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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ERIC MAWBY, HUI QIN, and FENG YU

Appeal 2017-011340
Application 13/564,000¹
Technology Center 2100

Before JEAN R. HOMERE, JASON V. MORGAN, and
JOSEPH P. LENTIVECH, *Administrative Patent Judges*.

MORGAN, *Administrative Patent Judge*.

DECISION ON APPEAL
STATEMENT OF THE CASE

Introduction

This is an appeal under 35 U.S.C. § 134(a) from the Examiner's Final Rejection of claims 1, 3–8, 10–15, and 17–20. App. Br. 2. Claims 2, 9, and 16 are cancelled. *Id.* at 94, 96, 98 (Claims App'x). We have jurisdiction under 35 U.S.C. § 6(b).

We REVERSE.

¹ Appellants identify Siemens Product Lifecycle Management Software Inc. as the real party in interest. Appeal Br. 5.

Invention

Appellants invented a method directed to performing “a Boolean operation to ‘subtract’ a shape from an object model.” Spec. ¶ 17. As part of the disclosed “operation to remove a ‘tool body’ from a ‘target body,’” the disclosed invention “ensure[s] that proper regions of the target body are removed, and that other portions of the target body are modified to properly reflect the operation.” *Id.* Relative convexity at the intersection of the tool body and target body are used in the claimed invention so that, rather than simply subtracting the tool from the target to produce a pocket, “the target remains an overall convex form and the tool produces a locally concave feature in the target.” *Id.* ¶ 31; *see also id.* ¶¶ 33, 46–47, Fig. 5.

Illustrative Claim (key limitations emphasized)

1. A method for product data management, performed by a product data management (PDM) data processing system, comprising:
 - receiving, in the PDM data processing system, a target body and a tool body;
 - evaluating a body type of the target body and a body type of the tool body;
 - evaluating interactions between the target body and the tool body;
 - determining a spatial relation and relative convexity of an intersection between the target body and the tool body;*
 - identifying tool face regions of the tool body based on the evaluations and the determined spatial relation and relative convexity of the intersection;
 - splitting the tool face regions from the tool body and maintaining the tool face regions as a separate body from the tool body; and
 - adding the tool face regions to the target body to produce a modified target body.

Rejections

The Examiner rejects claims 1, 3–8, 10–15, and 17–20 under 35 U.S.C. § 101 as being directed to non-statutory subject matter. Final Act. 2–4.

The Examiner rejects claims 1, 3–8, 10–15, and 17–20 under 35 U.S.C. § 103(a) as being unpatentable over Masatake Higashi et al., *Face-Based Data Structure and its Application to Robust Geometric Modeling*, Proc. of the Third ACM Symp. on Solid Modeling and Apps., 235–46 (1995) (“Higashi”), Steven Fortune, *Polyhedral Modelling with Multiprecision Integer Arithmetic*, Computer-Aided Design, Vol. 29, No. 2, 123–33 (1997) (“Fortune”), and Kevin Weiler, *Edge-Based Data Structures for Solid Modeling in Curved-Surface Environments*, IEEE Computer Graphics and Apps., Vol. 5, No. 1, 21–40 (1985) (“Weiler”). Final Act. 5–11.

35 U.S.C. § 101

Findings and Contentions

In rejecting claim 1 under 35 U.S.C. § 101, the Examiner concludes that the steps, being directed to “the concept of modifying [computer-aided design (CAD)] models . . . correspond[] to concepts identified as abstract ideas by the courts, such as organizing information through mathematical correlations . . . and/or organizing human activity and mathematical relationships/formulas.” Final Act. 3 (citing *Research Corp. Techs. v. Microsoft Corp.*, 627 F.3d 859 (Fed. Cir. 2010); *Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014); *Alice Corp. Pty. v. CLS Bank Int’l*, 134 S. Ct. 2347 (2014)); *see also, e.g.*, Ans. 4–5. The Examiner further concludes that additional recitations directed to “the ‘data

processing system’, ‘memory’, ‘processor’, and ‘machine-readable medium’ . . . are recited at a high level of generality and are recited as performing generic computer functions routinely used in computer applications.” Final Act. 3. Therefore, the Examiner concludes “the additional elements do not amount to significantly more than the” underlying, purportedly abstract, idea. *Id.*

Appellants contend the Examiner erred because the claimed invention is not directed to an abstract idea, but is instead directed to an improved CAD model Boolean operation that ensures “that proper regions of the target body are removed, and that other portions of the target body are modified to properly reflect the operation, such as by adding appropriate faces to the target body that bound the region removed by the tool body.” Appeal Br. 23. Appellants further contend the claimed steps are not directed merely to organizing human activity, organizing information through mathematical correlations, or otherwise describing mathematical relationships or formulas. *See Reply Br. 12.*

Analysis

In ascertaining whether a claim nominally directed to a new and useful process, manufacture, or composition of matter, or any new and useful improvement thereof (35 U.S.C. § 101) nonetheless is directed to non-statutory subject matter, the first step is to determine whether the claim is directed to a patent-ineligible law of nature, natural phenomena, or abstract idea. *Alice*, 134 S. Ct. at 2355.

