United States Court of Appeals for the Federal Circuit

SIGRAY, INC.,
Appellant

v.

CARL ZEISS X-RAY MICROSCOPY, INC.,
Appellee

2023-2211

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2022-00218.

Decided: May 23, 2025

ALAN GRAYSON LAQUER, Knobbe, Martens, Olson & Bear, LLP, Irvine, CA, argued for appellant. Also represented by CRAIG S. SUMMERS, JAMES YOUNGBLOOD.

KURT LOUIS GLITZENSTEIN, Fish & Richardson P.C., Boston, MA, argued for appellee. Also represented by RYAN PATRICK O'CONNOR, JOHN C. PHILLIPS, San Diego, CA; CHARLES NEVILLE REESE, JR., Atlanta, GA.

Before DYK and PROST, *Circuit Judges*, and GOLDBERG, *Chief District Judge*.[1]

GOLDBERG, *Chief District Judge*.

Appellee Carl Zeiss X-Ray Microscopy, Inc. ("Zeiss") owns U.S. Patent No. 7,400,704 (the "'704 patent"), which claims X-ray imaging systems that incorporate projection magnification. Appellant Sigray, Inc. ("Sigray") filed a petition with the Patent and Trademark Office requesting inter partes review of all claims of that patent. The Board granted Sigray's petition, finding that it demonstrated a reasonable likelihood that at least one of the challenged claims was unpatentable. In its final written decision, the Board declined to hold any of the asserted claims unpatentable. *Sigray, Inc., v. Carl Zeiss X-Ray Microscopy, Inc.*, No. IPR2022-00218, 2023 WL 5065239 (P.T.A.B. May 22, 2023) ("*Decision*"). Sigray appeals the Board's decision only as to whether claims 1–6 were unpatentable based on the prior art reference Jorgensen.[2] Specifically, Sigray challenges the Board's determination that claims 1, 3, and 4 were not anticipated by Jorgensen and that claims 1–6 would not have been obvious over Jorgensen, either in combination with other references or under a single reference theory. We reverse as to the lack of anticipation of claims 1, 3, and 4 and remand for the Board to determine if claims 2, 5, and 6 would have been obvious in light of this opinion.

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[1] Honorable Mitchell S. Goldberg, Chief Judge, United States District Court for the Eastern District of Pennsylvania, sitting by designation.

[2] S. Jorgensen, et al., Three-Dimensional Imaging of Vasculature and Parenchyma in Intact Rodent Organs with X-ray Micro-CT, Am. J. Physiology (Sept. 1998) ("Jorgensen").

BACKGROUND

X-ray technology has long been utilized to generate visual images of internal structures otherwise invisible to the naked eye. The typical X-ray process entails: (1) an X-ray source generating an X-ray beam, (2) that beam penetrating a sample, and (3) a detector receiving the transmitted beam. The information received by the detector is used to generate an image.

The patent at issue incorporates into this process a mechanism known as projection magnification, which enlarges the generated image. '704 patent, col. 2 ll. 47–49. Claim 1, of which all other disputed claims depend, recites:

> An x ray imaging system, comprising:
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> a projection x ray stage including:
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> an x ray source generating a diverging x ray beam; and
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> a scintillator for converting the x ray beam, after interacting with a sample, into an optical signal;
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> an optical stage including:
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> a detector; and
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> a magnification lens for imaging the optical signal of the scintillator onto the detector;
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> wherein *a magnification of the projection x ray stage is between 1 and 10 times* and a magnification of the optical stage is 5 or greater.

Id. at col. 9 l. 62–col. 10 l. 7 (emphasis added).

