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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte RICHARD ALLEN SNYDER

Appeal 2017-005386¹
Application 14/350,452²
Technology Center 3700

Before JEFFREY N. FREDMAN, JAMES A. WORTH, and
TAWEN CHANG, *Administrative Patent Judges*.

Opinion for the Board filed *per curiam*.

Opinion Concurring-in-part and Dissenting-in-part filed by *Administrative Patent Judge* WORTH

Per curiam.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's Final Rejection of claims 1–12, which are all pending claims. We have jurisdiction under 35 U.S.C. §§ 134 and 6(b).

We affirm.

¹ Our Decision refers to Appellant's Appeal Brief ("Appeal Br.," filed Oct. 3, 2016) and Reply Brief ("Reply Br.," filed Feb. 15, 2017), and the Examiner's Final Office Action ("Final Act.," mailed Mar. 29, 2016) and Answer ("Ans.," mailed Dec. 15, 2016).

² According to Appellant, the real party in interest is KONINKLIJKE PHILIPS N.V. Appeal Br. 3.

Statement of the Case

Background

Appellant's application relates to "an ultrasound system and method for providing a live three-dimensional image of a volume, for example an anatomical site of a patient," and a computer system for implementing such a method. Spec. 1: 2–4. In live three-dimensional imaging, a real-time view on the volume can be acquired enabling a user to view moving parts of the anatomical site, for example a beating heart. *Id.* at 1:16–18. The so-called region of interest (ROI) and its size might change through a clinical application of live three-dimensional ultrasound imaging. *Id.* at 1:22–24. There were problems in a prior art method using 4X multi-line imaging because when the received beams move apart, the image loses sensitivity and there are gaps between the receive lines. *Id.* at 2:5–20.

"The basic idea of the invention is to reduce the central receive frequency of a bandpass filter of the signal processor as a function of increasing line spacing." *Id.* at 3:24–25. According to the Specification:

It has been found out that if the line spacing is varied to maintain a sufficiently high volume acquisition rate when the size of the volume to be inspected or the region of interest is enlarged, reducing the receive frequency and, further, bandwidth as a function of increasing line spacing allows for much greater separation between lines without significant loss in sensitivity and increase in spatial aliasing. It is implemented in the signal processor to shift the receive frequency and, further, bandwidth of the bandpass filters as a function of the given line spacing.

Id. at 3:35–4:9.

The Specification sets forth two equations that may be used to calculate a frequency shift based on line spacing. In one embodiment, the relationship is described by the following equation:

$$SF = 1 - A \cdot (LS - MLS)^2,$$

wherein SF is a receive frequency shift factor, LS is the spacing in degrees, MLS is a minimum line spacing in degrees and A is a scaling parameter. *Id.* at 4:22–24. In another embodiment, the relationship is described by a second equation:

$$SF = 1 - A \cdot (LS - MLS) \cdot B^{LS},$$

wherein SF is a shift factor of the central receive frequency, LS is the spacing in degrees and MLS is a minimum line spacing in degrees, A is a scaling parameter and B is a scaling parameter. *Id.* at 5:1–4. The relationships are implemented in the signal processor with a set of parameters that give the user control of the relationship between line spacing and the shift factor. *Id.* at 5:7–9.

The Claims

Claims 1 and 11 are in the independent claims on appeal. Claim 1, reproduced below, is illustrative of the subject matter on appeal:

1. An ultrasound imaging system for providing a three-dimensional image of a volume, the ultrasound imaging system comprising:

a transducer array configured to provide an ultrasound receive signal,

a beam former configured to control the transducer array to scan the volume along a multitude of scanning lines, and further configured to receive the ultrasound receive signal and to provide an image signal,

a signal processor including a bandpass filter configured to receive the image signal and to conduct a bandpass filtering operation around a central receive frequency on the image signal, wherein the signal processor is further configured to adjust the central receive frequency as a function of a spacing of the scanning lines, wherein the signal processor is configured

to lower the central receive frequency when the spacing is increased, wherein the signal processor is further configured to provide image data of the three-dimensional image, and

a display configured to provide the three-dimensional image.

