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Nicolas E. Seckel
Westerman, Hattori, Daniels & Adrian LLP
1250 Connecticut Avenue, NW Suite 850
Washington, DC 20036

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WISE, OLIVIA M.	

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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 GRÉGORY STRUBEL, MAUD ARSAC, DENIS DESSEREE, and PIERRE-JEAN COTTE-PATTAT[1]

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Appeal 2018-007932
Application 14/361,794
Technology Center 1600

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Before ERIC B. GRIMES, JEFFREY N. FREDMAN, and ULRIKE W. JENKS, *Administrative Patent Judges*.

Opinion for the Board filed by *Administrative Patent Judge* GRIMES.

Opinion Concurring filed by *Administrative Patent Judge* FREDMAN.

GRIMES, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 involving claims relating to a method of identifying a microorganism in a sample, which have been rejected as being directed to patent-ineligible subject matter. We have jurisdiction under 35 U.S.C. § 6(b). We REVERSE.

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[1] Appellant identifies the Real Party in Interest as BIOMERIEUX, Inc. Appeal Br. 4.

STATEMENT OF THE CASE

"It is known to use mass spectrometry to identify microorganisms." Spec. ¶ 2. "[I]ts implementation is however delicate. Indeed, first, the quantity of information contained in a mass spectrum, and particularly the number of peaks, is very large, which requires very powerful calculation tools." *Id.* ¶ 3. "There then is a high measurement uncertainty, particularly as concerns the location of []peaks in the spectrum. . . . Finally, this uncertainty is not constant over the range of mass-to-charge ratios and increases as this ratio increases." *Id.* ¶ 4.

"The invention aims at providing a method enabling to robustly identify microorganisms by mass spectrometry due to a decrease in the mass of information to be analyzed and a decrease in the impact of the lack of accuracy as to the location of mass spectrum peaks." *Id.* ¶ 5.

Claims 1–14 are on appeal. Claim 1 is illustrative and reads as follows:

1. A method of providing an identification decision for a microorganism by mass spectrometry using a mass spectrometer connected to a processor-based calculation unit, comprising:

(i) acquiring at least one mass spectrum of a sample of the microorganism over a predetermined range of mass-to-charge ratios, said mass spectrum being generated by the mass spectrometer;

(ii) for each of said acquired at least one mass spectrum:

(a) detecting, using the processor of the calculation unit, peaks of the mass spectrum in the predetermined range of mass-to-charge ratios;

(b) generating, using the processor of the calculation unit, a list of peaks in intervals of a predetermined subdivision of the predetermined range of mass-to-charge ratios, the width of the

intervals of the subdivision increasing along with the mass-to-charge ratio according to relations:

$$L(b) = \exp\left(\frac{b-\beta}{\alpha}\right) \times \left(\exp\left(\frac{1}{\alpha}\right) - 1\right)$$

$$\alpha = \frac{b_{\min} - (b_{\max} + 1)}{\ln m_{\min} - \ln m_{\max}}$$

$$\beta = \frac{(b_{\max} + 1) \times \ln m_{\min} - b_{\min} \times \ln m_{\max}}{\ln m_{\min} - \ln m_{\max}}$$

where

the subdivision intervals are referenced with integers greater than 1, from integer $b_{\min}$, for the lowest mass-to-charge ratios in the predetermined range of mass-to-charge ratios, to integer $b_{\max}$, for the higher mass-to-charge ratios in the predetermined range of mass-to-charge ratios,

$L(b)$ is the width of the interval referenced with integer b,

$m_{\min}$ is a lower bound of the predetermined range of mass-to-charge ratios, and

$m_{\max}$ is an upper bound of the predetermined range of mass-to-charge ratios,

wherein, in the list of peaks, the processor of the calculation unit identifies at most one peak in each interval, so as to obtain a vector for each of said at least one mass spectrum,

wherein the vector(s) for the at least one mass spectrum form a matrix representative of the microorganism, which is stored in a memory of the calculation unit,

wherein the matrix is stored in the form of a binarized matrix that identifies for each of the at least one mass spectrum the presence or absence of a peak in the intervals; and

(iii) providing an identification decision for the microorganism to be identified by comparing the representative matrix stored in the memory of the calculation unit with a knowledge base of binarized matrices representative of previously-identified microorganisms and/or types of

microorganisms, said knowledge base being also stored in the memory of the calculation unit.

Claim 7 is the other independent claim and is directed to a device comprising a processor-based calculation unit with instructions that implement the method of claim 1.

