



March 23, 2020

**Via Email**

The Honorable Andrei Iancu  
Director, U.S. Patent and Trademark Office  
P.O. Box 1450  
Alexandria, VA 22313-1450  
[PTAB\\_Decision\\_Nomination@uspto.gov](mailto:PTAB_Decision_Nomination@uspto.gov)

**Re: Request to Designate Certain Board Decisions as Precedential**

Dear Director Iancu:

We write to nominate two decisions of the Patent Trial and Appeal Board to be designated as precedential under Standard Operating Procedure 2 (rev. 10), § III:

- *Ex parte Olson*, Appeal 2017-006489 (designated Informative July 1, 2019)
- *Ex parte Fautz*, Appeal 2019-000106 (designated Informative July 1, 2019).

A copy of both decisions is enclosed with this letter. In each decision, the Board reversed a rejection based on 35 U.S.C. § 101. And in each decision, the reversal was based on a proper application of the 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019) (hereinafter “Guidance”). Because proper application of the Guidance is important to ensure uniformity in examination, making these decisions precedential will promote both consistency among Board panels and a greater awareness of the decisions within the Examining Corps.

The claims at issue in each of these decisions involve medical inventions. The need for ongoing medical discovery and innovation in the life sciences has been highlighted by the recent outbreak of the COVID-19 pandemic—the very novelty of which will require innovation that should not be inhibited by a misapplication of Section 101. Designating these decisions as precedential will reduce the likelihood that Section 101 will be misapplied and, in turn, will promote innovation in the life sciences and encourage a robust response to public health challenges like the COVID-19 pandemic.

Turning to the specifics of each case and why each deserves precedential designation, the claims in *Olson* were directed to a catheter navigation system and method. The claims recited mathematical equations used in the claimed system and methods that reduced registration errors in a 3D imaging system resulting in improved catheter placement in a patient. The Board’s decision applied Revised Step 2A (Prongs 1 and 2) of the Guidance to the claims. In its application of Prong 1, the Board recognized that the claims recited mathematical formulae, but found this situation analogous to (and governed by) the use of the Arrhenius equation in a method to cure rubber that the Supreme Court found to be patent-eligible subject matter in

*Diamond v. Diehr*, 450 U.S. 175 (1981). The decision also cites Federal Circuit precedent from *Thales Visionix Inc. v. U.S.*, 850 F.3d 1343 (Fed. Cir. 2017), which held patent-eligible certain claims using mathematical formulae for determining the orientation of an object relative to a moving reference frame. Regarding Step 2A, Prong 2, the Board in *Olson* found that the claims recited additional limitations that applied the results of the mathematical formulae to achieve the claimed result, *i.e.*, reduce errors in catheter placement by accounting for patient-specific non-linearities and inhomogeneities in catheter navigation, again finding similarities to how the Arrhenius equation was used in *Diehr*. In addition, the Board held that, where the claims were eligible under Revised Step 2A, there was no reason to reach the questions in Revised Step 2B.

The *Olson* decision thus provides an important clarification on the proper application of the Guidance. The need for such clarification is evident from the Examiner's rejection, and the opinion provides appropriate blazemarks for both Examiners and the Board in applying the Guidance in light of this decision. While the Office has already implicitly recognized the importance of *Olson* by having designated it as "informative" in July 2019, a "precedential" designation would give the decision additional weight and ensure that it serves as "binding Board authority in subsequent matters involving similar facts or issues." Standard Operating Procedure 2 (rev. 10), § III.D. Accordingly, a precedential designation would signal to all Office personnel a requirement to apply the Guidance in the manner applied by *Olson* when encountering similarly structured claims (*i.e.*, that recite mathematical formulae). Moreover, a consistent application of *Olson* would include a need not to reach Revised Step 2B if the claimed invention is deemed eligible under Revised Step 2A, thereby increasing examination efficiency and guarding Office personnel from going astray on the basis of an unnecessary Revised Step 2B analysis.