Appeal Br. 14, Claims App.

The Issues

A. The Examiner rejected claims 1–12 under 35 U.S.C. § 103(a) as being unpatentable over Sato³ and Ustuner⁴.

B. The Examiner rejected 1–12 under 35 U.S.C. § 101 as lacking patentable subject matter.

A. 35 U.S.C. § 103 over Sato and Ustuner

The Examiner finds that Sato substantially discloses the ultrasound system of the claimed invention, but does not explicitly disclose adjusting the central receive frequency as a function of the scanning lines, wherein the signal processor is configured to lower the central receive frequency when the spacing is increased. Final Act. 6–7. The Examiner finds that Ustuner teaches that one of ordinary skill in the art can adjust multiple variables in order to achieve a particular type of scan and three dimensional image data. *Id.* at 7 (citing Ustuner ¶¶ 22–23, 38–40, claims 9, 25, 29). The Examiner concludes that it would have been obvious to a person having ordinary skill, in the art at the time of the invention, to use the teachings of Ustuner to modify Sato to include the concept of adjusting/controlling multiple

³ Sato, US 2008/0221449 A1, pub. Sept. 11, 2008.

⁴ Ustuner, US 2005/0228280 A1, pub. Oct. 13, 2005.

variables to obtain an image. *Id.* at 8. The Examiner reasons that it would have been obvious to decrease the frequency to mitigate attenuation in deeper tissue and to optimize multiple parameters for clinical purposes, i.e., because there is a countervailing consideration that increasing the frequency decreases resolution. *Id.*

The issue with respect to this rejection is: Does the evidence of record support the Examiner's conclusion that Sato and Ustuner render claims 1–12 obvious?

Appellant contends that paragraphs 22 and 23 of Ustuner disclose at most changing a frequency of scanning (i.e., *transmission*) but does not disclose any changes to a central *receive* frequency as required by independent claim 1, i.e., “a signal processor including a bandpass filter configured to receive the image signal and to conduct a bandpass filtering operation around a central receive frequency on the image signal, wherein the signal processor is further configured to adjust the central receive frequency as a function of a spacing of the scanning lines, wherein the signal processor is configured to lower the central receive frequency when the spacing is increased.” Appeal Br. 6.

We are persuaded by Appellant's contention. Paragraphs 22 and 23 of Ustuner disclose “switching between beamforming parameters,” but it is unclear at best that this refers to more than transmission parameters, and in any event does not refer to the receive frequency *of the bandpass filter*. We have reviewed the remaining portions of Ustuner relied on by the Examiner but do not find adequate support therein for the disputed limitation.

The Examiner reasons, without citation to prior art, that a change in the transmit frequency would be accompanied by a change in the receive

frequency and that the two frequencies must be in sync for purposes of image reconstruction. Ans. 10–11. In this manner, the Examiner has essentially relied on inherency for this factual finding.

Appellant, however, asserts that transmit frequencies can differ from receive frequencies, e.g., when receive frequencies are the harmonic of a transmit frequency. Reply Br. 2 (citing Chen, US 6,532,819, iss. March 18, 2003 (hereinafter, “Chen”). Chen discloses “it is possible to excite the object to be imaged by transmitting at a low (and therefore deeply penetrating) fundamental frequency (f_0) and receiving at a harmonic wave having a higher frequency (e.g., $2f_0$) that can be used to form a high resolution image of the object. By way of example, a wave having a frequency less than 2 MHz can be transmitted into the human body and one or more harmonic waves having frequencies greater than 3 MHz can be received to form the image.” Chen, 1:47–51.

