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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte LAURA L. AUME, THEODORE J. RONNINGEN, STEVE RUST, and JENNIFER L. WIGHTMAN

Appeal 2018-008445
Application 13/596,374
Technology Center 2800

Before GRACE KARAFFA OBERMANN, DONNA M. PRAISS, and JANE E. INGLESE, *Administrative Patent Judges*.

INGLESE, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants[1] request our review under 35 U.S.C. § 134(a) of the Examiner's decision to finally reject claims 1–5, 7–15, 17, and 21–23[2]. We have jurisdiction over this appeal under 35 U.S.C. § 6(b).

We AFFIRM.

STATEMENT OF THE CASE

Appellants claim a computer-implemented method of locating and removing spike noise from spectral data (independent claim 1), a method of

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[1] Appellants identify Battelle Memorial Institute as the real party in interest. Appeal Brief filed March 19, 2018 ("App. Br."), 1.

[2] Final Office Action entered October 20, 2017 ("Final Act.").

locating and removing noise spikes from spectral data (independent claim 15), and a system for spectral analysis of data (independent claim 22). Claim 1 illustrates the subject matter on appeal and is reproduced below with contested language italicized:

> 1. A computer-implemented method of locating and removing spike noise from spectral data comprising:
>
> collecting, by a spectrometer of an imaging system, a plurality of replicates of spectral data, wherein:
>
> each collected replicate comprises a plurality of pixels read from a charge coupled device of the spectrometer, each pixel having an associated intensity value; and
>
> the plurality of replicates represents discrete instances of spectral data obtained sequentially, from a sample under interrogation;
>
> communicating the plurality of replicates of spectral data to a processing device;
>
> performing, by a processor of the processing device, replicate processing to condition the intensity values of the collected replicates by compensating pixel intensity values in at least a subset of the plurality of pixels of a corresponding one of the plurality of replicates, that are invalid for subsequent pixel processing and spike noise filtering;
>
> performing, by the processor of the processing device, pixel processing to identify outliers corresponding to noise spikes within the plurality of replicates by collectively evaluating the conditioned intensity values of the plurality of replicates as a function of pixel position by:
>
> computing for each pixel, a residual for each replicate; and
>
> identifying whether an outlier exists for each pixel by:
>
> identifying the replicate having the maximum residual value for each pixel location; and
>
> declaring the pixel location for the replicate having the maximum residual value at each pixel

location an outlier if the value of that maximum residual is greater than a predetermined threshold;

wherein performing pixel processing further includes transforming the replicates by adjusting the intensity values of the plurality of replicates based upon a predetermined function;

performing, by the processor of the processing device, spike noise filtering by removing each identified outlier from its replicate and by replacing the removed outlier value with a computed approximation of an intensity value based on intensity values of other replicates of the plurality of replicates for the pixel of the replicate associated with the outlier at that removed outlier pixel position;

consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum; and

performing spectral analysis on the consolidated spectrum.

App Br. 39–40 (Claims Appendix) (emphasis added).

The Examiner maintains the following rejections in the Examiner's Answer entered June 21, 2018 ("Ans."):

I. Claims 1–5, 7–15, 17, and 21–23 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement; and

II. Claims 1–5, 7–15, 17, and 21–23 under 35 U.S.C. § 101 as directed to subject matter judicially excepted from patenting without significantly more.

DISCUSSION

Upon consideration of the evidence relied upon in this appeal and each of Appellants' timely contentions,[3] we affirm the Examiner's rejection

[3] We do not consider any new argument Appellants raise in the Reply Brief that Appellants could have raised in the Appeal Brief. 37 C.F.R. § 41.37(c)(1)(iv); 37 C.F.R. § 41.41(b)(2) (arguments raised for the first

of claims 1–5, 7–14, and 21–23 under 35 U.S.C. § 112, first paragraph, and rejection of claims 1–5, 7–15, 17, and 21–23 under 35 U.S.C. § 101, for reasons set forth in the Final Action, the Answer, and below. We reverse the Examiner's rejection of claims 15 and 17 under 35 U.S.C. § 112, first paragraph, for reasons set forth in the Appeal Brief and below.