DISCUSSION

The Examiner has rejected claims 1–14 under 35 U.S.C. § 101 on the basis that they "recite the judicial exceptions that are the abstract ideas of mathematical manipulation/calculation and comparison of data. Thus, the claims are directed to at least one judicial exception." Final Action 3. The Examiner finds that the "claims . . . recite additional elements that equate to well-understood, routine and conventional activities, generic post-solution activity and mere instructions to implement abstract ideas on a computer with generic computer components and function." *Id*. Specifically, acquiring a "mass spectrum of a microorganism with a mass spectrometer . . . was conventional," "providing an identification decision . . . equate[s] to conventional computer output functions," and "the data analysis steps . . . equate[] to mere instructions to implement the abstract idea on a generic computer." *Id*. at 3–4. The Examiner concludes that "the claims do not amount to significantly more than the judicial exception itself." *Id*. at 4.

Appellant argues that the claimed invention "uses algorithms and rules to provide a technological solution to a technological problem . . . the automated identification decision about the unknown microorganism." Appeal Br. 10. Appellant also argues that the claimed process "results in a technological product – the identification decision – which remains accurate and reliable, while the decisional process has been improved to require

significantly less processing resources." *Id*. at 13. Appellant also argues that the "invention does not simply reformat information, but transforms it non-conventionally by drastically reducing the number of peaks and the overall data being processed, which produces an automated prediction in a manner totally opposite the conventional paradigm that 'the more information the better.'" *Id*. at 15.

An invention is patent-eligible if it claims a "new and useful process, machine, manufacture, or composition of matter." 35 U.S.C. § 101. However, the Supreme Court has concluded that "[l]aws of nature, natural phenomena, and abstract ideas" are not patentable under 35 U.S.C. § 101. *See, e.g.*, *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 216 (2014).

To determine if a claim falls into an excluded category, we apply a two-step framework, described in *Mayo* and *Alice*. *Id.* at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). We first determine what the claim is "directed to." *See Alice*, 573 U.S. at 219 ("On their face, the claims before us are drawn to the concept of intermediated settlement, *i.e.*, the use of a third party to mitigate settlement risk."); *see also Bilski v. Kappos*, 561 U.S. 593, 611 (2010) ("Claims 1 and 4 in petitioners' application explain the basic concept of hedging.").

Patent-ineligible abstract ideas include certain methods of organizing human activity, such as fundamental economic practices (*Alice*, 573 U.S. at 219–20; *Bilski*, 561 U.S. at 611), mathematical formulas (*Parker v. Flook*, 437 U.S. 584, 594–95 (1978)), and mental processes (*Gottschalk v. Benson*, 409 U.S. 63, 69 (1972)). In contrast, patent-eligible inventions include physical and chemical processes, such as "molding rubber products"

(*Diamond v. Diehr*, 450 U.S. 175, 192 (1981)); "tanning, dyeing, making water-proof cloth, vulcanizing India rubber, smelting ores" (*id.* at 182 n.7 (quoting *Corning v. Burden*, 56 U.S. 252, 267–68 (1854))); and manufacturing flour (*Benson*, 409 U.S. at 69 (citing *Cochrane v. Deener*, 94 U.S. 780, 785 (1876))).

In *Diehr*, the claimed method employed a mathematical formula, but the Supreme Court held that "[a] claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula." *Diehr*, 450 U.S. at 176; *see also id.* at 192 ("We view respondents' claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula."). The Supreme Court noted, however, that a claim "seeking patent protection for that formula in the abstract . . . is not accorded the protection of our patent laws, . . . and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment." *Id.* (citing *Benson* and *Flook*); *see, e.g.*, *id*. at 187 ("It is now commonplace that an *application* of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection.").

If the claim is "directed to" an abstract idea, we turn to the second step of the *Alice* and *Mayo* framework, and "examine the elements of the claim to determine whether it contains an 'inventive concept' sufficient to 'transform' the claimed abstract idea into a patent-eligible application." *Alice*, 573 U.S. at 221 (quotation marks omitted). "A claim that recites an abstract idea must include 'additional features' to ensure 'that the [claim] is more than a drafting effort designed to monopolize the [abstract idea].'" *Id.*

(quoting *Mayo*, 566 U.S. at 77 (alterations in original)). "[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention." *Id.*

The PTO recently published revised guidance on the application of § 101. *2019 Revised Patent Subject Matter Eligibility Guidance*, 84 Fed. Reg. 50 (January 7, 2019) ("Revised Guidance"). Under that guidance, we first determine 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)).

See 84 Fed. Reg. at 54–55. Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then determine whether the claim:

> (3) adds a specific limitation beyond the judicial exception that is not a "well-understood, routine, conventional activity" 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 84 Fed. Reg. at 56.

