United States Court of Appeals for the Federal Circuit

NATURE SIMULATION SYSTEMS INC.,
Plaintiff-Appellant

v.

AUTODESK, INC.,
Defendant-Appellee

2020-2257

Appeal from the United States District Court for the Northern District of California in No. 3:19-cv-03192-SK, Magistrate Judge Sallie Kim.

OPINION ISSUED: January 27, 2022
OPINION MODIFIED: October 17, 2022*

MATTHEW MICHAEL WAWRZYN, Wawrzyn LLC, Chicago, IL, argued for plaintiff-appellant.

BRIAN ROBERT MATSUI, Morrison & Foerster LLP, Washington, DC, argued for defendant-appellee. Also represented by SETH W. LLOYD; RUDOLPH KIM, ROMAN A. SWOOPES, Palo Alto, CA.

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* This opinion has been modified and reissued following a petition for rehearing filed by Appellee.

Before NEWMAN, LOURIE, and DYK, *Circuit Judges*.

Opinion for the court filed by *Circuit Judge* NEWMAN.

Dissenting opinion filed by *Circuit Judge* DYK.

NEWMAN, *Circuit Judge*.

Nature Simulation Systems Inc. ("NSS") is the owner of United States Patents No. 10,120,961 ("the '961 patent") and No. 10,109,105 ("the '105 patent"), both entitled "Method for Immediate Boolean Operations Using Geometric Facets." The patents relate to methods of performing computer-aided operations for three-dimensional objects.[1]

NSS brought suit for infringement against Autodesk, Inc. in the United States District Court for the Northern District of California. At issue were claims 1 and 8 of the '961 patent and claim 1 of the '105 patent. The district court held a claim construction (*Markman*) hearing and ruled the claims invalid on the ground of claim indefiniteness, 35 U.S.C. § 112(b).[2] That decision is the subject of this appeal.

We conclude that the district court erred on the legal standard for claim indefiniteness, and that on the correct standard the claims are not indefinite. The decision of invalidity on this ground is reversed.

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[1] The '961 patent is a continuation-in-part of the '105 patent, and the specifications and claims do not materially differ with respect to the issues of this appeal; thus the parties and this court generally cite to the '961 patent.

[2] *Nature Simulation Sys. Inc. v. Autodesk, Inc.*, No. 19-CV-03192-SK, (N.D. Cal. July 31, 2020), ECF No. 61 ("Dist. Ct. Order").

BACKGROUND

Standards of review

Claim construction is a question of law and receives *de novo* review on appeal. *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 390–91 (1996); *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 325 (2015). Claim indefiniteness is a legal conclusion, in implementation of 35 U.S.C. § 112. *See Atmel Corp. v. Info. Storage Devices, Inc.*, 198 F.3d 1374, 1378 (Fed. Cir. 1999) ("'A determination of claim indefiniteness is a legal conclusion that is drawn from the court's performance of its duty as the construer of patent claims.' Indefiniteness, therefore, like claim construction, is a question of law that we review *de novo*." (quoting *Personalized Media Commc'ns, LLC v. Int'l Trade Comm'n*, 161 F.3d 696, 705 (Fed. Cir. 1998))).

Claim indefiniteness is decided from the viewpoint of persons skilled in the field of the invention. *Personalized Media*, 161 F.3d at 705. The district court and the parties agreed that for the technology here at issue, such persons would have "at least a master's degree in computer science or a related field, or a bachelor's degree in computer science or a related [field] plus two years of relevant experience, with experience in computer graphics, computer-aided design, solid modeling, or geometric modeling." Dist. Ct. Order at 7.

United States patents are accompanied by a presumption of validity, 35 U.S.C. § 282, and invalidity must be established by clear and convincing evidence. *Sonix Tech. Co. v. Publ'ns Int'l, Ltd.*, 844 F.3d 1370, 1377 (Fed. Cir. 2017).