In view of Appellant’s evidence and assertion, we find that Appellant has traversed the Examiner’s finding that transmit and receive frequencies must be “in sync” for purposes of this rejection. In other words, the Examiner has not explained why a change in the transmit frequency would *necessarily* be accompanied by a corresponding change in the central receive frequency. Accordingly, the Examiner has not provided sufficient evidence and reasoning to support the finding that Ustuner discloses the limitation of a signal processor configured to “adjust the central receive frequency as a function of a spacing of the scanning lines,” either expressly or inherently, or otherwise rendered obvious this limitation.

As such, we do not sustain the Examiner’s rejection under 35 U.S.C. § 103 of independent claim 1 and its dependent claims. Independent claim

11 contains similar language and requirements as independent claim 1. For similar reasons as independent claim 1, we do not sustain the Examiner's rejection under 35 U.S.C. § 103 of independent claim 11 and its dependent claim.

B. 35 U.S.C. § 101

The Examiner determines that the claims are directed to “an apparatus and method for providing an ultrasound three-dimensional image of a volume,” which relies upon “scanning a volume, performing signal processing (i.e., adjusting the central receive frequency) and constructing an image.” Final Act. 5. The Examiner determines that this “is considered an abstract idea, or a concept similar to those found by the courts to be abstract, as it involves measurement using a generic transducer, signal processing using a mathematical formulation that relates frequency and frequency shifting to line spacing, and creating an image, which can all be performed by human intelligence. . . .” Final Act. 5. The Examiner further determines these steps and elements amount to no more than insignificant post-solution activity and/or data gathering (e.g. using a transducer, determining a relationship between two variables and adjusting a signal based on a formula, and image reconstruction). *See id.* The Examiner states: “As discussed in *Mayo*, simply appending conventional steps, specified at a high level of generality, to a method already ‘well known in the art’ is not ‘enough’ to supply the ‘inventive concept’ needed to transform the abstract idea into a patent-eligible invention.” *Id.* The Examiner determines that the claims merely “link[] the use of an abstract idea to a particular technological environment.” *Id.* The Examiner states that 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.* at 6 (citing *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 566 U.S. 66, 11–14 (2012)).

Appellant asserts that the claimed invention is directed to an improvement to the technological field of medical imaging, and more specifically to an ultrasound imaging system and to a method for providing a three-dimensional image of a scanned volume. Appeal Br. 10. Appellant argues that claims purporting to improve an existing technological process may not fall under the abstract idea exception. *Id.* at 10 (citing *Alice Corp. Pty. Ltd. v. CLS Bank Int’l*, 134 S. Ct. 2347 (2014); *Enfish LLC v. Microsoft Corp.*, slip op. at 10 (*Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66 (2012))).

To determine whether a claim is invalid under § 101, we employ the two-step *Alice* framework. In step one, we ask whether the claims are directed to a patent ineligible concept, such as an abstract idea or law of nature. *Alice Corp. Pty. Ltd.*, 134 S. Ct. at 2355; *Mayo Collaborative Servs.*, 566 U.S. at 76–78; *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1375 (Fed. Cir. 2015). While method claims are generally eligible subject matter, method claims that are directed only to abstract ideas and/or natural phenomena are directed to a patent ineligible concept. *Ariosa*, 788 F.3d at 1376.

Alice Step One

We have reviewed the Examiner’s determinations, and we agree that claim 1 is directed to the abstract idea of a mathematical formulation that relates frequency and frequency shifting to line spacing, and creating an image. The Examiner’s determinations are adequately supported by the

intrinsic evidence. The Specification states that “[t]he basic idea of the invention is to reduce the central receive frequency of a bandpass filter of the signal processor as a function of increasing line spacing,” and then proceeds to provide mathematical equations for the calculation of the line spacing. Spec., 3:23–24, 4:23, 5:1.