Revised Guidance Step 2(A), Prong 1

Following the Revised Guidance, we first consider whether the claims recite a judicial exception. Claim 1 recites, among other elements, the

relations:

$$L(b) = \exp\left(\frac{b-\beta}{\alpha}\right) \times \left(\exp\left(\frac{1}{\alpha}\right) - 1\right)$$

$$\alpha = \frac{b_{\min} - (b_{\max} + 1)}{\ln m_{\min} - \ln m_{\max}}$$

$$\beta = \frac{(b_{\max} + 1) \times \ln m_{\min} - b_{\min} \times \ln m_{\max}}{\ln m_{\min} - \ln m_{\max}}$$

where

the subdivision intervals are referenced with integers greater than 1, from integer $b_{\min}$, for the lowest mass-to-charge ratios in the predetermined range of mass-to-charge ratios, to integer $b_{\max}$, for the higher mass-to-charge ratios in the predetermined range of mass-to-charge ratios,

$L(b)$ is the width of the interval referenced with integer b,

$m_{\min}$ is a lower bound of the predetermined range of mass-to-charge ratios, and

$m_{\max}$ is an upper bound of the predetermined range of mass-to-charge ratios.

Claim 1.

The recited relations are "mathematical relationships, mathematical formulas or equations." 84 Fed. Reg. at 52. Thus, we agree with the Examiner that claim 1 recites "the abstract ideas of mathematical manipulation/calculation." Final Action 3.

Revised Guidance Step 2(A), Prong 2

Although claim 1 recites an abstract idea, it is still patent-eligible if "the claim as a whole integrates the recited judicial exception into a practical application of the exception"; i.e., whether the claim "appl[ies], rel[ies] on, or use[s] the judicial exception in a manner that imposes a meaningful limit on the judicial exception." 84 Fed. Reg. at 54. This analysis includes "[i]dentifying whether there are any additional elements recited in the claim beyond the judicial exception(s)" and "evaluating those additional elements individually and in combination to determine whether they integrate the exception into a practical application." *Id.* at 54–55.

Among the "exemplary considerations [that] are indicative that an additional element (or combination of elements) may have integrated the exception into a practical application" is when "[a]n additional element reflects . . . an improvement to other technology or technical field." *Id*. at 55 (footnotes omitted).

Here, we agree with Appellant that claim 1 "provide[s] a technological solution to a technological problem," Appeal Br. 10, and therefore integrates the recited abstract idea into a practical application. In addition to the judicial exception, claim 1 recites "acquiring at least one mass spectrum of a sample of [a] microorganism . . . by [a] mass spectrometer" and "providing an identification decision for the microorganism to be identified by comparing . . . with a knowledge base . . . of previously-identified microorganisms." Claim 1.

The Specification states that mass spectrometry data has been used to identify microorganisms, based on detecting peaks, analyzing the list of

peaks, and comparing the peaks with data in a knowledge base of known microorganisms. Spec. ¶ 2. The Specification states, however, that implementing this process is "delicate," because "the quantity of information contained in a mass spectrum, and particularly the number of peaks, is very large, which requires very powerful calculation tools." *Id*. ¶ 3. The Specification also states that the location of peaks in the spectrum is subject to high measurement uncertainty, which increases as the mass-to-charge ratio increases. *Id*. ¶ 4.

The Specification discloses a solution to these problems: "generating a list of peaks identifying at most *one peak in each interval* of a predetermined subdivision of the range of mass-to-charge ratios, *the width of the intervals* of the subdivision *increasing along with the mass-to-charge ratio* according to" the mathematical relations recited in claim 1. *Id*. ¶ 6 (emphasis added). As the Specification explains:

> [T]he continuous space of mass-to-charge ratios . . . is logarithmically quantized, and a single peak is retained in each quantization interval if several peaks are present in this interval. This enables to substantially decrease the amount of data to be processed. Further, the accurate position of a peak is replaced with the reference of the interval to which the peak belongs. This decreases the measurement uncertainty relative to the position of peaks since it is no longer needed to compare an accurate position with the knowledge base. It is rather determined whether the peak belongs to an interval.

Id. ¶ 7.

The Specification states:

> The quantization according to the invention particularly enables to *decrease the amount of data*, as well as to *eliminate problems of peak location accuracy*, and thus enables to construct a more robust knowledge base, and this, in a simpler

> way. The implementation is much simpler than the calculation of a tolerant distance (for example) and allows an almost fully automated building of the knowledge base.

Id. ¶ 30 (emphasis added).

Thus, the mathematical relations that are recited in claim 1 reduce the amount of data (i.e., the number of peaks) that must be analyzed and compared to a database of known samples, and also reduce the uncertainty in the position of the peaks in a mass spectrum. The claimed method and device therefore improve the technology or technical field of identifying microorganisms using mass spectrometry, by addressing the known problems of the large quantity of information that must be analyzed and the high measurement uncertainty regarding the location of peaks. *See* Spec. ¶¶ 3–4.

