy those requirements. The parties agreed that the "applying a stimulus . . ." phrase has "its plain and ordinary meaning." J.A. 159. "Releasably attached" was construed to mean "'attached in a manner that allows the attached object to be released.'" J.A. 159 (quoting J.A. 643). That construction is not challenged on appeal.

The evidence shows that in Bio-Rad's system, the oligonucleotide molecules that include barcode sequences are contained within the gel bead. J.A. 165 (citing J.A. 4983 (describing oligonucleotides "in the volume of the . . . bead")). It further shows that the oligonucleotide molecules that include barcode sequences are attached through linking molecules to the gel bead. *See* J.A. 160–64, 1278–84. When an enzyme is applied to release oligonucleotides that contain barcode sequences, the "'enzyme enters the entire volume of the bead,'" and it

releases those nucleotides. J.A. 164 (quoting Bio-Rad's expert, J.A. 4870); *see also* J.A. 160–66, 1278–84, 3235, 3240–51. The evidence reasonably permitted the Commission to find the claim limitation at issue met when the enzyme is "appl[ied]," '024 patent, col. 33, line 65, to the entirety of the gel bead at a time when the bead includes the specified oligonucleotide molecules. J.A. 165.

Focusing on the claim's requirement that specified "oligonucleotide molecules are releasably attached to said porous gel bead," Bio-Rad argues that two items that are attached to each other must not be treated as identical. *See* Bio-Rad Opening Br. at 43–44 (citing *In re Cuozzo Speed Techs., LLC*, 793 F.3d 1268, 1280 (Fed. Cir. 2015) (affirming Board's construction of "integrally attached" to mean "discrete parts physically joined together as a unit without each part losing its own separate identity")). That observation does not undermine the Commission's finding that the claim limitation, given its plain and ordinary meaning, is met. The Commission did not treat the bead and the specified oligonucleotide as the "same object." *Id.* at 43. The Commission properly found that, after the specified oligonucleotides have been releasably attached to the gel bead, the specified "oligonucleotides are *part of* the gel bead," J.A. 165 (emphasis added), and it is after that attachment that the enzyme is applied to the entirety of the bead.

Bio-Rad argues that its enzyme removes or cleaves a part of the oligonucleotide molecule and not some part of the gel material, pointing to a portion of the '024 patent specification. Bio-Rad Opening Br. at 46–47 (citing '024 patent, col. 2, lines 20–25 (describing the gel bead as "degradable upon the application of a stimulus")). But the claim language merely requires "*applying a stimulus* to said porous gel bead to release said oligonucleotide molecules," the "said" molecules having only to consist of oligonucleotides that contain barcoding sequences (which may be less than the entirety of an oligonucleotide mole-

cule bonded with a gel bead). '024 patent, col. 33, lines 65–66 (emphasis added); J.A. 162. That language requires application of an enzyme to the gel bead, but it does not further specify which bonds must be broken to release the specified oligonucleotides that contain barcode sequences. Moreover, the specification contemplates that any number of stimuli could be applied, including "chemical triggers." '024 patent, col. 19, lines 36–46; *see also id.*, col. 9, lines 52–56 ("For example, in the case where an oligonucleotide barcode is immobilized to a gel bead via a disulfide bond, exposure of the disulfide bond to a reducing agent can cleave the disulfide bond and free the oligonucleotide barcode from the bead."). We conclude that substantial evidence supports the Commission's finding that Bio-Rad's system practices the asserted claims of the '024 patent.

2

Bio-Rad argues that it does not infringe the asserted claims of the '468 patent because its system's nucleic-acid-sample solution and reagent solution do not mix until droplets are formed. Bio-Rad Opening Br. at 47–51. The Commission reasonably found otherwise.

Claim 1 of the '468 patent requires both the oligonucleotide and nucleic-acid samples to be in an aqueous phase that meet at a "first junction . . . to form an aqueous mixture." '468 patent, col. 33, line 64, through col. 34, line 3. Thereafter a droplet is generated by having the aqueous mixture and an "immiscible continuous phase," *e.g.*, oil, meet at a second junction. *Id.*, col. 34, lines 4–9. As the Commission described, 10X's expert testified that Bio-Rad's system met the requirement of an aqueous mixture after the first junction, pointing to Bio-Rad documents that described the mixing of the two solutions. J.A. 201 (citing J.A. 1333–34). Bio-Rad responded that 10X's expert had admitted that Bio-Rad's oligonucleotide solution and its nucleic-acid-sample solution are kept

separate until they get to the second junction where the droplet is formed, lest the solutions react before being encased in a droplet. *See* J.A. 202; *see also* J.A. 10104 (10X expert Dr. Butte testifying that "it would be a big mess" if the two solutions mixed "without forming a droplet"). The Commission credited 10X's expert and rejected Bio-Rad's response, noting that 10X's expert had explained that the potentially worrisome reaction (lysis) is not instantaneous and a droplet is formed soon enough after the solutions are combined to avoid creation of a mess. J.A. 203 (citing J.A. 10104).