The patented inventions

The '961 and '105 patents are for a computer-implemented method for building three-dimensional objects employing a computation method called "Boolean operation." The patents introduce the invention as follows:

> This invention provides an immediate Boolean operation method for building three (3) dimensional geometric models from primary geometric objects to Computer Aided Design, Computer Graphics, Solid Modeling systems, and Surface Modeling systems, which are widely used in product design, manufacturing, and simulation. Mechanic industry, culture and sports, everywhere there are geometric shapes, may have CAD/CG applications.

'961 patent, col.1, ll.7–14. The patents are for data structures and algorithms for the claimed method, which is described as a modification of a known Boolean operation published in 1981 for analyzing and representing three-dimensional geometric shapes ("the Watson method"). The district court states: "NSS concedes that the general idea of performing Boolean operations in this area was well known before the patents in dispute, as the asserted patents cite to prior art disclosing this concept." Dist. Ct. Order at 2. The court summarized the prior art:

> There are two methods from prior art that are cited in the asserted patents. The Delaunay method is a known method of triangulation (known as the "Delaunay triangulation"), and the Watson method is a known algorithm for computing a Delaunay triangulation that is described in a paper written in 1981 by D.F. Watson.

Id. (citing '961 patent, col.6, ll.64–66; '105 patent, col.6, ll.42–44). The patents state that the "modified Watson method" described therein provides simplicity and flexibility compared with prior methods, and is easier to program and implement. '961 patent, col.1, ll.17–62. Both sides presented technology tutorials to the district court; the NSS tutorial was presented by inventor Shangwen Cao, and the

Autodesk tutorial was presented by expert Dr. Daniel Aliaga.[3]

At the *Markman* hearing, Autodesk requested construction of eight terms in the claims and supported this request with the Declaration of Dr. Aliaga. NSS argued that the challenged terms do not require construction, are clearly set forth in the specification, and should receive their ordinary meaning in this field of technology.

The district court based its decision on two of the challenged terms, shown in boldface in clauses [2] and [3] of Claim 1:

> 1. A method that performs immediate Boolean operations using geometric facets of geometric objects implemented in a computer system and operating with a computer, the method comprising:
>
> > [1] mapping rendering facets to extended triangles that contain neighbors;
> >
> > [2] building intersection lines starting with and ending with searching for the first pair of triangles that hold a start point of an

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[3] The dissent criticizes by footnote our recital that the inventor presented a technical tutorial to the district court. Our statement is correct. Technical tutorials were provided by both sides. The NSS tutorial was provided by the inventor, Dr. Shangwen Cao, and presented at the tutorial hearing by NSS counsel. *See* ECF No. 44 (slideshow captioned "Tutorial Presentation by the Inventor Shangwen Cao"). The Autodesk tutorial was provided by Autodesk's expert, Dr. Daniel Aliaga, and presented at the tutorial hearing by Dr. Aliaga. *See* ECF No. 45; *see also* ECF No. 42 (Clerk's Notice: "The Court requests that both sides file the slideshows presented at today's tutorial on the docket.").

> intersection line by detecting whether two minimum bounding boxes overlap and performing edge-triangle intersection calculations for locating an intersection point, then **searching neighboring triangles of the last triangle pair that holds the last intersection point** to extend the intersection line until the first intersection point is identical to the last intersection point of the intersection line ensuring that the intersection line gets closed or until all triangles are traversed;
>
> [3] splitting each triangle through which an intersection line passes using **modified Watson method,** wherein the modified Watson method includes removing duplicate intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion;
>
> [4] checking each triangle whether it is obscure or visible for Boolean operations or for surface trimming;
>
> [5] regrouping facets in separate steps that includes copying triangles, deleting triangles, reversing the normal of each triangle of a geometric object, and merging reserved triangles to form one or more new extended triangle sets; and
>
> [6] mapping extended triangles to rendering facets.

'961 patent, col.9, ll.17–48 (bracketed numbers and boldface added).

After the *Markman* hearing the district court ruled that these two claim terms are indefinite, rendering the claims invalid. The district court did not define the two terms; instead, the court held that a claim term is indefinite, as a matter of law, if there are any "unanswered questions" about the term. The court referred to the conflict between the opinion of Autodesk's expert and the patent examiner's resolution of indefiniteness, and stated:

> [T]he question is thus: if the PTO issues a patent after amendment to clarify an indefinite term, but an expert later opines that a POSITA would not understand the term, how does the Court determine whether the term is indefinite? The only way to do so here is to look at each argument to see if Autodesk raises any unanswered questions. Here, Autodesk does.