Projection magnification, also known as geometric magnification, utilizes diverging rays that spread out as they travel. The distance between the rays increases after

interacting with the sample but before being received by the detector. As a result, the generated image is larger than the sample itself. The level of magnification depends on the relative distances between the source, sample, and detector. *Id.* at col. 1 ll. 43–51. A larger distance between the source and the sample or a smaller distance between the sample and the detector will result in less magnification, and vise-versa.[3]

STANDARD OF REVIEW

We review the Board's legal conclusions de novo and its factual findings for substantial evidence. *ACCO Brands Corp. v. Fellowes, Inc.*, 813 F.3d 1361, 1365 (Fed. Cir. 2016). Anticipation is a question of fact reviewed for substantial evidence, *In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012), as is the question of whether a claim limitation is inherent in a prior art reference. *Monsanto Tech. LLC v. E.I. DuPont de Nemours & Co.*, 878 F.3d 1336, 1342 (Fed. Cir. 2018) (citing *Telemac Cellular Corp. v. Topp Telecom, Inc.*, 247 F.3d 1316, 1328 (Fed. Cir. 2001)). Substantial evidence "means such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." *In re Gartside*, 203 F.3d 1305, 1312 (Fed. Cir. 2000) (quoting *Consol. Edison Co. of New York v. N.L.R.B.*, 305 U.S. 197, 229 (1938)).

"Claim construction is ultimately a question of law, decided de novo on review, as are the intrinsic-evidence

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[3] This is expressed as $M = (L_s + L_d)/L_s$, where M is the level of magnification, L_s is the distance between the source and the sample, and L_d is the distance between the sample and the detector. '704 patent, col. 1 ll. 43–51. When $M = 1$, the size of the sample is equal to the size of the generated image, i.e., there is no magnification. This formula is applicable only if the rays are diverging, as completely parallel rays result in no magnification.

aspects of a claim-construction analysis." *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 808 (Fed. Cir. 2021).

DISCUSSION

Before the Board, Sigray asserted that claim 1 was anticipated by Jorgensen. A claim is anticipated only when every claim limitation is disclosed within a single reference. *Biogen MA Inc. v. EMD Serono, Inc.*, 976 F.3d 1326, 1331–32 (Fed. Cir. 2020). "Moreover, a prior art reference may anticipate without disclosing a feature of the claimed invention if that missing characteristic is necessarily present, or inherent, in the single anticipating reference." *SmithKline Beecham Corp. v. Apotex Corp.*, 403 F.3d 1331, 1343 (Fed. Cir. 2005) (quoting *Schering Corp. v. Geneva Pharms., Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003)). A limitation is inherently disclosed "when the reference discloses prior art that must *necessarily* include the unstated limitation." *Transclean Corp. v. Bridgewood Servs., Inc.*, 290 F.3d 1364, 1373 (Fed. Cir. 2002). Inherent disclosure does not require a person of ordinary skill to recognize the presence of the limitation at the time the reference is generated. *SmithKline*, 403 F.3d at 1343. Any presence of the limitation in the reference inherently discloses it for the purposes of anticipation. *See id.* at 1345 ("Because the record contains clear and convincing evidence that production of PHC anhydrate in accordance with the '196 patent inherently results in at least trace amounts of PHC hemihydrate, this court holds that the '196 patent inherently anticipates claim 1 of the '723 patent under 35 U.S.C. § 102(b).").

Jorgensen is a scientific paper that describes using an X-ray beam to image rodent organs. It describes a system that uses an X-ray source to generate an X-ray beam, which then passes through a sample before being received by a detector. J.A. 673. Jorgensen attempts to reduce concerns related to projection magnification by providing a large distance between the sample and the source and a short

distance between the sample and the detector. *Id.* Additionally, Jorgensen references a process known as collimation, explaining that "[t]he collimated X-ray beam is shielded by a lead-wrapped brass tube as the beam passes from the source into the shielded cover of the scanner." *Id.* at 674.

There is no disagreement that Jorgensen explicitly discloses all limitations of claim 1, except for the projection magnification limitation, which, as set forth above, reads "a magnification of the projection X ray stage . . . between 1 and 10 times." '704 patent, col. 10 ll. 5–6. The parties' primary dispute is whether this limitation is inherently disclosed in Jorgensen.