On appeal, Bio-Rad's challenge to the Commission's finding on this point relies crucially on a somewhat hazy image of the Bio-Rad system that seems to show a horizontal line between the two solutions until they are past the second junction—an image that, Bio-Rad argues, establishes that the two solutions do not mix together before the second junction (where the oil is introduced to form a droplet). Bio-Rad Opening Br. at 50 (citing J.A. 2207). But Bio-Rad does not point to any evidence in the record that explains the horizontal line in the image. Without record evidence explaining what the line is, we cannot say that the Commission lacked substantial evidence to find that Bio-Rad infringed the '468 patent.

3

Bio-Rad makes three arguments about the '530 patent. We reject all three arguments.

a

Bio-Rad argues that substantial evidence does not support the Commission's finding that Bio-Rad's system practices the asserted claims of the '530 patent. Bio-Rad Opening Br. at 58–60. We disagree. Bio-Rad's argument must fail unless the Commission erred, as a matter of claim construction, in determining that the claim permits some barcode detachment (from the gel of the bead) to

occur before 1,000 droplets are formed—as long as the claim-required number of detachments occur after 1,000 droplets have formed. J.A. 74–76, 81, 99–100, 232. But Bio-Rad does not even argue for a different claim construction, and in any event, we see no error in the Commission's construction, which fits the evident meaning of the claim.[5]

The method of claim 1 of the '530 patent requires three steps. As relevant here, it is not disputed that, as the Commission and ALJ both concluded, *see* J.A. 99–100, 233, the second step of generating "at least 1,000 droplets" (each containing the specified analyte along with a gel bead having at least 1,000 barcode molecules) must be completed before the third step of generating a "plurality of barcoded polynucleotide molecules" by detachment from the gel bead is performed in the 1,000 droplets. '530 patent, col. 48, line 59, through col. 49, line 4. Critically, that conclusion does not mean, and the claim language does not require, that there be no barcode detachment before 1,000 droplets are generated. J.A. 74–76, 81, 99–100, 232. All the claim language requires is that, after at least 1,000 droplets are formed, the required barcode detachment/generation occur in each of them. As long as that occurs, "[t]he fact that barcoding of other polynucleotides also happened before 1,000 droplets were generated is irrelevant." J.A. 99–100.

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[5] Bio-Rad does argue indefiniteness, resting that argument on the contention that the Commission and ALJ adopted conflicting constructions over time. Bio-Rad Opening Br. at 60–63. As we conclude *infra*, however, Bio-Rad has forfeited any indefiniteness challenge, and in any event, all the Commission (and ALJ) did was to resolve, correctly, a potential uncertainty in an initial formulation of the proper claim meaning, a process that does not support a conclusion of indefiniteness.

Without directly (or persuasively) challenging that claim construction, Bio-Rad argues on appeal that because barcoding begins immediately after a droplet is formed, 10X has not proven infringement. Bio-Rad Opening Br. at 59–60. But the Commission found that barcode molecules are not released from the gel beads instantaneously and that, instead, the barcoding process merely begins to occur upon droplet formation, with enough barcode detachment still occurring after 1,000 droplets are formed to meet the claim requirement. *See* J.A. 79–81. Indeed, the Commission found that "the bulk of cleavage and barcoding occur" after 1,000 droplets are formed. J.A. 80. The Commission cited sufficient evidence to support its findings. *See*, *e.g.*, J.A. 2169, 2290, 2631–32.

