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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* ERIC S. OLSON, ERIC J. VOTH,
and JEFFREY A. SCHWEITZER

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Appeal 2017-006489
Application 11/715,923[1]
Technology Center 3777

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Before JEFFREY N. FREDMAN, CHRISTOPHER G. PAULRAJ, and JAMES A. WORTH, *Administrative Patent Judges*.

PAULRAJ, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's non-final rejections of claims 7–13, 40, and 41 as set forth in a Non-Final Office Action and modified in the Examiner's Answer. Non-Final Office Action (Aug. 24, 2016) ("Non-Final Act."); Examiner's Answer (Jan. 26, 2017)

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[1] According to Appellants, the real party in interest is St. Jude Medical, Atrial Fibrillation Division, Inc., the assignee of record. Appeal Brief ("Appeal Br.") 2.

("Ans."); 37 C.F.R. § 41.31(a)(1). We have jurisdiction under 35 U.S.C. § 6(b).

The Examiner rejected all of the pending claims under 35 U.S.C. § 101 on the basis that the claimed invention is patent-ineligible because it is directed to a judicial exception without significantly more. Non-Final Act. 2. The Appellants argue that the claims are not directed to an abstract idea, are directed to patent-eligible subject matter, and the Examiner's rejection should be reversed. Appeal Br. 12–16. For the reasons explained below, we determine that the Examiner has not established that the claims are directed to patent-ineligible subject matter. Thus, we reverse.

## CLAIMED SUBJECT MATTER

The claims are directed to an improved "method and system for locally deformable registration of a catheter navigation system to an external model or external image data" such that the invention operates "to transform the coordinate system of [a] catheter navigation system to the coordinate system of [an] external model or external image data." Specification ("Spec.") ¶ 26. Claim 7, reproduced below, is illustrative of the claimed subject matter:

> 7. A method of registering a catheter navigation system to a three-dimensional image, comprising:
>
> a) obtaining a three-dimensional image of at least a portion of a heart, the three-dimensional image including position

information for a plurality of location points on a surface of the heart measured relative to a coordinate frame $Y$;

b) placing a tool on a surface location $X_i$ of the heart;

c) measuring position information for the surface location $X_i$ relative to a coordinate frame $X$;

d) identifying a corresponding location $Y_i$ on the three-dimensional image;

e) associating the position information for the surface location $X_i$ as measured by the catheter navigation system relative to coordinate frame $X$ with position information for the corresponding location $Y_i$ on the three-dimensional image relative to coordinate frame $Y$ as a fiducial pair ($X_i$, $Y_i$); and

f) using at least two fiducial pairs ($X_i$, $Y_i$) to generate a mapping function $f$ that transforms points within coordinate frame $X$ to coordinate frame $Y$ such that, for each fiducial pair ($X_i$, $Y_i$), an error function $f(X_i) - Y_i \approx 0$, wherein the step of using at least two fiducial pairs to generate a mapping function comprises:

using a thin plate splines algorithm to generate the mapping function,

wherein the thin plate splines algorithm comprises summing a fixed number of weighted basis functions,

wherein the fixed number of weighted basis functions is the same as a number of fiducial pairs that were associated, and

wherein the mapping function compensates for inhomogeneities in the catheter navigation system such that, for each fiducial pair ($X_i$, $Y_i$), the error function $f(X_i) - Y_i \approx 0$.

Appeal Br. Claims Appendix ("Appeal Br. Cl. Appx.") 18.

REJECTION

Claims 7–13, 40, and 41 stand rejected under 35 U.S.C. § 101 as being directed to patent-ineligible subject matter. Non-Final Act. 2.

ANALYSIS

*Standard for Patent Ineligibility*

In issues involving subject matter eligibility, our inquiry focuses on whether the claims satisfy the two-step test set forth by the Supreme Court in *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208 (2014). The Supreme Court instructs us to "first determine whether the claims at issue are directed to a patent-ineligible concept," *id.* at 216–218, and, in this case, the inquiry centers on whether the claims are directed to a judicial exception. If the initial threshold is met, we then move to the second step, in which we "consider the elements of each claim both individually and 'as an ordered combination' to determine whether the additional elements 'transform the nature of the claim' into a patent-eligible application." *Id.* at 217 (*quoting Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 79, 78 (2012)). The Supreme Court describes the second step as a search for "an 'inventive concept'—*i.e.*, an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'" *Id.* (quoting *Mayo*, 566 U.S. at 72–73).