In *Fautz* the invention was directed to magnetic resonance tomography (MRT) and methods for performing MRT using the apparatus. The claims recited three mathematical formulae and four calculations that use those formulae. The Board recognized in applying Revised Step 2A, Prong 1 that the claims recited a judicial exception, but applied Revised Step 2A, Prong 2 to conclude that the mathematical formulae and calculations using those formulae were integrated into a practical application. Analogous to the circumstances in the Federal Circuit's *Thales* decision, the invention in *Fautz* used the formulae and calculations to improve sensitivity correction in surface coils used in MRT. The result of this use was improved images reconstructed from the tomography. And, as in *Olson*, the Board in *Fautz* did not need to reach the Revised Step 2B question regarding whether there were additional elements recited in the claim that amounted to significantly more than the judicial exception.

The *Fautz* decision, like *Olson*, provides needed clarification on how to apply the Guidance, specifically with regard to certain apparatus claims. Using mathematical formulae (*e.g.*, in the form of algorithms) to direct the performance of an apparatus is increasingly common, and this use can result in improved performance of such devices. Improper application of Revised Step 2A, resulting in rejection of claims reciting such algorithms can retard innovation in this area and, as explained in *Fautz*, is an unnecessary extension of Supreme Court and Federal Circuit precedent. This decision deserves to be designated as precedential to ensure that both the Board and the Examining Corps apply the Guidelines in the manner applied by *Fautz* in subsequent matters involving similar facts or issues, including where the claims integrate a mathematical

Honorable Andrei Iancu  
March 23, 2020

concept into a practical application under Revised Step 2A, Prong 2. And, like *Olson*, the *Fautz* decision has the additional benefit of informing Office personnel when they need not reach Revised Step 2B.

We are aware of no other Board decision that is in conflict with the nominated decisions.

We submit this letter as citizens concerned about the proper and efficient functioning of the U.S. patent system and not on behalf of any client.

**About the Naples Roundtable**

The Naples Roundtable, Inc. is a 501(c)(3) non-profit organization whose primary mission is to explore ways to improve and strengthen the U.S. patent system. To achieve this goal, the Naples Roundtable supports the advanced study of both national and international intellectual property law and policy. The Naples Roundtable fosters the exchange of ideas and viewpoints among world-leading intellectual property experts and scholars. It also organizes conferences and other public events to promote the development and exchange of ideas to improve and strengthen the U.S. patent system. More information is available at [www.thenaplesroundtable.org](http://www.thenaplesroundtable.org).

Respectfully submitted,

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Enclosures (2)

***Ex parte Olson***

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UNITED STATES PATENT AND TRADEMARK OFFICE

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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<sup>1</sup>  
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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<sup>1</sup> 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  $f(X_i) - Y_i \approx 0$ .

## 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  $(X_i, Y_i)$ , 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  $X_i$  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

***Ex parte Fautz***

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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* HANS-PETER FAUTZ

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Appeal 2019-000106  
Application 14/326,661  
Technology Center 2800

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Before MELISSA A. HAAPALA, *Acting Vice Chief Administrative Patent Judge*, ALLEN R. MacDONALD and JASON M. REPKO, *Administrative Patent Judges*.

REPKO, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant<sup>1</sup> appeals under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1–9. App. Br. 4.<sup>2</sup> We have jurisdiction under 35 U.S.C. § 6(b). We reverse.

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<sup>1</sup> According to Appellant, the real party in interest is Siemens Aktiengesellschaft. App. Br. 1.

<sup>2</sup> Throughout this opinion, we refer to the Final Office Action (“Final Act.”), mailed July 26, 2017; the Appeal Brief (“App. Br.”), filed February 20, 2018; the Examiner’s Answer (“Ans.”), mailed August 3, 2018; and the Reply Brief (“Reply Br.”), filed October 3, 2018.