b

Invoking the same claim limitations as those just discussed, Bio-Rad contests the Commission's determination that 10X's product comes within the asserted claims of the '530 patent and thereby satisfies the domestic-industry requirement of the Tariff Act. *See* 19 U.S.C. § 1337(a)(2) (requiring that a domestic industry "relating to the articles protected by the patent . . . exist[] or [be] in the process of being established"). "The test for satisfying the 'technical prong' of the [domestic] industry requirement is essentially [the] same as that for infringement, i.e., a comparison of domestic products to the asserted claims." *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1375 (Fed. Cir. 2003). Bio-Rad argues that 10X's product does not practice the asserted claims of the '530 patent because, in 10X's product (as, Bio-Rad says, in its own systems), barcode molecules are released after droplets are formed. Bio-Rad Opening Br. at 53–58. In particular, Bio-Rad challenges the Commission's finding, based in part on information from 10X investor presentations, that at least 1,000 gel beads remain to be dissolved after at least 1,000 droplets are formed. *Id.* (citing J.A. 83–87).

We see no reversible error in the Commission's determination.

In its decision on the domestic-industry issue, the Commission found that a typical run of droplet formation, which can generate 8,000 droplets from one gel bead, lasts 6.5 minutes, suggesting that more than 1,000 droplets are generated in the last minute of the droplet-formation process. J.A. 83 (citing J.A. 1363–64, 1693). Bio-Rad does not explain why that conclusion is wrong on appeal. *See* Bio-Rad Opening Br. at 55. The Commission also found that gel beads are only partially dissolved two minutes after droplet formation. J.A. 85–87. In so finding, the Commission relied on a slide from a presentation 10X made to investors in 2013. J.A. 85–87 (citing J.A. 1429). In addition, the Commission credited testimony from Dr. Schnall-Levin (a co-inventor) that the gel bead does not "instantaneously" disappear after droplet formation. J.A. 87–88 (citing J.A. 10057 ("Q. When you take the first droplet, the cell and bead disappear immediately; right? A. No, I don't think so."). On those bases, the Commission found that the '530 patent's claim requirement at issue is met, *i.e.*, "at least 1,000 droplets" are generated before generating a "plurality of barcoded polynucleotide molecules." J.A. 87.

On appeal, Bio-Rad argues that the Commission erred in relying on the investor slide because there was no evidence to suggest that the slide, from 2013, J.A. 1394, accurately represented the operation of the commercial products that 10X actually sold (GemCode products starting in 2015, Chromium products starting in 2016, J.A. 36, 1237). Bio-Rad Opening Br. at 55–56. But the slide explicitly refers to the "10X GEM System," which is the GEM architecture that is used in 10X's products. *See* J.A. 1429. The 10X Chromium User Guide itself describes the use of the GEM architecture in the product. *See* J.A. 1557. The evidence, not contradicted by any evidence

that Bio-Rad identifies, suffices for the Commission to rely on the investor slides.

Bio-Rad also argues that it never had the opportunity to present evidence disputing the significance of the slide with respect to the domestic-injury requirement because 10X did not cite the slide for that purpose until the proceedings before the Commission, on review of the ALJ determination. Bio-Rad Opening Br. at 56–57 (citing J.A. 83). But Bio-Rad is responsible for the timing it criticizes: In the evidentiary proceeding before the ALJ, Bio-Rad never disputed that 10X's products practice the barcode-release requirement. *Compare* J.A. 3807–10 (Bio-Rad Pre-Trial Brief), 4103–04 (Bio-Rad Post-Trial Brief), 4247–28 (Bio-Rad Post-Trial Reply Brief), *with* J.A. 789 (Petition for Commission Review). Bio-Rad raised this issue for the first time in seeking Commission review, after the evidentiary record was complete. J.A. 789. When the Commission ordered additional submissions on this issue (among others), it directed the parties to identify all evidence supporting their positions. J.A. 831. After Bio-Rad made its submission, 10X responded, citing the in-the-record slide as supporting evidence. *See* J.A. 83–85. Bio-Rad does not show that it asked the Commission for an opportunity to submit further evidence to counter the slide evidence. In these circumstances, when there is no concrete showing of prejudice even now, we see no reversible error in the Commission's reliance on the slide evidence.

Bio-Rad also argues that the Commission erred in relying on Dr. Schnall-Levin's statement as corroborating the Commission's understanding of the dissolution rate of the gel beads. Bio-Rad Opening Br. at 57. But when Bio-Rad asked Dr. Schnall-Levin, "When you take the first droplet, the cell and bead disappear immediately; right?", he responded, "No, I don't think so." J.A. 10057. That statement lends support to the Commission's finding, and, of course, it does not stand alone.