Dist. Ct. Order at 8. The district court recited several "unanswered questions," and further stated that even if the questions are answered in the specification, the definiteness requirement is not met if the questions are not answered in the claims. Thus the court held the claims invalid under 35 U.S.C. § 112.

NSS states that the court applied incorrect legal standards, and that on the correct law the claims are not indefinite.

DISCUSSION

Patent claims must provide reasonable certainty in defining what is patented, in conformity with the requirements of 35 U.S.C. § 112. We start with the statute.

35 U.S.C. § 112

Section 112 states the required content of the patent document. Section 112(a) provides that the specification must describe the invention in full, clear, concise, and exact

terms, as to enable its practice by any person skilled in the field of the invention:

> § 112. Specification
>
> **(a) In General.--** The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

Section 112(b) requires that the specification conclude with claims that state the subject matter that is patented:

> **(b) Conclusion.--** The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The claims define the patent right and perform the "notice" function of legal documents; thus precision and clarity are necessary. *See Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336 (Fed. Cir. 2010):

> [The claims'] principal function, therefore, is to provide notice of the boundaries of the right to exclude and to define limits; it is not to describe the invention, although their original language contributes to the description and in certain cases satisfies it. Claims define and circumscribe, the written description discloses and teaches.

Id. at 1347; *see Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 909 (2014) ("[A] patent must be precise enough to afford clear notice of what is claimed, thereby 'appris[ing] the public of what is still open to them.'"

(second alteration in original) (quoting *Markman*, 517 U.S. at 373)).

The claims are viewed and understood in the context of the specification and the prosecution history, as the Court summarized in *Nautilus*:

> Cognizant of the competing concerns, we read § 112, ¶ 2 to require that a patent's claims, viewed in light of the specification and prosecution history, inform those skilled in the art about the scope of the invention with reasonable certainty. The definiteness requirement, so understood, mandates clarity, while recognizing that absolute precision is unattainable.

572 U.S. at 910. When the meaning or scope of a patent claim is disputed by litigants, the judicial role is to construe the claim as a matter of law, on review of appropriate sources of relevant information. As summarized in *Phillips v. AWH Corp.*, the court looks first to the intrinsic record of the patent document, including "the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms, and the state of the art." 415 F.3d 1303, 1314 (Fed. Cir. 2005) (en banc) (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1116 (Fed. Cir. 2004)).

Here, however, the district court did not construe the claims, did not apply the protocols of intrinsic and extrinsic evidence, and did not resolve the meaning and scope of the challenged claims. The district court applied an incorrect standard of "unanswered questions" and a flawed analysis of validity.

The district court's standard of "unanswered questions"

The district court held the claims indefinite based on the "unanswered questions" that were suggested by

Autodesk's expert. For the term "searching neighboring triangles of the last triangle pair that holds the last intersection point," the court recited three unanswered questions:

> Aliaga points to several unanswered questions about this language: (1) whether the phrase requires searching repeatedly or iteratively or merely once; (2) what the "last triangle pair" or "last intersection point" is; (3) how can one "extend an intersection line" when in some cases it is not possible, as Aliaga demonstrates.

Dist. Ct. Order at 17–18 (citing Aliaga Decl. ¶ 26, ECF No. 36-1).

For the term "modified Watson method," the district court recited four unanswered questions provided by Autodesk's expert:

> The claim language leaves unanswered the following questions: (1) What is a neighboring point of intersection (referred to as "PET" in the patents)?; (2) What is the meaning of an "identical" point of intersection?; (3) What is the meaning of removing a point of intersection?; (4) From what is the point of intersection being removed? NSS does not respond to these specific questions, which highlight the ambiguity of the claim language.