The USPTO recently published revised guidance on the application of § 101. USPTO's January 7, 2019 Memorandum, *2019 Revised Patent*

*Subject Matter Eligibility Guidance* ("Memorandum"). Under that guidance, we look to whether the claim recites:

> (1) any judicial exceptions, including certain groupings of abstract ideas (i.e. mathematical concepts, certain methods of organizing human activity such as a fundamental economic practice, or mental processes); and
> (2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h)). Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look to whether the claim:
> (3) adds a specific limitation beyond the judicial exception that is not "well-understood, routine, conventional" in the field (*see* MPEP § 2106.05(d)); or
> (4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

*See* Memorandum.

*Examiner's Findings and Conclusion*

At the first step of the *Alice* inquiry, the Examiner determines claims 7–13 are directed to "a method of registering a catheter navigation system to a three-dimensional image," which is abstract because:

> the claimed invention relies upon collecting and comparing known information, comparing new and stored information and using rules to identify options, organizing information through mathematical correlations, which are considered an abstract idea, or a concept similar to those found by the courts to be abstract, as it involves an idea of itself or registering images using mathematical algorithm such as splines.

Non-Final Act. 3; Ans. 2–3. The Examiner concludes that "[t]he claims essentially cover[] a general algorithm to be executed on a general purpose computer that is cited with [a] generic catheter navigation system and generic catheter/tool that are well-known, conventional systems/devices in

the field of medical imaging" and contends that the Appellants do not "claim any new and novel structures for the catheter and catheter navigation system." Ans. 5.

At the second step of the *Alice* inquiry, the Examiner determines the claims do not recite elements sufficient to transform the abstract idea into a patent-eligible invention. The Examiner states that the steps are merely:

> insignificant post-solution activity and/or data gathering (e.g. obtain 3d images, measuring position); routine and conventional data processing steps (e.g. generate a mapping function that transform points); conventional elements of a computing environment (e.g. catheter navigation system etc.); and/or applying the abstract idea in a computer environment according to well-known, routine, and conventional techniques (e.g. measuring position information and identifying a corresponding location).

Non-Final Act. 3; Ans. 3. The Examiner finds that although "the claim(s) result in the registration of a catheter to a 3D cardiac image," it is not "a meaningful limitation beyond generally linking the use of an abstract idea to a particular technological environment." Non-Final Act. 4; Ans. 3–4.

Additionally, the Examiner finds that "the claimed invention fails to recite any specific machine for performing the apparent computational steps," which is problematic because "generic computer implementation is not the sort of 'additional feature' that provides any 'practical assurance that the process is more than a drafting effort designed to monopolize the [abstract idea] itself.'" *Id.* (citing *Mayo*, 566 U.S. at 77). The Examiner further explains that the "localization, mapping, register and display catheter tool[s]" are "well-known and conventional" and states that the "[c]atheter tool and mapping function are conventional." Non-Final Act. 6. Thus, the Examiner concludes that the catheter navigation system is generic and "does

not add significantly more to the general mapping function that is an algorithm which in itself is an abstract idea." Ans. 6.

The Examiner also finds that Appellants' incorporation of a general error function that is "approximately zero into the mapping function to compensate for inhomogeneities in the catheter navigation system appears to preempt many fields with the known desired result." Ans. 5. Thus, the Examiner concludes that Appellants have fail to show that the claims are directed to an improvement in the technology at issue and that the "technology or desired result already exists." *Id.*

*Appellants' Contentions*

At *Alice* step 1, Appellants argue that the claims are not directed to an abstract idea and dispute the Examiner's characterization of the claimed invention as a "method of registering a catheter navigation system to a three-dimensional image." Appeal Br. 12. Rather, Appellants argue that the claims are directed to "registering the coordinate system of specific hardware (*e.g.*, 'a catheter navigation system') to the coordinate system of a medical image." *Id.* (emphasis omitted). Appellants contend that the claims are "focused 'on an improvement to [catheter navigation system] functionality itself, not on economic or other tasks for which a computer is used in its ordinary capacity'" (citing *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1336 (Fed. Cir. 2016)) and explain that the claims are "directed to an improvement in how inhomogeneities in a specific medical device ('a catheter navigation system') can be compensated for in order to utilize a medical image, such as an MRI or CT image, during a medical procedure

carried out using the catheter navigation system." *Id.* at 13; Reply Brief ("Reply Br.") 4.