We review appealed rejections for reversible error based on the arguments and evidence Appellants provide for each ground of rejection Appellants contest. 37 C.F.R. § 41.37(c)(1)(iv); *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) (cited with approval in *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011) (Explaining that even if the Examiner had failed to make a prima facie case, "it has long been the Board's practice to require an applicant to identify the alleged error in the examiner's rejections.")).

Rejection I

Claims 1–5, 7–15, 17, and 21–23: "spectral analysis"

The Examiner finds that Appellants' Specification does not provide written description support for "performing spectral analysis on the consolidated spectrum" as recited in independent claim 1, "performing spectral analysis on the single spectrum that is free of cosmic noise spikes" as recited in independent claim 15, and "performing spectral analysis on the consolidated set of spectral data" as recited in independent claim 22. Final Act. 8–9. The Examiner finds that the Specification discloses that cosmic spikes can interfere with analysis, and removing cosmic spike noise renders a filtered spectrum suitable for implementing spectral analysis, but "does not

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time in the Reply Brief that could have been raised in the Appeal Brief will not be considered by the Board unless good cause is shown).

teach actually performing that spectral analysis." Final Act. 8. The Examiner finds that "analysis" is a broad term, and "simply teaching to perform analysis without any guidelines does not adequately convey what steps are to be performed to a person of ordinary skill." *Id.* The Examiner finds that because the claims are "computer implemented," the disclosure is insufficient because "the step of 'performing spectral analysis' does not have any associated algorithm in the specification." *Id.*

Appellants argue that the Specification provides written description support for "performing spectral analysis" on a consolidated spectrum, a single spectrum free of cosmic noise spikes, and a consolidated set of spectral data, obtained as recited in independent claims 1, 15, and 22, respectively, in view of the following disclosures in the Specification. App. Br. 15–20; Reply Br. 2–6.

The Background section of the Specification explains that "various spectroscopic methods, including Raman spectroscopy, can be advantageously employed in the practical identification of particulates." Spec. ¶ 3. In dispersive Raman spectroscopy, as the Background further explains, a laser is used as an excitation source to focus light onto a particle, and the light interacts with chemical bonds of the particle to produce Raman lines having a wavelength shifted relative to that of the wavelength of the excitation laser light. *Id.* After filtering light from the sample area of the particle to block the excitation wavelength, and using a grating to disperse the filtered light, the Specification explains that the dispersed, filtered light travels to an optical detector, such as a charge coupled device camera (CCD), which captures spectral data representative of the Raman spectrum of the particle. Spec. ¶ 3–4. The Specification indicates that "data captured

by the CCD can be utilized as a signature, which is typically compared to a library of previously determined signatures to identify the material excited by the laser." Spec. ¶ 4.

The Detailed Description section of the Specification discloses that "detection of biological and chemical materials can be accomplished according to various aspects of the present invention, using an imaging system 10," as shown in Figure 1. Spec. ¶ 32. Figure 1 illustrates "a system for collecting and filtering spectral data for subsequent analysis of the filtered spectral data." Spec. ¶ 8. As Appellants argue, one of ordinary skill in the art would recognize from these disclosures that Appellants' invention involves using an imaging system to collect spectral data from a sample, filtering the spectral data (as discussed below), and, as described in the Background section of the Specification, identifying biological and chemical materials by comparing the filtered data to spectral data of known materials—or performing "spectral analysis." App. Br. 15. One of ordinary skill in the art would thus understand that performing spectral analysis is implicit in the detection of biological and chemical materials using spectral data obtained from an imaging system, as Appellants further argue. App. Br. 15–16.