Dist. Ct. Order at 9. The district court acknowledged that "NSS points to the specification's discussion of optional splitting of partitions," but the court held that "[t]his argument does not enable NSS to succeed in re-writing the language of the claim itself." *Id.*

In response to NSS's argument that these questions are answered in the specification, the court held that definiteness requires that questions are answered in "the claim language, standing alone," as stated in the Aliaga Declaration:

> ¶ 27. . . . the claim language, standing alone, does not specify which of those neighboring, intersecting triangles should be used to identify additional intersection points. Nor does the claim specify (where there are multiple potential intersection points for a given pair of neighboring triangles) which of the multiple potential intersection points should be used to extend the intersection line. Thus, the claim language is indefinite.

Aliaga Decl. ¶ 27, ECF No. 36-1.

"Claim language, standing alone" is not the correct standard of law and is contrary to uniform precedent. Patent claims are viewed and understood in light of the specification, the prosecution history, and other relevant evidence, as "would have allowed a skilled artisan to know the scope of the claimed invention with reasonable certainty." *Sonix Tech.*, 844 F.3d at 1376.

The district court did not apply this standard protocol for analyzing claim definiteness and did not construe the claims. Instead, the court held that the questions raised by Autodesk's expert must be answered, and that the answers must be in the claims.

NSS states that on the correct claim construction, the claims are not indefinite.

The specification

The specification describes the invention in text, drawings, and flowcharts. NSS states on this appeal that even if the theory of "unanswered questions" were accepted, any relevant questions are answered in the specification. For example, with respect to the intersection points that were a focus of the criticism recited by the district court, NSS cites the description in the specification captioned "The First Intersection Point" and "Extending an Intersection Line." '961 patent, col.5, l.41–col.6, l.24. NSS also points to the Figure 4 flowchart for building intersection lines, to

Figures 6A and 6B for showing intersection points, and Figures 9A–9D for examples of intersection lines.

The specification describes, and the claim recites, that the intersection line is built from the intersection points around the objects being compared, "searching neighboring triangles of the last triangle pair that holds the last intersection point to extend the intersection line until the first intersection point is identical to the last intersection point of the intersection line ensuring that the intersection line gets closed or until all triangles are traversed." '961 patent, col.9, ll.23–33.

Figure 13 is a flowchart of "Delaunay mesh modified Watson method that created the sequence" shown in Figure 12. Figures 12A–12H show the decomposition of a square into triangles, the placement of intersection points within those triangles, and the use of triangles containing intersection points to build polygons from which new triangles are generated, along with comparisons with the prior art Watson method. Figure 13 shows that where any triangle contains a valid intersection point, the claimed method moves the triangle to the deleted Triangle Set, uses deleted Triangle Set to build a polygon, and uses the polygon to generate triangles.

The specification describes the Watson and Delaunay prior art in text and drawings to show how they are used and modified in the subject invention. Dr. Aliaga acknowledged this prior art in his expert declaration, stating: "To be clear, I am familiar with the Delaunay method, which is a known method of triangulation that is mentioned in the patents. . . . And I am also aware of the 'Watson' algorithm for computing a Delaunay triangulation that is described in a 1981 paper by D.F. Watson cited in the patents." Aliaga Decl. ¶ 15.

The claims are properly viewed in light of this knowledge, for this prior art constitutes "extrinsic evidence concerning relevant scientific principles [and] the meaning

of technical terms." *Phillips*, 415 F.3d at 1314 (quoting *Innova/Pure Water*, 381 F.3d at 1116). The Court guided in *Nautilus*:

> One must bear in mind, moreover, that patents are "not addressed to lawyers, or even to the public generally," but rather to those skilled in the relevant art. *Carnegie Steel Co. v. Cambria Iron Co.*, 185 U.S. 403, 437 (1902) (also stating that "any description which is sufficient to apprise [steel manufacturers] in the language of the art of the definite feature of the invention, and to serve as a warning to others of what the patent claims as a monopoly, is sufficiently definite to sustain the patent").

572 U.S. at 909 (alteration in original).

The function of the claims is not to duplicate the specification. The district court declined to consider information in the specification that was not included in the claims. For example, in rejecting NSS's argument that the modified Watson method is described in the specification, the district court stated:

> NSS points to column 7 of the specification and relies on step 5(a) of column 7 to show the modification of the Watson method. ('961 patent at 7:17–23). This language adds an additional condition: "or last segment passes through the triangle." Again, this language is not contained in the claim language and does not explain the challenged claim language.