Finally, Bio-Rad repeats an argument that the Commission rejected—namely that certain 10X promotional materials explain that its gel bead dissolves "immediately" after droplet generation. J.A. 83. Bio-Rad points to documents like the 10X Chromium Single Cell User Guide, which states that "[i]mmediately following generation of a GEM [droplet], the Single Cell 5' Gel Bead is dissolved." J.A. 1557; *see also* J.A. 3259 (Bio-Rad expert explaining that "[a]fter encapsulation into droplets, cell lysis starts almost immediately following rapid mixing in the droplets"). We see no error in the Commission's calculations, or in its conclusion that "immediately" does not mean "instantaneously" or so fast that fewer than 1,000 gel beads would have barcodes attached after droplet formation was complete. J.A. 87–88. The evidence that Bio-Rad cites could also mean, as the Commission found, that gel bead dissolution begins immediately but is not completed "instantaneously."

c

Bio-Rad seeks reversal of the Commission's rejection of Bio-Rad's indefiniteness challenge to the asserted claims of the '530 patent. Bio-Rad Opening Br. at 60–63. The Commission determined that Bio-Rad forfeited its indefiniteness argument by failing to raise it to the ALJ and also rejected the argument on its merits. J.A. 89–100. Where, as in this case, Bio-Rad does not dispute any findings of material underlying facts on appeal, a ruling on indefiniteness is reviewed de novo. *See Nevro Corp. v. Bos. Sci. Corp.*, 955 F.3d 35, 37 (Fed. Cir. 2020). We reject Bio-Rad's challenge.

First, the Commission's forfeiture determination independently sufficed to reject the indefiniteness challenge, apart from the merits of the challenge, and Bio-Rad did not contest the Commission's forfeiture ruling in its Opening Brief. *Cf.* Bio-Rad Reply Br. at 29 (responding to 10X and the Commission's argument that "indefiniteness

is waived"). "Ordinarily, an appellant waives issues or arguments not properly raised in its opening brief." *In re Apple Inc.*, 979 F.3d 1332, 1337 (Fed. Cir. 2020). We see no persuasive reason not to apply that principle here.

Second, and in any event, Bio-Rad's indefiniteness challenge rests on the contention that indefiniteness is shown by the Commission's (and ALJ's) clarification of the initially formulated construction. But even a modification of a claim construction does not imply or presumptively suggest indefiniteness: Modifications are proper and sometimes necessary steps as disputes sharpen during litigation. *See*, *e.g.*, *Pfizer, Inc. v. Teva Pharms. USA, Inc.*, 429 F.3d 1364, 1377 (Fed. Cir. 2005). Mere amplification of an initial construction to resolve a material dispute about claim meaning—which is sometimes necessary, *see*, *e.g.*, *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1360–62 (Fed. Cir. 2008)—provides an even weaker potential basis for a suggestion of indefiniteness. Such amplification is all that occurred here. And the result of the amplification in this case was to state, with greater clarity than was earlier provided, what we think is the correct interpretation of the claim limitations at issue. In these circumstances, we see no merit to Bio-Rad's indefiniteness appeal.

B

On appeal, Bio-Rad renews its argument, made as a defense to infringement, that it co-owns the three asserted patents based on the assignment provisions in the employment contracts signed by Drs. Hindson and Saxonov. It is undisputed that, if Bio-Rad is a co-owner, it cannot be an infringer. *See* 35 U.S.C. § 262 ("[E]ach of the joint owners of a patent may make, use, offer to sell, or sell the patented invention . . . without the consent of and without accounting to the other owners."). But co-ownership is disputed.

We accept the finding that the asserted claims in this matter had a conception date no earlier than January 2013, after Drs. Hindson and Saxonov left their employment at Bio-Rad (and its predecessor QuantaLife) *See* J.A. 282–92; J.A. 1209–16, 6205. On appeal, Bio-Rad has not squarely asserted, let alone shown, otherwise. Before the Commission, Bio-Rad did not present an alternative conception date (earlier than January 2013), *see* J.A. 10179 (Bio-Rad's expert declining to dispute conception date), and it lost the opportunity to argue conception of certain claim elements while Drs. Hindson and Saxonov were at QuantaLife, as the Commission decided (for procedural reasons) in a ruling that Bio-Rad has not appealed, *see* J.A. 104 n.15, 701–02, 7243.