Appellants also point to the Specification's disclosure that cosmic spike noise can distort spectral data, and can therefore interfere with spectral analysis and classification. App. Br. 16–17 (citing Spec. ¶¶ 41, 42, 67). The Specification describes locating and eliminating such spike noise according to Appellants' invention, which the Specification indicates "render[s] the filtered spectrum suitable for implementing spectral analysis." Spec. ¶ 68. As Appellants argue, "[b]ecause the Appellant's system is purposefully for

the detection of biological and chemical materials, one of skill in the art will readily understand that if a biological sample is collected and interrogated (e.g., using the imaging system 10 of FIG. 1), then the spectrum collected from the collection and interrogation is analyzed." App. Br. 17.

"[T]he test for sufficiency [of the written description] is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). "[H]ow the specification accomplishes this is not material." *In re Herschler*, 591 F.2d 693, 700–01 (CCPA 1979) (internal citations omitted) ("The claimed subject matter need not be described in *haec verba* to satisfy the description requirement. It is not necessary that the application describe the claim limitations exactly, but only so clearly that one having ordinary skill in the pertinent art would recognize from the disclosure that appellants invented processes including those limitations.")

What is conventional or well known to one of ordinary skill in the art need not be disclosed in detail. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384 (Fed. Cir. 1986); *see also Capon v. Eshhar*, 418 F.3d 1349, 1358 (Fed. Cir. 2005) ("The 'written description' requirement must be applied in the context of the particular invention and the state of the knowledge. . . . As each field evolves, the balance also evolves between what is known and what is added by each inventive contribution.").

As discussed above, the Specification explains that spectroscopic methods, such as Raman spectroscopy, are well-known methods used in the art to identify—or classify—a given material by comparing spectral data obtained from the material to that of known materials. Such "spectral

analysis" for the "detection of biological and chemical materials" thus constitutes a well-known and conventional technique in the art. Accordingly, "spectral analysis" as applied to a consolidated spectrum, a single spectrum free of cosmic noise spikes, and a consolidated set of spectral data produced as recited in claims 1, 15, and 22, need not be described in detail in the Specification to satisfy the written description requirement. Consequently, contrary to the Examiner's assertion, the Specification need not disclose the details of "performing spectral analysis" in order to provide written description support for this phrase as it is used in claims 1, 15, and 22. *Hybritech,* 802 F. 2d at 1384.

Furthermore, although the Examiner finds that "analysis" is a broad term, and "simply teaching to perform analysis without any guidelines does not adequately convey what steps are to be performed to a person of ordinary skill," claims 1, 15, and 22 do not recite "analysis" in isolation as the Examiner implies. Rather, claims 1, 15, and 22 recite "performing spectral analysis" on a consolidated spectrum, a single spectrum free of cosmic noise spikes, and a consolidated set of spectral data, produced according to the numerous steps recited in the claims. When one of ordinary skill in the art considers "performing spectral analysis" in the context in which this phrase occurs in the independent claims, in view of the description provided in the Specification as a whole, including the disclosures discussed above, and in light of the knowledge and understanding of one of ordinary skill in the art at the time of filing, the ordinarily skilled artisan would recognize that Appellants were in possession of "performing spectral analysis" on a consolidated spectrum, a single

spectrum free of cosmic noise spikes, and a consolidated set of spectral data, obtained as described in the Specification and recited claims 1, 15, and 22.

Furthermore, although the Examiner asserts that because the claims are "computer implemented," the disclosure is insufficient because "the step of 'performing spectral analysis' does not have any associated algorithm in the specification," as discussed above, the details of a known, conventional technique—including any associated algorithm—need not be provided in the Specification to satisfy the written description requirement. *Hybritech,* 802 F. 2d at 1384.

We accordingly do not sustain the Examiner's rejection of independent claims 1, 15, and 22, and also claims 2–5, 7–15, 17, and 21, which each depend from either claim 1, 15, or 22, for lack of written description support for "spectral analysis."

Claim 23: "classification"

Claim 23 depends from claim 22 and recites performing "classification of the consolidated spectrum." The Examiner finds that this step is "not supported by the written description, which only teaches that cosmic spikes can interfere with classification." Final Act. 9.