Dist. Ct. Order at 10. However, the language that the court stated "is not contained in the claim language" is in the specification. Figure 13 is a flowchart describing the claimed modified Watson method, showing how to build an intersection line that references two triangles and use the intersection line to split triangles. '961 patent, Sheet 5.

The specification describes the steps of the modified Watson method, stating that an "edge-triangle intersection point(s) falls inside a triangle" and the system "stores the point data into an intersection line set." '961 patent, col.2, ll.18–21. Then "[t]o extend the current intersection line, this method traces neighboring triangles and calculates edge-triangle intersection points until the intersection line becomes closed." '961 patent, col.2, ll.22–24. "Each segment of the intersection lines references two (2) triangles, each of the triangles has at least one sub-intersection line that contains one or more segments, which divide a triangle into three (3) or more smaller triangles." '961 patent, col.2, ll.26–30. Figures 12G–H demonstrate how multiple triangles (not a single polygon, as the district court states) are split when a non-duplicate point on the intersection line is identified. '961 patent, Sheet 4.

The district court misperceived the function of patent claims; *see In re Vamco Mach. & Tool, Inc.*, 752 F.2d 1564 (Fed. Cir. 1985):

> The function of claims is (a) to point out what the invention *is* in such a way as to distinguish it from what was previously known, i.e., from the prior art; and (b) to define the *scope of protection* afforded by the patent. In both of those aspects, claims are not technical descriptions of the disclosed inventions but are legal documents like the descriptions of lands by metes and bounds in a deed which *define the area* conveyed but *do not describe the land*.

Id. at 1577 n.5 (emphases in original). As noted in *SRI Int'l v. Matsushita Elec. Corp. of Am.*, 775 F.2d 1107, 1121 n.14 (Fed. Cir. 1985): "Specifications teach. Claims claim."

Although the district court adopted the argument of Autodesk's expert that there are "unanswered questions" about the claims, this was not the correct standard for evaluating whether the claims met the standard for definiteness. The claims set forth the metes and bounds of the

invention; they are not intended to repeat the detailed operation of the method as described in the specification. *See Liberty Ammunition, Inc. v. United States*, 835 F.3d 1388, 1396 (Fed. Cir. 2016) (finding the patent specification "saves the term [in the claim] from indefiniteness" by disclosing additional information about the invention that clarifies meaning).

The prosecution history

The prosecution history here is significant, for the patent examiner had initially rejected the claims on the ground of indefiniteness, and the examiner required additional definition in the claim clauses here at issue. For example, the examiner had initially rejected the claims for indefiniteness of the clause "extending the intersection lines until they get closed by searching neighboring triangles;" the examiner wrote: "What is causing the closure of the intersection lines? The nexus between 'extending the intersection lines' and 'searching neighboring triangles' is also not clearly set forth." Appl. No. 15/840,052, Official Action (Non-Final Rejection) of Feb. 6, 2018, at 3. The applicant, in consultation with the examiner, amended this term in claim clause [2], as shown in the prosecution record:

> [2] building intersection lines starting with and ending with searching for the first pair of triangles that hold a start point of an intersection line by detecting whether two minimum bounding boxes overlap and performing edge-triangle intersection calculations for locating an intersection point, ~~extending the intersection lines until they get closed by searching neighboring triangles or all triangles are traversed;~~ then searching neighboring triangles of the last triangle pair that holds the last intersection point to extend the intersection line until the first intersection point is identical to the last intersection point of the intersection line ensuring

> that the intersection line gets closed or until all triangles are traversed;

Appl. No. 15/840,052, Amend. of Apr. 4, 2018, at 9 (markings in original). With this amendment the examiner withdrew the indefiniteness rejection relating to the intersection lines.