Bio-Rad nevertheless argues for co-ownership, building that contention on the undisputed legal premise that co-inventorship (equivalently, joint inventorship) entails co-ownership. *See Israel Bio-Eng'g Project v. Amgen, Inc.*, 475 F.3d 1256, 1263 (Fed. Cir. 2007). Bio-Rad's contention has two components. *First,* Bio-Rad asserts, if Drs. Hindson and Saxonov, when working at Bio-Rad (or its predecessor QuantaLife), had ideas that contributed to the post-employment inventions at issue, and if *those* contributions would make them co-inventors (regardless of post-employment contributions to the inventions), then the assignment provisions required assignment of their co-ownership interest to Bio-Rad. *Second*, Bio-Rad asserts, Drs. Hindson and Saxonov did in fact have such co-inventorship-qualifying ideas while employed at Bio-Rad (specifically, while working for QuantaLife).[6]

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[6] Although some language used by Bio-Rad suggests a view that the assignment provisions reach beyond even what would count as co-inventorship, Bio-Rad ultimately develops no alternative interpretation. The only argument Bio-Rad develops is that "joint inventorship is

The Commission rejected both assertions advanced by Bio-Rad to claim co-ownership. J.A. 101–08 (Commission); *see also* J.A. 277–93 (ALJ). Bio-Rad seeks reversal; it does not ask for a remand for further proceedings on the issue. We affirm the Commission's ruling.

The assignment provisions by their terms are governed by California law. J.A. 3194, 3196, 3202, 3212; *see also Intell. Ventures I LLC v. Erie Indem. Co.*, 850 F.3d 1315, 1320 (Fed. Cir. 2017) (applying state law to interpret contracts for assignments of patents). "Under California law, 'the interpretation of a contract is a question of law subject to de novo review' on appeal." *Semitool, Inc. v. Dynamic Micro Systems Semiconductor Equip. GmbH*, 444 F.3d 1337, 1341 (Fed. Cir. 2006) (quoting *Int'l Rectifier Corp. v. SGS-Thompson Microelectronics*, No. CV 90-4802, 1994 WL 896313, at *19 (C.D. Cal. Aug. 22, 1994)). "Inventorship is a mixed question of law and fact: The overall inventorship determination is a question of law, but it is premised on underlying questions of fact." *Eli Lilly & Co. v. Aradigm Corp.*, 376 F.3d 1352, 1362 (Fed. Cir. 2004). We accept the Commission's underlying findings of fact unless they lack support in substantial evidence. *See id.* (same for inventorship in jury case); *see also Dana-Farber Cancer Inst., Inc. v. Ono Pharm. Co.*, 964 F.3d 1365, 1370 (Fed. Cir. 2020), *petition for cert. filed*, No. 20-1258 (U.S. Mar. 11, 2021).

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the appropriate framework to view this case." Bio-Rad Reply Br. at 6; *see also* Bio-Rad Opening Br. at 25, 36. Bio-Rad's argument is one for co-ownership, not full ownership, and co-inventorship is the sole cited legal basis for co-ownership. We therefore restrict our attention to the two-step argument for assignment based on co-inventorship.

1

Bio-Rad has furnished no persuasive basis for disturbing the Commission's conclusion that the assignment provisions do not apply to a signatory's ideas developed during the employment (with Bio-Rad or QuantaLife) solely because the ideas ended up contributing to a post-employment patentable invention in a way that supports co-inventorship of that eventual invention.

Bio-Rad itself declares that what the assignment provisions apply to is "intellectual property." Bio-Rad Reply Br. at 1, 3. The agreements lend support to that characterization as a limitation on coverage. The QuantaLife agreement, on which Bio-Rad has focused, first imposes a requirement to disclose to the Company (QuantaLife) trademarks, inventions, and other ideas (all of which it parenthetically calls "IP") that bear specified relations to the Employee's employment or the Company's business. J.A. 3199 (§ 2(a)). The assignment provision follows, and it states that "Employee shall assign to the Company . . . Employee's *entire right to* any IP described in the preceding subsection, . . . whether or not patentable." J.A. 3199 (§ 2(b)) (emphasis added). The language of "right to" suggests that the subject of the required assignment must be "intellectual property," whether or not the right is a patent, trademark, trade secret, copyright, or other form of intellectual property. *See* J.A. 3199 (§ 2(b)); *see also* J.A. 3195 (Bio-Rad agreement, after acquisition of QuantaLife, using "inventions" as the umbrella term); Oral Arg. at 1:50–2:45 (Bio-Rad agreeing that the scope of the assignment duties is the same).