The fact that projection magnification is the result of diverging rays interacting with a sample is agreed upon. It is also uncontested that Jorgensen's source creates a diverging beam that passes through a collimator before reaching the sample. Zeiss concedes that a beam that is diverging, even by an undetectable amount, will result in some magnification[4] but asserts that Jorgensen is not anticipatory because its collimator eliminates divergence, resulting in a parallel or non-diverging beam.

Sigray disagrees, arguing that Jorgensen's collimator cannot eliminate divergence but rather only reduces it. Therefore, the question before the Board was whether Jorgensen's collimator eliminated X-ray divergence, thus negating inherent disclosure.

The Board ultimately concluded that "viewing the record as a whole, . . . [Sigray] has not shown persuasively that Jorgensen inherently discloses projection magnification within the claimed range." *Decision*, 2023 WL 5065239, at *17. In finding no inherent disclosure, the

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[4] *See* Oral Arg. at 11:22–12:03, https://www.cafc.uscourts.gov/home/oral-argument/listen-to-oral-arguments/.

Board cited "a vigorous dispute about whether Jorgensen teaches a diverging X-ray beam." *Id.* Sigray argues that these findings are flawed as they depend on an incorrect understanding of the claimed range. Specifically, Sigray asserts that the Board implicitly and incorrectly construed the limitation "between 1 and 10" to exclude unspecified, small divergence resulting in projection magnifications only slightly greater than 1. Appellant's Br. 1–2. According to Sigray, this was error because the claim contains no such exclusion. Zeiss disputes that any claim construction occurred.

While the Board stated that it was not engaging in claim construction, those statements are "not dispositive as to whether claim construction occurred." *Google LLC v. EcoFactor, Inc.*, 92 F.4th 1049, 1056 (Fed. Cir. 2024). Instead, in determining whether the Board construed a claim, we look at the outcome of the Board's analysis and its reasoning. *See id.* at 1055. If the outcome of the Board's analysis establishes the scope and meaning of the claim, then the Board has implicitly construed the claim. *Id.*

Here the Board's analysis demonstrates that it construed the disputed claim limitation. Most notably, the Board stated that Sigray "fail[ed] to show that the . . . X-ray beam in Jorgensen diverges *enough* to result in projection magnification 'between 1 and 10 times' . . . ." *Decision*, 2023 WL 5065239, at *11 (emphasis added). The Board's use of the word "enough" reflects that it considered a certain level of divergence as outside the claim. Narrowing the claim scope in this way is in fact claim construction.

Zeiss posits that the Board's single use of the word "enough" is taken out of context and that the Board actually found that Jorgensen does not disclose a diverging beam. We disagree. An examination of the Board's analysis demonstrates that (1) it applied the word "enough" in reaching its conclusion and (2) that the evidence relied on by the Board supports a finding of some divergence.

First, the Board describes the term "collimated X-ray beam" in a way that suggests that collimation reduces without eliminating divergence. *Id.* at *10–12. The Board relied on U.S. Patent No. 4,891,829 (the "'829 patent") for the assertion that "[d]ifferent collimation techniques can be used to achieve *[the required] degree of parallelism*" and reasoned that the '829 patent "thus confirms that collimation is [a] technique for *minimizing beam divergence* so as to provide a *nearly parallel* X-ray beam." *Id.* at *10 (first and second alterations in original) (emphases added).

The Board further relied on the testimony of Zeiss's expert Dr. Gonzalo Acre, who stated that a "collimated X-ray beam is a beam where . . . no *meaningful divergence* is present," and "the X-rays that reach Jorgensen's sample are *essentially parallel* (i.e., not diverging) and there is no projection stage magnification." *Id.* at *10–11 (emphases added) (quoting J.A. 2779–81).

The above two examples discuss reduction in divergence but expressly contemplate the continued existence of some amount of divergence. The fact that the Board relied on this evidence to find no inherent disclosure demonstrates that the Board narrowed the disputed limitation to exclude magnification generated by small amounts of divergence, that would result in magnification "between 1 and 10 times."