## THE INVENTION

Appellant's invention generally relates to magnetic resonance (MR) tomography. Spec. 1. An MR tomography device performs slice-imaging MR tomography. *Id.* These devices use reception coils to receive signals generated while scanning a subject. *Id.* The described invention optimizes the signal-to-noise ratio (SNR) from the reception coils. *Id.* at 3.

Claims 1, 8, and 9 are independent. Claim 8, reproduced below, is exemplary:

8. A magnetic resonance (MR) tomography apparatus comprising:

an MR data acquisition unit comprising a radio frequency (RF) transmission system comprising a number  $n$  of single RF coils  $E_i$  with which reception signals  $I_i$  are respectively acquired, with  $i = 1, \dots, n$ ;

a processor provided with or configured to determine, for each single coil  $E_i$ , an individual reception sensitivity profile in the spatial domain  $r$   $B1_i^-(r)$ :

$$B1_i^-(r) = |a_i(r)| * e^{i\varphi_i(r)}$$

with amplitude  $a_i(r)$  and phase  $\varphi_i(r)$ ;

said processor being configured to operate the MR tomography apparatus to scan an examination subject introduced into the MR tomography apparatus to acquire reception signals  $I_i(k)$  in the frequency domain with wave number  $k$  via the  $n$  reception coils  $E_i$ ;

said processor being configured to determine Fourier-transformed signals  $IF_i(r)$  from the reception signals  $I_i(k)$ , wherein:

$$IF_i(r) = \rho(r) \cdot e^{i\phi(r)} \cdot B1_i^-(r) + N$$

with  $N$ := noise term,  $\rho(r)e^{i\phi(r)}$ := proton density;

said processor being configured to determine complexly corrected signals  $\tilde{I}F_i(r)$  on the basis of the signals  $I F_i(r)$  and the individual reception sensitivity profiles  $B1_i^-(r)$ ;

said processor being configured to determine a sum signal  $MR(r)$  via complex addition of the corrected signals  $\tilde{I}F_i(r)$ :

$$MR(r) = \sum_i \tilde{I}F_i(r); \text{ and}$$

said processor being configured to reconstruct image data of the examination subject on the basis of the sum signal  $MR(r)$ , and to make the image data available at an output of the processor as an electronic data file.

Amendments to the Claims, filed May 12, 2017, p. 4.<sup>3</sup>

#### THE REJECTION

Claims 1–9 stand rejected under 35 U.S.C. § 101 as directed to patent-ineligible subject matter.<sup>4</sup> Final Act. 1–5.

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<sup>3</sup> The claim listing in the Appeal Brief was defective. *See* Notification of Non-Compliant Appeal Brief, Paper No. 20180309-1, mailed March 13, 2018. Appellant then filed a Supplemental Appeal Brief with a replacement claim listing. Supplemental Appeal Brief, filed April 6, 2018. But the replacement claim listing contains extraneous text. *See, e.g., id.* at 5 (showing claim 1 with references to page and line numbers such as “(p.9, l.1-3)”). In this decision, we refer to the last-entered claims, which are the claims on appeal.

<sup>4</sup> We note that claim 1 uses italics inconsistently (e.g., claim 1 recites  $a_i(r)$  and  $a_i(r)$ ). Amendments to the Claims, filed May 12, 2017, p. 2. Also, several terms are italicized in claim 1 but not in its dependent claims. Claim 1 as originally filed does not contain the italicized versions of these terms, and we find no entered amendment that changes these terms. Claims, filed July 9, 2014. Thus, we treat all italicizations as typographical errors and, for example, interpret  $a_i(r)$  and  $a_i(r)$  as the same term.

## ANALYSIS

### *I. Principles of Law*

Section 101 defines patent-eligible subject matter as “any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof.” 35 U.S.C. § 101. But courts have long held that laws of nature, natural phenomena, and abstract ideas are not patentable. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 70–71 (2012) (citing *Diamond v. Diehr*, 450 U.S. 175, 185 (1981)). These ineligible concepts are implicit exceptions to the statutory categories. *Id.* at 71.