Crucially, the assignment provisions are limited temporally. The assignment provision of the QuantaLife agreement reaches only a "right to any IP described in the preceding section," J.A. 3199 (§ 2(b)), and the preceding (disclosure-duty) section is limited to IP "that Employee conceives, develops or creates alone or with the aid of

others *during the term of Employee's employment with the Company*," J.A. 3199 (§ 2(a)) (emphasis added). *See* J.A. 3195 (§ 3) (before adding a limitation, stating: "All inventions . . . which I may solely or jointly conceive, develop, or reduce to practice during the period of my employment by Bio-Rad shall be assigned to Bio-Rad."). The most straightforward interpretation is that the assignment duty is limited to subject matter that itself could be protected as intellectual property *before* the termination of employment (even if any formal government grants needed for protection may not have been acquired).

Bio-Rad does not argue, much less demonstrate, that a person's work, just because it might one day turn out to contribute significantly to a later patentable invention and make the person a co-inventor, is itself protectible intellectual property before the patentable invention is made. Such work is merely one component of "possible intellectual property." Bio-Rad Reply Br. at 3. In the case of a patent, it may be a step toward the potential ultimate existence of the only pertinent intellectual property, namely, a completed "invention," but the pertinent intellectual property does not exist until at least conception of that invention. *See*, *e.g.*, *REG Synthetic Fuels, LLC v. Neste Oil Oyj*, 841 F.3d 954, 958 (Fed. Cir. 2016); *Dawson v. Dawson*, 710 F.3d 1347, 1353 (Fed. Cir. 2013); *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1227–28 (Fed. Cir. 1994).

Significantly, Bio-Rad has not cited any decision that held a significant contribution to post-employment inventions to come within an assignment provision that was limited to intellectual property developed during the term of employment. In *Israel Bio-Engineering Project*, which Bio-Rad cites, we read a contractual agreement as *not* reaching inventions conceived after the term of the agreement (two of the patent claims at issue), even though those inventions were based on work done during the term of the agreement. 475 F.3d at 1267–68. The

contractual limitation to information "developed in the [specified] R&D programs," we held, limited the assignment to information developed "during the term of the Sub-R&D Agreement," and that temporal limit excluded assignments of "any other newly developed inventions, even when these inventions built on proprietary information developed during the R&D process." *Id.* at 1267 (emphasis and internal quotation marks omitted). We did not look beyond the conception of the claimed inventions to consider whether a merely significant contribution to those inventions might be subject to the assignment duty.

The *FilmTec* case cited by Bio-Rad involved language of an agreement, and language of the statutory command embodied in the agreement, that expressly assigned ownership to the United States of certain inventions as long as they were "conceived" during performance of government-supported work under a contract. *FilmTec Corp. v Hydranautics*, 982 F.2d 1546, 1548 (Fed. Cir. 1992). We examined the claimed invention, namely, a composition conceived during the term of the agreement, where conception meant the "'formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.'" *Id.* at 1551–52 (quoting *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986)). We noted that the inventor, continuing to work on the invention after the agreement ended, added certain "narrow performance limitations in the claims." *See id.* at 1553. But we treated the performance limitations as not adding anything of inventive significance because they were mere "refine[ments]" to the invention already conceived during the term of the agreement. *See id.* at 1552–53. We held the claimed inventions to have been conceived during the agreement—something that Bio-Rad accepts is not true here. We did not deem a mere joint inventor's contribution to a post-agreement conception sufficient.

Finally, the *Stanford* case, on which Bio-Rad relies, involved quite different contract language from the language at issue here. *See Bd. of Trustees of the Leland Stanford Junior Univ. v. Roche Molecular Sys., Inc.*, 583 F.3d 832, 837 (Fed. Cir. 2009), *aff'd on different grounds*, 563 U.S. 776 (2011). The case involved a Stanford employee who was spending time at Cetus in order to learn important new research techniques; as part of the arrangement, the Stanford employee signed an agreement with Cetus committing to assign to Cetus his "right, title, and interest" in the ideas, inventions, and improvements he conceived or made "as a consequence of" his work at Cetus. *Id.* at 837 (internal quotation marks omitted). *Stanford* was not a former-employee case, as we recently explained. *Whitewater West Indus., Ltd. v. Alleshouse*, 981 F.3d 1045, 1056 (Fed. Cir. 2020). The language at issue in *Stanford* did not contain the temporal limitation at issue here. And the agreement here does not contain the broad "as a consequence of" language at issue in *Stanford*.[7]