The applicant and the examiner also interacted to amend the term "modified Watson method." An Examiner's Amendment of August 28, 2018, amended claim clause [3] as follows:

> [3] splitting each triangle through which an intersection line passes using modified Watson method, wherein the modified Watson method includes removing duplicate intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion;

Appl. No. 15/840,052, Examiner's Amend. in Notice of Allowance, Sept. 18, 2018, at 4–5 (markings in original).

With the agreed amendments, the examiner withdrew the rejections for indefiniteness and allowed the claims. *Id.* The claims as amended during prosecution distinguish the claimed method from the prior art and define the scope of the patented subject matter. The district court made no contrary findings. However, the district court rejected the examiner's conclusion as to indefiniteness, the court reciting the initial rejection and the amendment, and stating that this action did not answer "the questions posed by Aliaga." The district court stated:

> The prosecution history does not show how or why the amendment answered the unanswered questions. The prosecution history does not provide a clear reason for the amendment that clarifies the underling ambiguity. The PTO initially rejected Claim 1 as indefinite: "The nexus between

> 'extending the intersection lines' and 'searching neighboring triangles' is also not clearly set forth. The examiner is not able to ascertain the scope of the claimed invention," (Dkt. 37-1 (Ex. A at page 4).) In response, NSS added the following language: "building intersection lines starting with and ending with . . . calculations for locating an intersection point, then searching neighboring triangles of the last triangle pair that holds the last intersection point to extend the intersection line until the first intersection point is identical to the last intersection point of the intersection line ensuring that the intersection line gets closed or until all triangles are traversed." (*Id.*) This added language does not answer the questions posed by Aliaga.

Dist. Ct. Order at 18–19 (ellipses and parentheticals in original).

The district court gave no weight to the prosecution history showing the resolution of indefiniteness by adding the designated technologic limitations to the claims. The court did not discuss the Examiner's Amendment and held that since Dr. Aliaga's questions were not answered, the claims are invalid. The district court did not apply the Court's guidance that "'[e]xperts may be examined to explain terms of art, and the state of the art . . . but they cannot be used to prove 'the proper or legal construction of any instrument of writing.'" *Teva Pharms.*, 574 U.S. at 332 (quoting *Winans v. N.Y. & Erie R.R. Co.,* 62 U.S. 88, 100–01 (1859)). The Court recognized, in discussing claim definiteness, that:

> The standard we adopt accords with opinions of this Court stating that "the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject-matter."

Nautilus, 572 U.S. at 910 (quoting *Mins. Separation, Ltd. v. Hyde*, 242 U.S. 261, 270 (1916)).

The subject matter herein is an improvement on the known Watson and Delaunay methods and partakes of known usages for these established technologies. Precedent teaches that when "the general approach was sufficiently well established in the art and referenced in the patent" this "render[ed] the claims not indefinite." *Presidio Components, Inc. v. Am. Tech. Ceramics Corp.*, 875 F.3d 1369, 1377 (Fed. Cir. 2017); *see Ethicon Endo-Surgery, Inc. v. Covidien, Inc.*, 796 F.3d 1312, 1322 (Fed. Cir. 2015); *Phillips*, 415 F.3d at 1316–19 (patent claims are construed in light of the specification, the prosecution history, and the knowledge of persons skilled in the field of the invention).

CONCLUSION

Indefiniteness under 35 U.S.C. § 112 was not established as a matter of law. The district court's decision is reversed. We remand for further proceedings.

REVERSED AND REMANDED

COSTS

Each party shall bear its costs.

United States Court of Appeals for the Federal Circuit

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Plaintiff-Appellant

v.

AUTODESK, INC.,
Defendant-Appellee

2020-2257

Appeal from the United States District Court for the Northern District of California in No. 3:19-cv-03192-SK, Magistrate Judge Sallie Kim.

DYK, *Circuit Judge*, dissenting.

Contrary to the majority, I think that the asserted claims are invalid because they are indefinite. The majority faults the district court for applying an incorrect "[c]laim language, standing alone" standard for definiteness. Maj. Op. 10–11. This language, quoted from Autodesk's expert declaration, appears nowhere in the district court's opinion and forms no part of its decision.[1] In a

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[1] The expert himself did not apply an incorrect standard. In searching for a meaning for the term "modified Watson method," the expert looked not just to the

detailed and thorough analysis, the district court read the patent's claims in light of the specification and prosecution history to determine if it would inform those skilled in the art about the scope of the invention with reasonable certainty, which is exactly what is required under *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 910 (2014). Regardless, the question of definiteness is a legal question which we review de novo, and the majority's legal conclusion is, in my view, manifestly incorrect.