The Supreme Court articulated a two-step subject-matter eligibility test in *Mayo* and *Alice Corp. v. CLS Bank International*, 573 U.S. 208 (2014). *Alice/Mayo* step one asks whether a claim is “directed to” a judicial exception. *Alice*, 573 U.S. at 217. In *Alice/Mayo* step two, 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.* (quoting *Mayo*, 566 U.S. at 79, 78). Step two is described as a search for an “inventive concept.” *Id.*

The USPTO recently published revised guidance on patent subject matter eligibility. 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (USPTO Jan. 7, 2019) (“Guidance”). Step 1 of the USPTO’s eligibility analysis asks whether the claimed subject matter falls within the four statutory categories of invention. *Id.* at 53–54. Under Step 2A, Prong One of the Guidance, we determine if the claim recites a judicial exception, including particular groupings of abstract ideas (i.e.,

mathematical concepts, certain methods of organizing human activity, or mental processes). *Id.* at 52–53. If so, we then analyze the claim to determine whether the recited judicial exception is integrated into a practical application of that exception under Step 2A, Prong Two of the Guidance. *Id.* at 53–55; MPEP §§ 2106.05(a)–(c), (e)–(h) (9th ed. Rev. 08.2017, Jan. 2018). Only if the claim is directed to the judicial exception, do we then look to whether the claim adds a specific limitation beyond the judicial exception that is not “well-understood, routine, conventional activity in the field” (*see* MPEP § 2106.05(d)) or whether the claim simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception. Guidance, 84 Fed. Reg. at 56.

## *II. The Examiner’s Rejection and Appellant’s Arguments*

According to the Examiner, the claims are directed to an abstract idea. Final Act. 1. The Examiner determines that the claims are similar to abstract ideas relating to mathematical formulas and “collecting information, analyzing it, and displaying certain results of the collection and analysis.” *Id.* at 3 (citing *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350 (Fed. Cir. 2016); *Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014); *Classen Immunotherapies, Inc. v. Biogen IDEC*, 659 F.3d 1057 (Fed. Cir. 2011); *In re Grams*, 888 F.2d 835 (Fed. Cir. 1989)). Also, the Examiner finds that the MR tomography apparatus is an additional element that is well-understood, routine, and conventional in the art. Ans. 4. According to the Examiner, the processor does not meaningfully limit the abstract idea beyond generally linking the method’s use to a computer. *Id.*

The Examiner finds that the data collection and display are insignificant extra-solution activity. *Id.* at 6–8.

Appellant argues that the claims are patent eligible because they provide a technical solution to a problem in the field of MR tomography. App. Br. 6–7. In Appellant’s view, a processor analyzes signals from the MR tomography device and its reception coils in a specific way.

Reply Br. 2. Appellant points out that the “physical properties of those reception coils, namely the reception sensitivity profiles, are used in the analysis.” *Id.*

*III. Does the claim recite a judicial exception?*

Under Step 2A, Prong One of the Guidance, we first consider whether the claim recites a judicial exception. Guidance, 84 Fed. Reg. at 51. The Guidance organizes the abstract-idea exception into the following subject-matter groupings: mathematical concepts, certain methods of organizing human activity (e.g., a fundamental economic practice), and mental processes. *Id.* at 52. The mathematical-concept grouping includes mathematical relationships, calculations, equations, and formulas. *Id.*

Here, the independent claims<sup>5</sup> recite three mathematical formulas:

$$(1) B1_i^-(r) = |a_i(r)| * e^{i\phi_i(r)},$$

$$(2) IF_i(r) = \rho(r) \cdot e^{i\phi(r)} \cdot B1_i^-(r) + N, \text{ and}$$

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<sup>5</sup> The three independent claims in this appeal recite substantially similar functions as a method (claim 1), an apparatus (claim 8), and a medium (claim 9). In particular, claim 8 recites an apparatus with a processor that performs the steps recited in claim 1’s method. Likewise, claim 9 recites a computer-readable data-storage medium encoded with programming instructions causing a control and processing system to perform claim 1’s method. We refer to claims 1, 8, and 9 collectively as the independent claims.