Second, the Board considered Jorgensen's prefatory clause, which identifies an "X-ray focal spot that subtends ≤0.8 mrad at the [detector]." *Id.* at *12. The Board relied on Zeiss's expert Dr. Julie Bentley's explanation that 0.8 mrad is "a very small angle and is small enough to be considered [a] parallel source at infinity." *Id.* at *11 (alteration in original) (quoting J.A. 2207). Angles are created from intersecting lines, and parallel lines do not intersect. The mere presence of an angle demonstrates divergence, and the Board's consideration of degree of divergence again

demonstrates its belief that small amounts of divergence, and therefore magnification, are outside the claim.

Third, the Board relied on the testimony of Dr. Bentley, who stated:

> Jorgensen explains that when magnification of the lens is set to 2x, the [sample] size is doubled by the lens (such that a 12 µm on a side square at the sample corresponds to a 24 µm on a side pixel at the detector). That can be true *only if* there is no additional magnification in the projection stage. . . . [E]ven if the projection stage magnification were only 1.1x, then a 24 µm pixel at the detector would correspond to a 10.9 µm pixel referenced to the sample, not 12 µm, as stated by Jorgensen.

Id. at *15 (emphasis in original) (internal quotation marks omitted) (quoting J.A. 1181). However, had Dr. Bentley performed the same calculation using a 1.001x magnification and the same rounding principles, she would have reached "12 µm," which is what is represented in Jorgensen. In other words, Dr. Bentley's testimony highlights that Jorgensen's passage is too imprecise to capture very small magnification and is relevant only if the Board construed the claim to exclude small levels of magnification that were nonetheless between 1 and 10. While this evidence is unhelpful in determining if magnification is inherently present, it reflects that the Board engaged in claim construction.

Fourth, the Board considered Jorgensen's explanation that "[t]he geometry and intensity distribution of the X-ray focal spot are of concern if the X-ray beam geometry is used to achieve magnification, but in our system the long X-ray focal spot-to-[sample] distance and the close proximity of the [sample] to the [detector] greatly reduce this concern." *Id.* at *5 (quoting J.A. 673). The Board states that "greatly reduc[ing] [the] concern" related to magnification shows

that Jorgensen "does *not* use the X-ray beam geometry to achieve magnification." *Id.* at *10 (emphasis in original).

However, Jorgensen's aspirational statements of purpose that it is not attempting to achieve magnification does not address whether magnification is inherently present. *See SmithKline*, 403 F.3d at 1344 (finding inherent disclosure of a compound that was unknown when the prior art reference was created). "Reduce" does not mean eliminate. As stated in the specification of the '704 patent, elimination of magnification can only be achieved if the distance between the sample and the detector is zero.[5] The fact that the Board was satisfied with Jorgensen's reduction further demonstrates that it considered small amounts of magnification as not between 1 and 10 as required by the claim.

Additionally, the spacing of the components affect magnification only in the presence of a diverging beam. Thus, Jorgensen's attempt to reduce magnification in this way indicates the presence of a diverging beam.

Finally, the Board continuously relied on Zeiss's experts for the assertion that Jorgensen did not contain a diverging beam. *Decision*, 2023 WL 5065239, at *17. However, Dr. Bentley and Dr. Acre continuously stated that collimation of the type found in Jorgensen reduces, without eliminating, divergence. The Board cited to Dr. Bentley's testimony that the source was made to look "like it's far enough [a]way that those rays are *essentially parallel*," and Dr. Acre's testimony that a "collimated X-ray beam is a beam where the X-rays have been made to be parallel such that *no meaningful divergence* is present." *Id.* at *10–13 (emphasis added) (citations omitted). These statements, and others like them, support a finding that some divergence was present and is consistent with the

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[5] $M = 1$ only when $L_d = 0$.

Board's analysis only under an alternative claim construction.