Further, Appellants argue that the recited system is not used for its plain and ordinary use as a mere tool in the claimed invention, but it is a "specific improvement in the system itself that facilitates its use with external imagery." Appeal Br. 13. Appellants further argue that the instant appeal is similar to *McRO* in that the Examiner "oversimplified" specific requirements found in the claims. *Id.* at 13 (citing *McRO, Inc. v. Bandai Namco Games America Inc.*, 837 F.3d 1299, 1313 (Fed. Cir. 2016) ("We have previously cautioned that courts 'must be careful to avoid oversimplifying the claims' by looking at them generally and failing to account for the specific requirements of the claims.")). Appellants contend that "the instant claims require specific characteristics – specific types of user inputs and the use of specific warping algorithms that result in specific mapping functions that achieve specific results." *Id.* Appellants assert that "the claimed invention effects a specific improvement in the performance of this technology" and "a claim need not recite 'new and novel structures' to be considered not abstract." Reply Br. 4–5 (emphasis omitted), n.1 (citing *Enfish*, 822 F.3d at 1335 ("Software can make non-abstract improvements to computer technology just as hardware improvements can, and sometimes the improvements can be accomplished through either route.")).

At *Alice* step 2, Appellants argue that even if the claims are found to be directed to an abstract idea, "it is clear that the claims as a whole 'clearly do[] not seek to tie up any judicial exception such that others cannot practice it.'" Appeal Br. 14. (emphasis omitted) (citing 2014 Interim Guidance, 79 Fed. Reg. at 74625). Appellants argue that the Examiner does not address

the claim elements as a whole and only addresses them in isolation. Reply Br. 5. Appellants maintain that the claims are patent-eligible because they:

> require the use of specific hardware (*e.g.*, "a catheter navigation system"), the collection of specific inputs (*e.g.*, position information for multiple surface locations relative to both a coordinate frame *X* and a coordinate frame *Y*), and the creation of a specific mapping function (*e.g.*, one that, for each fiducial pair, yields an error function of about zero).

*Id.*; Appeal Br. 14.

Appellants also argue that the claims "'recite a specific application of the mathematical algorithm that improves the functioning' of the medical system itself" and that both the individual claims and ordered combination of the claims solve the problem of a "need to ensure that medical images [] can be utilized in connection with a catheter navigation system (*e.g.*, an electrical impedance-based navigation system) in a manner that compensates for non-linearities and other inhomogeneities in the catheter navigation system itself" and "the claimed solution 'is tethered to the technology that created the problem.'" *Id.* at 14–15.

*Our Review*

Applying the guidance set forth in the Memorandum, we conclude the Examiner erred in rejecting the claims as being directed to patent-ineligible subject matter. The Memorandum instructs us first to determine whether any judicial exception to patent eligibility is recited in the claim. The guidance identifies three judicially-excepted groupings: (1) mathematical concepts; (2) certain methods of organizing human behavior such as

fundamental economic practices; and (3) mental processes. We focus here on the first grouping—mathematical concepts.

Claim 7 recites the following limitations: "using at least two fiducial pairs ($X_i$, $Y_i$) to generate a mapping function $f$ that transforms points within [] $X$ to [] $Y$ such that, for each fiducial pair[], an error function $f(X_i) - Y_i \approx 0$"; and:

> using a thin plate splines algorithm to generate the mapping function, wherein the thin plate splines algorithm comprises summing a fixed number of weighted basis functions . . . [that] is the same as a number of fiducial pairs that were associated, and wherein the mapping function compensates for inhomogeneities in the catheter navigation system such that, for each fiducial pair ($X_i$, $Y_i$), the error function $f(X_i) - Y_i \approx 0$.

Appeal Br. Cl. Appx. 18. These limitations, under their broadest reasonable interpretation, recite the mathematical relationships between coordinate frames $X$ and $Y$, the mathematical formula for the error function, $f(X_i) - Y_i \approx 0$, and the mathematical calculation using a thin plate splines algorithm to generate the mapping function by summing a fixed number of weighted basis functions. Thus, like the use of mathematical equations to determine the optimal cure time for rubber in a mold or to determine the orientation of an object relative to a moving reference frame, Appellants' claims use mathematical equations to register a catheter navigation system to a three-dimensional image. *See Diamond v. Diehr*, 450 U.S. 175, 177–179 (1981); *Thales Visionix Inc. v. United States*, 850 F.3d 1343, 1347–1348 (2017). Accordingly, we conclude under Step 2A, Prong 1 of the Memorandum that the claims recite the judicial exception of a mathematical concept.