As discussed above for claims 1, 15, and 22, however, the Specification explains that spectroscopy is a well-known method used in the art to identify—or classify—a given material by comparing spectral data obtained from the material to that of known materials. Such "classification" for the detection of biological and chemical materials thus constitutes a well-known and conventional technique in the art. Consequently, "classification" of a consolidated spectrum need not be described in detail in the

Specification to satisfy the written description requirement. *Hybritech,* 802 F. 2d at 1384.

We accordingly do not sustain the Examiner's rejection of claim 23 for lack of written description support for "classification of the consolidated spectrum."

Claims 1–5, 7–14, and 21–23: "consolidating"

Appellants present arguments for claim 1, and assert that the arguments "show support in the specification" for the subject matter at issue in the remaining claims. App. Br. 15–21. We accordingly select claim 1 as representative, and decide the appeal as to claims 1–5, 7–14, and 21–23 based on claim 1 alone. 37 C.F.R. § 41.37(c)(1)(iv).

Claim 1 recites "consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum."

The Specification describes two embodiments of Appellants' invention, referred to as "*Two-Replicate* Cosmic Spike Filter for Raman Spectra," ("the first embodiment") and "Cosmic Spike Filter Based Upon *Multiple Replicate* Spectra" ("the second embodiment"). *Compare* Spec. ¶¶ 43–96, *with* Spec. ¶¶ 97–130 (emphasis added). The Examiner finds that the Specification only describes "consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum" in connection with the first embodiment (the two-replicate cosmic spike filter embodiment). Final Act. 8. The Examiner finds that although claim 1 is drawn to the second embodiment (the cosmic spike filter based upon multiple replicate spectra embodiment), the claim nonetheless recites "consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum." *Id.* The Examiner finds that the

Specification, therefore, does not provide written description support for the "consolidating" element of claim 1. *Id.*

Appellants argue that "the second embodiment provides support for the claim element at issue," and Appellants quote paragraph 128 of the Specification to support this argument. App. Br. 18 (citing Spec. ¶ 128). Appellants also argue that "FIG. 20 shows that the data is averaged to derive a final, consolidated spectrum." App. Br. 18–19 (citing Fig. 2).

Appellants' arguments are unpersuasive of reversible error in the Examiner's rejection, however, for reasons that follow.

In the context of describing the first embodiment of Appellants' invention—two-replicate cosmic spike filter for Raman spectra—the Specification indicates that after filtering (or removing) cosmic spikes from two replicates, "the two resultant locally re-smoothed replicates are summed, combined or otherwise merged to yield a single spectrum that is free of cosmic spikes." Spec. ¶¶ 43, 53. The Specification, again in the context of describing two-replicate cosmic spike filtering, refers to this process as "consolidating" the two replicates "to yield a single set of spectral data that is free from cosmic spikes." Spec. ¶ 82.

In the context of describing the second embodiment—cosmic spike filter based upon multiple replicate spectra—the Specification describes acquiring "clean" spectral data free of noise spikes for an array of six pixels "read out eight times in sequence to derive Replicate 1 through Replicate 8 for each pixel." Spec. ¶ 98. The Specification describes averaging the signal values for the eight replicates at each of the six pixels to obtain an average signal value for each pixel, and plotting the averaged signal values against the pixel numbers, as illustrated in Figure 15. Spec. ¶ 99. The

Specification further describes obtaining "noisy" spectral data for six pixels acquired for eight replicates, and locating and removing noise spikes from the spectra to obtain filtered and processed signal values for the six pixels of each replicate. Spec. ¶¶ 104–126; Figs. 16–18. The disclosure identified by Appellants describes averaging the filtered and processed signal values for each pixel, and plotting the averaged values against the pixel numbers, as illustrated in Figure 20. Spec. ¶ 128. The Specification indicates that Figure 20 demonstrates that after processing the "noisy" spectral data, the average signal values for each pixel correspond closely with the average signal values of the ideal "clean" signal represented in Figure 15 (discussed above). *Id.*