Viewing the Board's reasoning, we conclude it construed "between 1 and 10" to exclude small amounts of magnification. This was error. At all times, the language of the claims govern their scope and meaning, and unless the intrinsic evidence compels a contrary conclusion, the claim language carries the meaning accorded those words in the usage of skilled artisans at the time of invention. *SmithKline*, 403 F.3d at 1339. In *SmithKline*, this court concluded that a claim to PHC hemihydrate was inherently anticipated because "producing PHC anydrate according to the [prior art] inevitably results in the production of at least trace amounts of . . . PHC hemihydrate." *Id.* at 1344. We found that the district court erred in requiring a higher standard of proof because it was "sufficient to show that the natural result flowing from the operation as taught [in the prior art] would result in" the claimed invention. *Id.* at 1343 (alteration in original) (quoting *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981)). Here, it is undisputed that Jorgenson's X-ray beams are not completely parallel and naturally must result in some magnification. That miniscule amount of magnification disclosed by the prior art definitionally achieves a magnification within the claimed range of 1 to 10. This court "repeatedly and consistently has recognized that courts may not redraft claims, whether to make them operable or to sustain their validity." *Chef Am., Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1374 (Fed. Cir. 2004). The plain meaning of "between 1 and 10" includes tiny, even undetectable, magnification, and Zeiss has pointed to nothing compelling a contrary conclusion.

As the Board applied an incorrect claim construction, it never addressed anticipation under the correct construction. Reversal, rather than remand, is appropriate if "[o]n the evidence and arguments presented to the Board, there is only one possible evidence-supported finding: [that] the

Board's [determination] . . . when the correct construction is employed, is not supported by substantial evidence." *Owens Corning v. Fast Felt Corp.*, 873 F.3d 896, 901–02 (Fed. Cir. 2017) (reversing, rather than remanding, when "only one answer is supported by substantial evidence").

As explained above, the evidence relied on by the Board compels a singular conclusion—that Jorgensen inherently contains projection magnification. Zeiss has recognized "that absolute, theoretical parallelism cannot be achieved as a practical matter," J.A. 2465 n.3, and "if there is divergence of the X-ray beams . . . at the point they pass through the [sample], then . . . the consequence of that is that there would be some geometric magnification in the projection." Oral Arg. at 11:45–11:56. The only evidence-supported conclusion is that Jorgensen contains a beam diverging at the sample, which necessarily produces projection magnification over 1. As such, claim 1 is anticipated by Jorgensen.

Finding that claim 1 is anticipated, we now turn to the remaining disputed claims, all of which are dependent on claim 1. "When a dependent claim and the independent claim it incorporates are not separately argued, precedent guides that absent some effort at distinction, the claims rise or fall together." *Soverain Software LLC v. Newegg Inc.*, 728 F.3d 1332, 1335 (Fed. Cir. 2013). Before the Board, Sigray asserted that claims 3 and 4 were anticipated by Jorgensen, and Zeiss did not separately argue these claims to the Board. We cannot discern for ourselves any independent basis for why these claims, which recite narrower versions of limitations found in claim 1, are not unpatentable.

Sigray never asserted that claims 2, 5, and 6 were anticipated and instead argued unpatentability under various obviousness theories. J.A. 108. Even though Sigray asserted that these claims would have been obvious based on Jorgensen as a single reference, "it does not follow that every technically anticipated invention would also have

been obvious." *Cohesive Techs., Inc. v. Waters Corp.*, 543 F.3d 1351, 1364 (Fed. Cir. 2008) (quoting *In re Fracalossi*, 681 F.2d 792, 796 (CCPA 1982) (Miller, J., concurring)). We therefore remand to the Board to consider whether claims 2, 5, and 6 would have been obvious.

CONCLUSION

The Board's decision regarding claims 1, 3, and 4, is reversed. The Board's decision as to claims 2, 5, and 6, is vacated. The matter is remanded for further proceedings consistent with this opinion.

REVERSED-IN-PART, VACATED-IN-PART, AND REMANDED

COSTS

Costs to Appellant.