The Examiner concludes claim 1 is directed to an abstract idea because the claimed “concept of modifying CAD models” is similar to patent-ineligible abstract ideas discussed in *Research Corp.*, *Digitech*, and

Alice. Final Act. 3. However, we agree with Appellants the Examiner’s comparisons fail to show that claim 1 is directed to an abstract idea. *See, e.g.,* Appeal Br. 24.

The Examiner’s reliance on *Research Corp.* is unhelpful because the claimed inventions in *Research Corp.* were directed to patent-eligible subject matter. 627 F.3d at 862, 869.

We are unpersuaded that the invention of claim 1 is similar to the claimed method in *Digitech*, which merely recited “a process of taking two data sets and combining them into a single set, [a] device profile,” without reciting anything directed to, “use of that profile in the capturing, transforming, or rendering of a digital image.” 758 F.3d at 1351. The claimed invention does not merely combine two data sets, but effects a transformation by adding tool face regions to a target body to produce a modified target body.

We agree with Appellants that the Examiner fails to show that “the concept of modifying CAD models” represents the mere organization of human activity. *See* Reply Br. 12–13; *see also* Ans. 4. The Examiner fails to identify what human activity (e.g., hedging, content filtering, organizing, thinking) is organized through CAD model modification.

Furthermore, we agree with Appellants that the Examiner fails to show that the claimed invention is otherwise directed to mathematical relationships or formulas. *See* Reply Br. 14–15 *see also* Ans. 9–10. The Examiner does not identify what mathematical relationship or formula is purportedly claimed. Moreover, although the Specification describes the claimed modification as performing “a Boolean operation to ‘subtract’ a shape from an object model” (Spec. ¶ 17), the claimed invention is not

directed to a basic Boolean operation (e.g., AND, OR, NOT, XOR) in the mathematical sense. Rather, the claimed steps use evaluations of interactions between the target body and the tool body, along with a determined spatial relation and relative convexity of an intersection between the target body and the tool body, to identify tool face regions to add to the target body. *See also* Spec. ¶ 33, Figs. 4A–D (describing and illustrating the formation of a “pocket” formed, not by “simply subtracting a tool from a target,” but by producing “a void on the ‘near’ side of the target while adding wall thickness on the ‘far’ side”).

Because the Examiner does not show that claim 1 is directed to an abstract idea, we do not agree with the Examiner’s conclusion that claim 1 is directed to patent-ineligible subject matter. Accordingly, we do not sustain the Examiner’s 35 U.S.C. § 101 rejection of claim 1, or claims 3–8, 10–15, and 17–20, which contain similar recitations.

35 U.S.C. § 103(a)

Findings and Contentions

In rejecting claim 1 under 35 U.S.C. § 103(a), the Examiner finds Higashi’s determination of a local structure from a global structure—which involves both using whether an edge is convex and, after removing a face from a face array, determining the new convexity of a new edge—and Higashi’s use of whether an edge is convex in determining the next intersection from an intersection point teaches or suggests *determining a relative convexity of an intersection between the target body and the tool body*. Final Act. 6–7 (citing Higashi 239, 245); *see also* Ans. 16. The Examiner relies on Fortune and Weiler for other claim recitations. Final Act. 7–8.

Appellants contend the Examiner erred because the first disclosed use and determination of convexity is discussed as part of a process that “has nothing to do with determining a relative convexity *of an intersection between the target body and the tool body.*” Appeal Br. 44; *see also* Reply Br. 45. Appellants further contend the second disclosed use of convexity “*simply assumes* that an edge is concave on the interior of the corresponding faces” rather than determining relative convexity of an intersection as claimed. Appeal Br. 44; *see also* Reply Br. 45.

Analysis

As Appellants persuasively argue, the Examiner’s findings do not show that Higashi’s disclosed algorithm for determining a local structure from a global structure pertains to determining a relative convexity of an intersection between a target body and a tool body. Appeal Br. 44. The disclosed algorithm for obtaining a local structure from a global structure, “a sequence of faces $f_i, (i = 1, n)$ around a region,” “assume the properties of edge convexity are . . . given” and, after removing face f_{i+1} in step 2, determines the “convexity of the new edge of the remaining two adjacent faces f_i , and f_{i+2} .” Higashi 239. Although this algorithm is applicable in “an area where two solids intersect with almost coincident vertices” (*id.*), the Examiner’s findings do not show that the convexities assumed and determined teach or suggest *relative convexity of an intersection between two objects (e.g., a target body and a tool body)*.

Furthermore Appellants persuasively argue (Appeal Br. 44) that Higashi’s determination of a next intersection from an intersection point merely assumes that an “edge becomes concave when the intersection is in the interior of the corresponding faces, not on their edges” (Higashi 245).

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Higashi characterizes this assumption as “reasonable,” but does not describe this assumption as a determination of *relative convexity of an intersection between two objects* (e.g., *a target body and a tool body*).

For these reasons, we agree with Appellants that the Examiner’s findings do not show that Higashi, even in combination with Fortune and Weiler, renders obvious “determining a spatial relation and relative convexity of an intersection between the target body and the tool body,” as recited in claim 1. Accordingly, we do not sustain the Examiner’s 35 U.S.C. § 103(a) rejection of claim 1, or claims 3–8, 10–15, and 17–20, which contain similar recitations.

DECISION

We reverse the Examiner’s decision rejecting claims 1, 3–8, 10–15, and 17–20.

REVERSED