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[7] Other decisions cited by Bio-Rad likewise do not hold that assignment language like the language here covers work during employment as long as it supports co-inventorship of post-employment patentable inventions. *See AT&T Co. v. Integrated Network Corp.*, 972 F.2d 1321, 1324–25 (Fed. Cir. 1992) (dismissing for want of jurisdiction where state-law claims did not necessarily raise federal patent-law issue); *Venclose Inc. v. Covidien Holding, Inc.*, No. 16-cv-07372, 2017 WL 3335984, at *1–2, *7 (N.D. Cal. Aug. 4, 2017) (dismissing state-law claims, including contract claims, because they did not necessarily raise federal patent-law issues); *Motorola, Inc. v. Lemko Corp.*, No. 08 C 5427, 2012 WL 74319, at *3, *11–12 (N.D. Ill. Jan. 10, 2012) (addressing assignment of completed inventions, where issue was conception date).

The governing law of California provides a confirmatory reason not to read the assignment provision at issue here more broadly than we do. In particular, California law recognizes significant policy constraints on employer agreements that restrain former employees in the practice of their profession, including agreements that require assignment of rights in post-employment inventions. *See Whitewater*, 981 F.3d at 1051–57. Substantial questions about compliance with that policy would be raised by an employer-employee agreement under which particular subject matter's coverage by an assignment provision could not be determined at the time of employment, but depended on an unknown range of contingent future work, after the employment ended, to which the subject matter might sufficiently contribute. Such an agreement might deter a former employee from pursuing future work related to the subject matter and might deter a future employer from hiring that individual to work in the area. The contract language before us does not demand a reading that would test the California-law constraints. We do not think it reasonable to test those constraints here by adopting a broader reading of the contract language than the straightforward reading we have identified.

2

In any event, Bio-Rad has not shown reversible error in the Commission's rejection of the contention that the work of Drs. Hindson and Saxonov at Bio-Rad (or its predecessor) qualified them for joint inventorship of the patents at issue. Bio-Rad argues that Drs. Hindson and Saxonov "conceived of key aspects of the claimed inventions, if not the entirety of the claims, at QuantaLife/Bio-Rad." Bio-Rad Opening Br. at 26–36. The Commission determined that many of these "ideas" are at a level of generality that cannot support joint inventorship, *see* J.A. 104–06, or (sometimes and) involve nothing more than elements in the already-published prior art, *see* J.A. 106 ("Bio-Rad has not shown that the 'ideas' it relies on to

build its joint inventorship argument are distinct from the prior art."); *Dana-Farber*, 964 F.3d at 1371 (noting that joint inventors must "'do more than merely explain to the real inventors well-known concepts and/or the current state of the art'" (quoting *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1351 (Fed. Cir. 1998))). To accept Bio-Rad's contention after we give the required deference to the Commission's factual (and, in one instance, procedural) rulings would require that we find joint inventorship simply because Drs. Hindson and Saxonov, while at Bio-Rad (or QuantaLife), were working on the overall, known problem—how to tag small DNA segments in microfluidics using droplets—that was the subject of widespread work in the art. We see no sound support for such a conclusion.

The Commission found that many of Bio-Rad's "ideas" are disclosed in Bio-Rad's '059 patent. J.A. 106. The application for that patent was published on December 13, 2012, J.A. 2111, making the ideas disclosed in it part of the published prior art before the undisputed earliest January 2013 conception date of the 10X patents at issue. Bio-Rad also argued in this matter that the '059 patent anticipated the 10X patents (an argument rejected, though not for reasons of lack of priority, in a ruling that Bio-Rad does not appeal). *See* J.A. 735, 758–63, 790–91; *see also* Oral Arg. at 16:00–17:45.

Bio-Rad contends that at least three ideas developed at QuantaLife were not publicly known in the prior art at the time Drs. Hindson and Saxonov were working on them: tagging droplets to track a sample-reagent reaction complex, using double-junction microfluidics to combine sample and reagent, and using oligonucleotides as barcodes to tag single cells within droplets. But these contentions, by their terms, look to a time long before the January 2013 conception date for the inventions at issue here. Bio-Rad does not deny that these ideas were in the published prior art by the time of the conception of the inventions at issue or that they were, by then, readily

available to the co-inventors on the patents involved. For that reason and others, the contentions are insufficient to establish co-inventorship.