The Examiner notes Appellant's argument regarding "the improvement to technology realized by the instant claims." Ans. 3. The Examiner points out that the Specification's example of error rates with intervals determined using the claimed method (logarithmic quantization), compared to the prior art (constant quantization),

> indicates that the difference in error rate between the logarithmic and constant binning procedures is at most 2.5% at lower interval levels. In addition, the table does not present any indication of the standard deviation in these error rate percentages for the different binning techniques. Without further information on the standard deviation of these error rates, the presented data does not clearly present a *significant* improvement as a difference of 2.5% can reasonabl[y] fall within the standard deviation of the obtained values. Therefore, Applicant's evidence does not support the finding of an improvement to technology in the form of reduced memory and

> processing capabilities while maintaining accuracy and reliability.

Ans. 4. *See also id*. at 8–9, 15–16 (same).

The Examiner's analysis appears to be based on the results achieved with 600 intervals: The Specification reports an error rate of 6.25% for logarithmic binning, versus 8.75% for constant binning. Spec. ¶ 32. The same table shows, however, that the lowest error rate achieved using logarithmic binning was 5.0% (at 1300 intervals), versus 5.9% using constant binning (at 1700 intervals). *See id*. In that context, an absolute difference of 2.5% (6.25% compared to 8.75%) would seem to be significant but, in any event, the Specification states that the claimed method also allows less memory usage: "[F]or a same error rate, for example, approximately 6%, the quantization according to the invention only requires 700 intervals [occupied memory space ≈ 280] while the constant quantization requires 1,700 [occupied memory space = 680]." Spec. ¶ 35; *see also id*. ¶ 32.

In summary, the Specification states that the claimed method is an improvement in the process of identifying microorganisms based on mass spectrometry data. Spec. ¶¶ 5, 7, 30, 35. The Examiner has the burden of showing that the Specification's description is inaccurate. *See In re Marzocchi*, 439 F.2d 220, 224 (CCPA 1971) (It is incumbent on the Patent Office to back up assertions of a specification's inaccuracy "with acceptable evidence or reasoning which is inconsistent with the contested statement.") The Examiner has not cited any evidence to show that the claimed method would not be recognized as an improvement over prior art methods.

"[P]atentability is determined on the totality of the record, by a preponderance of evidence with due consideration to persuasiveness of argument." *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). We conclude, based on a preponderance of the evidence, that the claims integrate the recited mathematical relations into a practical application, and are not directed to a judicial exception to patent-eligible subject matter under 35 U.S.C. § 101.

CONCLUSION

In summary:

Claims Rejected	Basis	Affirmed	Reversed
1–14	§ 101		1–14

REVERSED

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte GRÉGORY STRUBEL, MAUD ARSAC, DENIS DESSEREE, and PIERRE-JEAN COTTE-PATTAT

Appeal 2018-007932
Application 14/361,794
Technology Center 1600

Before ERIC B. GRIMES, JEFFREY N. FREDMAN, and ULRIKE W. JENKS, *Administrative Patent Judges*.

FREDMAN, *Administrative Patent Judge*, Concurring.

I concur with the Majority's findings but I write this short separate concurrence to explain the distinction between the instant case and Appeal 2018-007935 in which I am dissenting. In Appeal 2018-007935, I disagreed with the Majority's reasoning under Guidance Step 2A, Prong 2 that the claims integrated the recited mathematical relationship into a practical application.

In the instant case, I agree that the mathematical relationship is integrated into the claims because the use of the mathematical relationship allows the user "to substantially decrease the amount of data to be processed. Further, the accurate position of a peak is replaced with the reference of the interval to which the peak belongs. This decreases the measurement

uncertainty relative to the position of peaks since it is no longer needed to compare an accurate position with the knowledge base" (Spec. ¶ 7). As Appellant explains in the Appeal Brief, "the mathematical operations are embedded in the method to modify the functionality of a specific, concrete technology (identification device) so as to improve the technical operation of the device" (App. Br. 21).

In *Enfish*, claims to a specific improved database process were found patent eligible, in part because the claims demonstrated "benefits over conventional databases, such as increased flexibility, faster search times, and smaller memory requirements." *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1337 (Fed. Cir. 2016). The same reasoning applies to the instant claims that improve the speed of processing by reducing the amount of data that must be processed (*see* Spec. ¶ 7). Similar to *Enfish*, the mathematical algorithm in "the claims on appeal is a specific type of data structure designed to improve the way a computer stores and retrieves data in memory." *Enfish*, 822 F.3d at 1339.

For these reasons, I concur with the Majority that these claims recite patent-eligible subject matter under 35 U.S.C. § 101.