$$(3) \text{MR}(\mathbf{r}) = \sum_i \tilde{\text{IF}}_i(\mathbf{r}).$$

The recited processor uses the first formula,  $B1_i^-(\mathbf{r})$ , for the individual reception-sensitivity profiles of the device's coil array. The MR tomography system then scans the examination subject to acquire frequency-domain signals,  $\text{IF}_i(\mathbf{r})$ . From these signals, the processor uses the second formula to determine the corresponding Fourier-transformed signals. Next, the processor determines the complexly corrected signals from the results of the first two formulas. Last, the processor sums the complexly corrected signals in the third formula to obtain sum signal  $\text{MR}(\mathbf{r})$  for image reconstruction. In summary, the independent claims recite three mathematical formulas and four calculations that use those formulas.

The Examiner identifies these limitations as an abstract idea. Final Act. 2 (reproducing the limitations with bold formatting). As to this identified concept only, we conclude that, under Step 2A, Prong One of the Guidance, the independent claims recite an abstract idea: a mathematical concept.

*IV. Is the claim directed to the recited judicial exception?*

Because the claims recite an abstract idea, we now proceed to determine, under Step 2A, Prong Two of the Guidance, whether the recited judicial exception is integrated into a practical application. Guidance, 84 Fed. Reg. at 51. When a claim recites a judicial exception and fails to integrate the exception into a practical application, the claim is “directed to” the judicial exception. *Id.*

To the extent that the Examiner regards the MR tomography device's operation to be abstract, we disagree. *See* Final Act. 3 (discussing scanning an examination subject and reconstructing image data). As we explain in

our analysis below, the additional elements<sup>6</sup> reflect an improvement to a technology, and thus the independent claims integrate the recited mathematical concept into a practical application.

A claim may integrate the judicial exception into a practical application when, for example, it reflects an improvement to technology or a technical field. Guidance, 84 Fed. Reg. at 55 n.25 (citing MPEP § 2106.05(a)). For instance, the Federal Circuit found claims eligible when they were directed to a “particular configuration of inertial sensors and a particular method of using the raw data from the sensors,” which improved the accuracy of calculating an object’s position and orientation. *Thales Visionix, Inc. v. United States*, 850 F.3d 1343, 1349 (Fed. Cir. 2017), cited in MPEP § 2106.05(a)(II)(vii). Although the claims used mathematical equations, the Federal Circuit in *Thales* explained that “[t]he mathematical equations are a consequence of the arrangement of the sensors and the unconventional choice of reference frame in order to calculate position and orientation.” *Id.* The claimed system eliminated “many ‘complications’ inherent in previous solutions” for determining an object’s position and orientation. *Id.* at 1348.

On the other hand, a claim does not integrate the abstract idea into a practical application when it merely adds insignificant extra-solution activity or generally links the judicial exception’s use to a particular technological environment or field. Guidance, 84 Fed. Reg. at 55 n.32 (citing MPEP § 2106.05(h)). For example, in *Parker v. Flook*, the claim used a

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<sup>6</sup> We use the term “additional elements” for “claim features, limitations, and/or steps that are recited in the claim beyond the identified judicial exception.” See Guidance, 84 Fed. Reg. at 55 n.24.

mathematical formula to calculate a numerical limit on a process variable in the catalytic chemical conversion of hydrocarbons. 437 U.S. 584, 586 (1978), *cited in* MPEP § 2106.05(h). The Supreme Court rejected the argument that the claim was made eligible through its limitations to the petrochemical field and oil refining. *Id.* at 589–91. Reflecting on this case, the Supreme Court in *Bilski v. Kappos* commented that “*Flook* established that limiting an abstract idea to one field of use or adding token postsolution components did not make the concept patentable.” 561 U.S. 593, 612 (2010).