Thus, in a first embodiment, the Specification describes "consolidating" two filtered replicates into a single spectrum by summing, combining, or otherwise merging the two filtered replicates, while in a separate, second embodiment, the Specification describes averaging the signal values of eight replicates of six pixels to obtain an average signal value for each pixel. "Consolidating" two filtered replicates as described in the Specification into a single spectrum by summing, combining, or otherwise merging the two filtered replicates appears to differ from averaging the signal values of eight replicates of six pixels. We find no description in the Specification indicating that this pixel signal averaging process is the same as, similar to, or encompassed by, "consolidating" two replicates into a single spectrum as described in the Specification. Appellants' conclusory arguments do not identify any such disclosure in the Specification, or explain why one of ordinary skill in the art would consider these two processes to be analogous, such that describing one process would

provide written description support for the other process. Consequently, because "consolidating" is only described in the Specification in connection with two-replicate cosmic spike filtering (the first embodiment), and because claim 1 is drawn to cosmic spike filtering based on multiple replicate spectra (the second embodiment), Appellants' arguments are unpersuasive of reversible error in the Examiner's finding that the Specification does not provide written description support for "consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum" as recited in claim 1.

We accordingly sustain the Examiner's rejection of claims 1–5, 7–14, and 21–23 under 35 U.S.C. § 112, first paragraph for lack of written description support for "consolidating" a plurality of replicates into a consolidated spectrum. We note that claims 15 and 17 relate to two-replicate cosmic spike filtering (the first embodiment), and, therefore, do not stand rejected for lack of written description support for "consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum." Final Act. 8–9.

In summary, we do not sustain the Examiner's rejection of claims 1–5, 7–15, 17, and 21–23 for lack of written description support for "spectral analysis" and rejection of claim 23 for lack of written description support for "classification of the consolidated spectrum." We sustain the Examiner's rejection of claims 1–5, 7–14, and 21–23 for failing to provide written description support for "consolidating, after performing the spike noise filtering, the plurality of replicates into a consolidated spectrum." We thus affirm the rejection of claims 1–5, 7–14, and 21–23 under 35 U.S.C. § 112,

first paragraph, and reverse the rejection of claims 15 and 17 under 35 U.S.C. § 112, first paragraph.

Rejection II

We next turn to the Examiner's rejection of claims 1–5, 7–15, 17, and 21–23 under 35 U.S.C. § 101 as directed to subject matter judicially excepted from patenting without significantly more. Final Act. 9.

Although Appellants present separate arguments for claims 1, 15, and 22, Appellants' arguments for claims 15 and 22 are not substantively distinct from the arguments Appellants provide for claim 1. *Compare* App. Br. 21–31, 35–37, *with* App. Br. 31–35. We accordingly select claim 1 as representative, and decide the appeal as to claims 1–5, 7–15, 17, and 21–23 based on claim 1 alone. 37 C.F.R. § 41.37(c)(1)(iv).

35 U.S.C. § 101 states that "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof may obtain a patent therefor, subject to the conditions and requirements of this title." This section of the statute, however, must be read within the confines of the U.S. Constitution, which states that Congress's power is limited to laws that "promote the Progress of . . . useful Arts." U.S. Const. art. I, § 8, cl. 8. According to the Supreme Court, "[p]henomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work." *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 70–72 (2012) (quoting *Diamond v. Diehr,* 450 U.S. 175, 185 (1981) (quoting *Gottschalk v. Benson,* 409 U.S. 63, 67 (1972)). "And monopolization of those tools through the grant of a

patent might tend to impede innovation more than it would tend to promote it." *Id.*

As stated in *Alice*:

> Accordingly, in applying the § 101 exception, we must distinguish between patents that claim the building blocks of human ingenuity and those that integrate the building blocks into something more, thereby transforming them into a patent-eligible invention. The former would risk disproportionately tying up the use of the underlying ideas and are therefore ineligible for patent protection. The latter pose no comparable risk of pre-emption, and therefore remain eligible for the monopoly granted under our patent laws.