First, Bio-Rad argues that a slide from a May 2011 presentation shows that Dr. Hindson suggested, while still at QuantaLife, that droplets could be "tagged" with barcodes in a single-cell system. *See* J.A. 3442, 10040–41; Bio-Rad Opening Br. at 27–29. The slide describes delivering oligonucleotide barcodes contained within an inner droplet to the sample cell within the droplet, referred to as a "droplet-in-droplet" architecture. *See* J.A. 3442. This droplet-in-droplet architecture is materially different from the architecture used in the 10X patents at issue here, which deliver the oligonucleotide barcodes via gel beads. *See* J.A. 105–06; *see also* J.A. 6204 (Hindson explaining the significant difference). Moreover, Bio-Rad's expert, Dr. Metzker, acknowledged that droplet tagging has been used as a method for sample preparation "[f]or a number of years before the . . . priority date of the patents-in-suit." J.A. 7102. Dr. Metzker also pointed to the '059 patent in particular—published before the conception date at issue here—as one example of prior art that discloses droplet tagging. J.A. 7102.

Second, Bio-Rad argues that a slide from a May 2009 QuantaLife presentation shows that Dr. Hindson suggested using a microfluidic device containing a double junction to combine nucleic acid samples with reagents, which is claimed in the '468 patent. *See* J.A. 2885, 2904; Bio-Rad Opening Br. at 34–35. This slide is part of a group of slides describing an experiment that involved multiple emulsions, conducted by Dr. Hindson in February 2009. *See* J.A. 10038. The evidence indicated, however, that the experiment was not an idea that Dr. Hindson came up with, but rather was an attempt to recreate an experiment already described in the prior art. *See* J.A. 6203–04, 10046. Moreover, the double-junction arrangement appeared in published prior art long before

the conception date of the patents at issue here. *See*, *e.g.*, J.A. 2683–84 (July 2009 article).

Third, Bio-Rad argues that an April 14, 2011 email sent by Dr. Saxonov when at QuantaLife (with a copy to Dr. Hindson, also at QuantaLife) lays out the idea of using oligonucleotides as barcodes to tag single cells within droplets, which is claimed in the '024 and '468 patents. *See* J.A. 2907–13; Bio-Rad Opening Br. at 32. But the '024 patent itself suggests that using oligonucleotide molecules as barcodes was publicly known. *See* '024 patent, col. 12, lines 9–17 ("In some cases, one or more unique molecular identifiers, sometimes known in the art as a 'molecular barcode[],' are used as sample preparation reagents. These molecules may comprise a variety of different forms such as oligonucleotide bar codes . . . .").

The common core of the inventions in the asserted 10X patents is the use of gel beads with releasably attached oligonucleotide barcode molecules as a system for delivery of barcodes to nucleic acid segments. The Commission could reasonably find that this invention was not conceived at QuantaLife or Bio-Rad. *See* J.A. 1215–16 (discussing conception of the invention, particularly the "gel bead in emulsion" concept, in January 2013), 10179 (Bio-Rad expert declining to dispute the conception date). Although Bio-Rad suggests that certain emails in the record on appeal would support a finding that Dr. Hindson thought of using gel beads as a delivery system when at QuantaLife, *see* Bio-Rad Opening Br. at 32–34; J.A. 2907–13, 2303, a late-disclosure-based order of the ALJ—not challenged by Bio-Rad on appeal—precluded Bio-Rad from affirmatively contending that using gel beads was conceived at QuantaLife, J.A. 104 n.15, 701–02, 7243. Moreover, Bio-Rad was permitted to use Dr. Hindson's emails to cross-examine him and challenge his credibility, but the ALJ found Dr. Hindson credible in his testimony, including as to gel beads, and the Commission did not

disagree. *See* J.A. 106, 289–90; *see also* J.A. 6200–05 (Hindson Statement), 6213–19 (Saxonov Statement).

In short, we see no lack of substantial evidence in support of the findings that underlie, and no error in, the rejection of Bio-Rad's co-inventorship contention—or, therefore, in the Commission's rejection of Bio-Rad's ownership defense.

III

For the foregoing reasons, the decision of the International Trade Commission is affirmed.

AFFIRMED