We disagree with the Examiner that the recited data collection is a field of use or merely adds token components to the mathematical equations. *See* Final Act. 3; Ans. 6–8. Here, as in *Thales*, the independent claims solve a technical problem. We agree with Appellant that the MR tomography device in the claimed solution is neither a token addition nor an abstract concept. App. Br. 6–7.

Specifically, the invention involves surface coils used in MR tomography. *See* Spec. 1–3. Modern MR tomography systems have both volume and surface coils. *Id.* at 1. Typically, volume coils act as a transmitter, and surface coils are “reception coils”—i.e., they receive signals generated during a scan of an examined subject. *Id.* Because the surface coils are flexible and small, they are particularly suited for imaging surface-proximate structures. *Id.* But surface coils have a small measurement depth and a reduced field of view. *Id.* Also, the coil’s sensitivity decreases with distance. *Id.* at 2. So the surface coils have an inhomogeneous image exposure. *Id.* at 1–2. These properties may cause an undesirable intensity decline in the resulting image. *Id.* at 2.

Appellant is concerned with solving the technical problem of improving sensitivity correction in MR tomography devices. *See id.* at 3. Appellant's described solution overcomes the limitations of existing approaches. *See id.* at 2–4.

For example, one existing approach is the prescan-normalize method. *Id.* at 3. The prescan-normalize method creates a spatial-correction map using values from both the surface-coil array and the volume coil. *Id.* But this method cannot be used with high-field devices available at the time of the invention, because these devices lack a volume coil with a homogeneous reception sensitivity. *Id.* Unlike the prescan-normalize method, the claimed invention, as explained below, can be used in high-field systems because it does not use a volume coil as a reference. *Id.* at 6.

Another approach is the adaptive-combine method. *Id.* at 3. This method combines the reception coil's signals, but its SNR is sub-optimal. *Id.* The claimed invention, though, combines the signals in a way that optimizes SNR through the complex correction of the individual reception signals  $I_i(k)$ . *Id.* at 5.

Appellant's described technical solution is required by the independent claims. For instance, the independent claims recite determining each single coil's reception sensitivities,  $B_{1i}^-(r)$ , with the relative phases and amplitudes. This addresses the shortcomings of the prescan-normalize method, which does not determine the reception sensitivities of individual channels. *Id.* Also, the recited complex correction of the individual reception signals  $I_i(k)$  allows the direct addition with optimal SNR. *Id.* This is an improvement over methods that combine measurement signals by calculating the absolute value, which prevents signal cancelations but does

not deliver optimal SNR. *Id.* at 3. The independent claims recite a practical application of these results because the claimed method, device, and medium improve the output by reconstructing “image data of the examination subject on the basis of the sum signal.” *See* Claims 1, 8, and 9.

Here, as in *Thales*, “[t]hat a mathematical equation is required to complete the claimed method and system does not doom the claims to abstraction.” 850 F.3d at 1349. The mathematical calculations recited in the independent claims are “a consequence of the arrangement of” the device’s coils and how they receive signals during the scan. *See id.* For instance, Appellant points out that the reception coil’s physical properties—i.e., the reception-sensitivity profiles—are used in the analysis. Reply Br. 2. This analysis results in an improved reconstructed image. *Id.* For all these reasons, the claimed invention uses the recited mathematical equations to improve the imaging system. *See id.*

Because we find the claims are not directed to an abstract idea, we need not proceed to determine whether the claims provide an inventive concept. *See* Guidance, 84 Fed. Reg. at 56 (discussing “*Step 2B: If the Claim Is Directed to a Judicial Exception, Evaluate Whether the Claim Provides an Inventive Concept*”).

Thus, we do not sustain the rejection of independent claims 1, 8, and 9. For the same reasons, we also do not sustain the rejection of dependent claims 2–7, which are rejected under the same rationale. *See* Final Act. 4–5.

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DECISION

We reverse the Examiner's decision to reject claims 1–9.

REVERSED