The field of art here, computer-aided design, is unusually complex, involving methods of using computer systems to build geometric objects. The patents purport to improve on two established methods of computer-aided design: constructive solid geometry, which combines simple objects using Boolean operations (e.g., intersection, combination, exclusion) to build complex objects, and boundary representation, which represents three-dimensional objects by defining their surfaces as meshes of two-dimensional objects.

Claim 1 of U.S. Patent No. 10,120,961 ("the '961 patent") claims:

> 1. A method that performs immediate Boolean operations using geometric facets of geometric objects implemented in a computer system and operating with a computer, the method comprising:
>
> > mapping rendering facets to extended triangles that contain neighbors;
> >
> > building intersection lines starting with and ending with searching for the first pair of triangles that hold a start point of an

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claim language itself, but also to the specification, including the very figures that the majority cites. *See* Aliaga Decl. ¶¶ 16–19, J.A. 54–58.

> intersection line by detecting whether two minimum bounding boxes overlap and performing edge-triangle intersection calculations for locating an intersection point, then searching neighboring triangles of the last triangle pair that holds the last intersection point to extend the intersection line until the first intersection point is identical to the last intersection point of the intersection line ensuring that the intersection line gets closed or until all triangles are traversed;
>
> splitting each triangle through which an intersection line passes using modified Watson method, wherein the modified Watson method includes removing duplicate intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion . . . .

'961 patent, col. 9, ll. 17–40 (emphasis added); *see also* U.S. Patent No. 10,109,105, col. 8, l. 47–col. 9, l. 3. The indefiniteness issue concerns the underscored language, additional limitations which were added during prosecution at the suggestion of the examiner.

While the Watson method itself was well understood,[2] there is no claim that the term "modified Watson method" has, or had at the time the patents were issued, an ordinary

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[2] The Delaunay method is a known method of triangulation. The Watson method is a known algorithm for computing a Delaunay triangulation that was described in a paper written by D.F. Watson in 1981. J.A. 2; Aliaga Decl. ¶ 15, J.A. 53–54.

and customary meaning to a person of ordinary skill in the art. The sole expert testimony on that subject, by Autodesk's expert, confirms that it did not. Aliaga Decl. ¶ 15, J.A. 53–54. [3] The majority says that "[t]he specification describes the Watson and Delaunay prior art in text and drawings to show how they are used and modified in the subject invention." Maj. Op. 12.

The majority first relies on figures in the specification: Figures 12 and 13. Maj. Op. 12–14. The problem is that nothing in these figures defines "modified Watson method" or the language "removing duplicate intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion."

Figures 12A through 12H of the patents at issue "show a Delaunay mesh sequence in which each intersection point is inserted into the mesh step by step," while Figure 13 "is the flowchart of Delaunay mesh modified Watson method that created the sequence of [Figures] 12A through 12H." '961 patent, col. 3, ll. 36–41. These figures were submitted with the initial application and so predate the limitations added during prosecution. As the district court found, J.A. 9–17, and Nature concedes, Reply Br. 6 ("Figures 12 and 13 do not add all of the limitations of claim 1 because the examiner amended claim 1."), claim 1 adds limitations not found in Figures 12A–H or 13: "removing duplicate

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[3] The majority asserts that the inventor provided a technical tutorial to the district court. Maj. Op. 4–5. While it is true that the inventor prepared slides that were utilized by counsel, the district court confirmed that Nature presented no expert witnesses at the tutorial. Dist. Ct. Order 1, J.A. 1 ("[Nature] presented no expert witness testimony at the tutorial hearing."); *see also* ECF No. 43, J.A. 284. Nature does not rely on the tutorial for any purpose. The tutorial apparently was not recorded.

intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion." Thus, the majority looks to Figures 12 and 13 to find the "modified Watson method" but those figures do not include the additional limitations which are expressly required by the claim language.