Nonetheless, that is not the end of our analysis. Having determined that the claims "recite" a judicial exception, our analysis under Step 2A,

Prong 2 of the Memorandum now turns whether there are "additional elements that integrate the judicial exception into a practical application." *See* MPEP § 2106.05(a)–(c), (e)–(h). Here, Appellants' claim 7 recites additional limitations which focus on addressing problems arising in the context of registering a catheter navigation system to a three-dimensional image in connection with cardiac procedures. Spec. ¶¶ 26, 28. These limitations include (1) "placing a tool on a surface location $X_i$ of the heart"; (2) "measuring position information for [] $X_i$ relative to a coordinate frame $X$"; (3) "identifying a corresponding location $Y_i$ on the three-dimensional image"; and (4) "associating the position information for [] $X_i$ as measured by the catheter navigation system relative to [] $X$ with position information for [] $Y_i$ on the three-dimensional image relative to [] $Y$ as a fiducial pair ($X_i$, $Y_i$)." Appeal Br. Cl. Appx. 18.

We conclude that these limitations integrate the recited judicial exception of mathematical concepts into a practical application. These additional elements apply the thin plate splines algorithm, weighted basis functions, and error functions recited in the claims in a meaningful way, such that it is more than a drafting effort designed to monopolize the mathematical concepts exception. *See* MPEP § 2106.05(e). In particular, these limitations apply the recited mathematical calculations to improve registration of a catheter navigation system to a three-dimensional image of a heart by accounting for non-linearities and inhomogeneities in the catheter navigation system and reduce errors in the localization field. Spec. ¶¶ 5–8. As further explained in the Specification, the claimed method "generate[s] a mapping function that transforms points within the catheter navigation system to the three-dimensional image such that, for each fiducial pair ($X_i$,

$Y_i$), an error function measures a mapping error of about zero." Spec. ¶ 9. Thus, the claimed transformation avoids errors introduced in the prior art, such as those introduced when an affine transformation is used. *Id.* ¶ 5.

We also find this to be similar to the claims at issue in *Diehr* and *Thales*, in which mathematical concepts were used to improve particular technology. *See Diehr*, 450 U.S. at 187 (concluding that when "computer use incorporated in the process patent significantly lessens the possibility of 'overcuring' or 'undercuring,' the process as a whole does not thereby become unpatentable subject matter"); *Thales*, 850 F.3d at 1348–1349 (finding patent-eligibility upon considering "claims directed to a new and useful technique for using sensors to more efficiently track an object on a moving platform"); *see also* MPEP § 2106.05(a)(II) ("The courts have also found that improvements in technology beyond computer functionality may demonstrate patent eligibility").

We also conclude that the claimed limitations apply the mathematical concepts with a particular machine, i.e., the catheter navigation system. As with the GPS receiver in *SiRF*, the catheter navigation system recited in the present claims is a particular machine that "is integral to each of the claims at issue." *SiRF Tech., Inc. v. Int'l Trade Com'n*, 601 F.3d 1319, 1332 (2010). Claim 7 is expressly directed in its preamble to "[a] method of registering a catheter navigation system to a three-dimensional image," and further recites "placing a tool on a surface location *Xi* of the heart." Appeal Br. Cl. Appx. 18. It also refers to "associating the position information for the surface location $X_i$ as measured by the catheter navigation system" and "wherein the mapping function compensates for inhomogeneities in the catheter navigation system." *Id.* Further, claim 7 relies on the catheter

navigation system to measure "the position information for the surface location $X_i$" of the heart, and the position information for the surface location can exist only with respect to a particular catheter navigation system that connected to the tool on a surface location of the heart. *See SiRF*, 601 F.3d at 1332 (concluding that the claim required "'pseudoranges' that estimate the distance from 'the GPS receiver to a plurality of GPS satellites" and that pseudoranges "can exist only with respect to a *particular* GPS receiver that receives the satellite signals"). Thus, as in *SiRF*, "the methods at issue could not be performed without the use of a [catheter navigation system]." *Id.*; *see also* MPEP § 2106.05(b) ("When determining whether a claim recites significantly more than a judicial exception, examiners should consider whether the judicial exception is applied with, or by use of, a particular machine.").

Accordingly, we conclude the claimed invention is integrated into a practical application, and under the guidance provided in the Memorandum, the claims have not been shown to be patent-ineligible because they are not "directed to" a judicial exception.

## DECISION

We reverse the Examiner's rejection of claims 7–13, 40, and 41.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

REVERSED