Neither the claims nor the Specification provide any technological improvements to any of the transducer or signal processing components, instead using generic components, and the claims fail to provide any specific machine for performing the apparatus computational steps. *See* Final Act. 5–6. Thus, unlike in *Enfish*, Appellant has not pointed to a technological improvement in any structure. Rather, as the Examiner found, the claims are directed to a mathematical formulation with general linking of an abstract idea to a particular technological environment. *Id.*

We agree with the Examiner’s determination that the feature that appears to result in the alleged improvement (i.e., lowering the central receive frequency when the spacing is increased) essentially reflects the natural relationship between increasing depth of imaging and without losing image quality. *See* Ans. 12; Final Act. 8. We agree with the Examiner that this type of data processing is abstract, both as a matter of mathematical relationships (between depth of processing and image quality) and data processing itself. Indeed, the claim in *Mayo* sought to optimize the therapeutic efficacy of 6-thioguanine but was still held to be unpatentable subject matter. *Mayo*, 566 U.S. at 71. Appellant’s claim is related to the type of extra-solution activity and routine data processing that does not create patentable subject matter. *See Parker v. Flook*, 437 U.S. 584, 590 (1978); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353–54

(Fed. Cir. 2016) (presenting the results of the collection and analysis without more are patent ineligible abstract concepts).

Appellant asserts that the Examiner provides no citation to a court decision that supports a conclusion that “an apparatus and method for providing an ultrasound three-dimensional image of a volume” is an abstract idea. Appeal Br. 9. However, the Examiner cites *Mayo* for the proposition that appending conventional steps, specified at a high level of generality, to a method already well known in the art is not enough to supply the “inventive concept” needed to transform the abstract idea into a patent-eligible invention. Final Act. 6. Indeed, this result is consistent with *Alice* itself, which finds system claims, even a claim using “a simple mathematical formula” unpatentable because “none of the hardware recited by the system claims ‘offers a meaningful limitation beyond generally linking “the use of the [method] to a particular technological environment,” that is, implementation via computers.’” *Alice*, 134 S. Ct. at 2356, 2360.

Moreover, in *RecogniCorp*, a claim drawn to a method for creating a composite image by analyzing particular facial elements and performing a mathematical operation, a process slightly analogous to the ultrasound imaging at issue here, was found unpatentable because the claims was “directed to the abstract idea of encoding and decoding image data.” *RecogniCorp, LLC v. Nintendo Co., Ltd.*, 855 F.3d 1322, 1326 (Fed. Cir. 2017). The current claims 1 and 11 are drawn to obtaining scan data using conventional devices and analyzing that data to form a three-dimensional image.

This case is also similar to *Digitech Image Technologies, LLC v. Electronics for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014). There, the

claims of the challenged patent were directed to the abstract idea of organizing information through mathematical correlations. *Id.* at 1350–51. *Digitech* explained that the claim at issue “recites a process of taking two data sets and combining them into a single data set” simply by organizing existing data into a new form. *Id.* at 1351. Here, the claim begins by obtaining data from a transducer array, processing that data and then displaying the data as a three-dimensional image. We discern no material difference between the *Alice* step one analysis in *Digitech* and the analysis here.

Alice Step Two

In *Alice* step two, we examine the elements of the claims to determine whether they contain an inventive concept sufficient to transform the claimed naturally occurring phenomena into a patent-eligible application. *Alice*, 134 S. Ct. at 2355 (quoting *Mayo*, 566 U.S. at 71–72). We must consider the elements of the claims both individually and as an ordered combination to determine whether additional elements transform the nature of the claims into a patent-eligible concept. *Ariosa*, 788 F.3d at 1375.

Appellant argues that:

The transducer array, beam former, and bandpass filter in combination with other features recited in claim 1 provide meaningful limitations on the operations of the signal processor such that the claim is not directed to performing mathematical operations on a computer alone. Furthermore, as recited in the combination of claim 1, the transducer array, beam former, and bandpass filter constitute more than generic computer components.

Appeal Br. 11–12.

Appellant thus contends that the components are not conventional or routine and that the Examiner has failed to consider the combination as a

whole. *Id.* However, as already discussed, neither the claims nor the Specification disclose more than generic components, and Appellant has failed to explain why the combination removes the claimed invention, which is directed to a mathematical relationship, Spec. 3:23–24, from the realm of the abstract.