Apart from the figures, the majority finds that "[t]he specification describes the steps of the modified Watson method" based on quotes from the portion of the specification reproduced below:

> The second step of a Boolean operation this invention described is to search and build intersection lines between triangle sets. It starts with finding the first pair of intersecting triangles: this system builds an axis aligned minimum bounding box for each triangle and checks whether two bounding boxes overlap to decide if edge-triangle intersection needs to be calculated. Once the edge-triangle intersection point(s) falls inside a triangle, this system completes the searching task and stores the point data into an intersection line set.
>
> To extend the current intersection line, this method traces neighboring triangles and calculates edge-triangle intersection points until the intersection line becomes closed.
>
> The third step of a Boolean operation this invention described is to split triangles. Each segment of the intersection lines references two (2) triangles, each of the triangles has at least one sub-intersection line that contains one or more segments, which divide a triangle into three (3) or more smaller triangles. After splitting the triangles, the original triangles are removed, and those smaller triangles are added to the BIOpTriangleSet.

'961 patent, col. 2, ll. 12–32; Maj. Op. 14. But this portion of the specification again deals with the claims before the amendments and does not mention "modified Watson method" or the language that was added during prosecution, "removing duplicate intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion." *See* '961 patent, col. 2, ll. 12–32. Instead, this portion of the specification describes "step[s] of a Boolean operation." *Id.* The quoted part of the specification largely corresponds to limitations other than "modified Watson method" that are elsewhere described in the claims, i.e.,

> building intersection lines starting with and ending with searching for the first pair of triangles that hold a start point of an intersection line by detecting whether two minimum bounding boxes overlap and performing edge-triangle intersection calculations for locating an intersection point, then searching neighboring triangles of the last triangle pair that holds the last intersection point to extend the intersection line until the first intersection point is identical to the last intersection point of the intersection line ensuring that the intersection line gets closed or until all triangles are traversed.

'961 patent, col. 9, ll. 23–33 (emphasis added).

The only expert evidence on the meaning of the additional limitations added during prosecution in the record is by Autodesk's expert, who testified without contradiction that these limitations are "not describe[d]" in the patent, are "ambiguous" and "unclear," and are "inconsistent with" Figure 13 and the accompanying text. Aliaga Decl. ¶¶ 16–17, J.A. 54–56. The majority faults the district court for "declin[ing] to consider information in the specification that was not included in the claims," Maj. Op. 13, but it seems to me that the district court correctly determined

that the cited portions of the specification simply "do[] not explain the challenged claim language." Dist. Ct. Order 10, J.A. 10.[4]

The majority relies on the prosecution history as somehow providing clarity to the meaning of the claim language. The majority states that the prosecution history is "significant," Maj. Op. 15, and implies that the district court erred when it "gave no weight to the prosecution history showing the resolution of indefiniteness by adding the designated technologic limitations to the claims," Maj. Op. 17. But the majority does not identify anything in the prosecution history, whether statements by the applicant or by the examiner, that would illuminate the meaning of "modified Watson method" or the language "removing duplicate intersection points, identifying positions of end intersection points, and splitting portion of each triangle including an upper portion, a lower portion, and a middle portion."

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[4] The added claim language may also present a written description problem, though that issue is not before us.

Lastly, the majority suggests that the claim language is not indefinite because it is "an improvement on the known Watson and Delaunay methods and partakes of known usages for these established technologies." Maj. Op. 18. It cites to *Presidio Components, Inc. v. Am. Tech. Ceramics Corp.*, 875 F.3d 1369, 1377 (Fed. Cir. 2017), for the proposition that when "the general approach [is] sufficiently well established in the art and referenced in the patent," the claims are not indefinite. But in *Presidio*, there was expert testimony that the general approach of the methodology at issue was within the knowledge of someone skilled in the art. *Id.* at 1376–77. As noted, there is nothing in the record to suggest that someone skilled in the art would know the meaning of the added claim language, and the sole evidence on that point is to the contrary.

I respectfully dissent.