As such, we sustain the Examiner’s rejection under § 101 of claim 1. Claims 2–12, which were not separately argued, fall with claim 1. Appeal Br. 12; 37 C.F.R. § 41.37(c)(1)(iv); *cf. In re Lovin*, 652 F.3d 1349, 1357 (Fed. Cir. 2011) (“[T]he Board [has] reasonably interpreted Rule 41.37 to require more substantive arguments in an appeal brief than a mere recitation of the claim elements and a naked assertion that the corresponding elements were not found in the prior art.”).

DECISION

The Examiner’s decision to reject claims 1–12 under 35 U.S.C. § 103 is reversed.

The Examiner’s decision to reject claims 1–12 under 35 U.S.C. § 101 is affirmed.

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).

AFFIRMED

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte RICHARD ALLEN SNYDER

Appeal 2017-005386
Application 14/350,452
Technology Center 3700

Before JEFFREY N. FREDMAN, JAMES A. WORTH, and
TAWEN CHANG, *Administrative Patent Judges*.

Opinion for the Board filed *per curiam*.

Opinion Concurring-in-part and Dissenting-in-part filed by *Administrative Patent Judge* WORTH.

Administrative Patent Judge WORTH, concurring-in-part and dissenting-in-part.

I conclude that the claimed invention resembles that at issue in *Exergen Corp. v. Kaz USA, Inc.*, Case Nos. 2016-2315, 2016-2341, 2018 WL 1193529, ___ Fed. Appx. ___ (Fed. Cir. Mar. 8, 2018) (non-precedential), which was directed to electronics that measure radiation and provide a body temperature approximation based on detected radiation. In that case, the Court reasoned as follows:

This case is not like either *Mayo* or *Ariosa*, where well-known, existing methods were utilized to determine the existence of a natural phenomenon. In *Mayo*, the claimed method was directed to measuring metabolite levels in the blood (and determining the relationship to toxicity and effectiveness), a

“natural law.” 566 U.S. at 77. The methods of measurement “were well known in the art” and were “well-understood, routine, conventional activity.” *Id.* at 80. Similarly, in *Ariosa* the claimed method was directed to measuring fetal DNA in the mother’s blood, a “naturally occurring phenomenon.” *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1376 (Fed. Cir. 2015), cert denied, 136 S. Ct. 2511 (2016). The measurement method there, too, was “conventional, routine and well understood.” *Id.* at 1378.

This case is different. Here, the patent is directed to the measurement of a natural phenomenon (core body temperature). Even if the concept of such measurement is directed to a natural phenomenon and is abstract at step one, the measurement method here was not conventional, routine, and well-understood.

Exergen, slip op. at 11.

Whether or not it was known that there was a natural relationship between *transmission* frequency and attenuation of signal, as discussed in Sato ¶ 4, the Examiner has not established that the claimed invention is directed to a natural law when it sets forth a way to adjust the central *receive* frequency of a bandpass filter in relation to line spacing. The presence of a mathematical relationship does not itself necessitate a determination that an invention is abstract. *Parker v. Flook*, 437 U.S. 584, 590 (1978). Changing the central receive frequency of the bandpass filter and narrowing the bandwidth represents an engineering choice.

Further, as in *Exergen*, even if the concept were directed to a natural phenomenon and is abstract at step one, the system here was not conventional, routine, and well-understood, when considered as an ordered combination. The claimed invention coordinates the relationship of the components and adjusts the frequency of the bandpass filter. I would determine that the change in the central receive frequency of the bandpass

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filter cannot be removed from its technological environment. My conclusion here is further consistent with Example 26 of the July 2015 USPTO Guidance (Appendix 1: Examples), where the use of a mathematical equation to control a valve was understood to constitute a technological improvement.

As such, I respectfully dissent from the panel's determination that the claims are directed to unpatentable subject matter under 35 U.S.C. § 101. I concur, however, with the panel's determination with respect to the rejection under 35 U.S.C. § 103.