Alice, 573 U.S. at 217 (internal quotations and citations to *Mayo* omitted). In *Alice*, the Court extended a framework that had been used in *Mayo* for distinguishing claims pre-empting laws of nature, natural phenomena, and abstract ideas from claims amounting to patent-eligible applications of those concepts. As stated in *Alice*:

> First, we determine whether the claims at issue are directed to one of those patent-ineligible concepts. If so, we then ask, what else is there in the claims before us? To answer that question, 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. We have described step two of this analysis 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.

Alice, 573 U.S. at 217–18 (internal quotations and citations omitted).

In 2014, the Office provided Interim Guidance on Patent Subject Matter Eligibility (79 Fed. Reg. 74618 (Dec. 15, 2014)), which added a first step of determining whether the claim is directed to one of the statutory

classes of invention (process, machine, manufacture or composition of matter) enunciated in § 101. The Examiner applies the 2014 Interim Guidance in rejecting claim 1 under 35 U.S.C. § 101. Final Act. 10–11.

The Examiner finds that the steps of "performing . . . replicate processing . . . ," "performing . . . pixel processing . . . ," "performing . . . spike noise filtering . . . ," and "consolidating . . . the plurality of replicates into a consolidated spectrum" recited in claim 1 pertain to mathematical operations and mathematical processing, which are abstract ideas, while the step of "performing spectral analysis . . ." "is a broadly defined analysis operation, which is abstract consistent with *Electric Power Group, LLC v. Alstom*, 830 F.3d 1350 (Fed. Cir. 2016)." Final Act. 10–11 (parallel citation omitted).

The Examiner finds that the additional steps recited in claim 1 of "collecting . . . a plurality of replicates of spectral data . . ." and "communicating the plurality of replicates of spectral data to a processing device" describe "nothing more than data gathering necessary to perform the abstract method by a conventional device and in a conventional manner," and, therefore, "do[] not amount to significantly more than the abstract idea." Final Act. 11. The Examiner finds that the recitation in claim 1 that the replicate processing, pixel processing, and spike noise filtering are performed by a processor of a processing device "is equivalent to indicating that the method is performed by a computer which does not elevate the claim to significantly more than the abstract idea." *Id.* The Examiner concludes that "the claim as a whole does not amount to significantly more than the abstract idea itself." *Id.*

Appellants argue that the claimed invention relates to the field of

using Raman spectroscopy for the analytical identification and classification of materials, and addresses the technical problem in this field of corruption of the spectral output of a charge coupled device (CCD) within a Raman imaging system by random noise spikes, most typically attributable to cosmic interference. App. Br. 27 (citing Spec. ¶¶ 41, 42). Appellants argue that the method of claim 1 provides a technical solution to this problem by removing large noise spikes from spectral data that can distort the true spectrum of a material being analyzed, which improves the accuracy of the results of analyzing the material's spectrum (spectral analysis), and the accuracy of classification and identification of the material based on the spectrum, and thus improves a technical process. App. Br. 27, 29, 37–38. Appellants argue that claim 1, therefore, "sits squarely on *Diehr*." App. Br. 29 (referring to *Diamond v. Diehr*, 450 U.S. 175 (1981)).

Appellants' arguments are unpersuasive of reversible error in the Examiner's rejection, however, for reasons discussed below.

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

2019 Guidance 54–57.

Applying step 1 of the 2019 Guidance, we determine that claim 1 recites mathematical concepts. The step in claim 1 of "performing . . . replicate processing . . ." involves conditioning the intensity values of collected replicates. We look to the Specification to inform our understanding of this claim element, and note that the Specification indicates that "replicates" are spectra collected at least two discrete times, from a given sample at a given sample location. Spec. ¶ 46. The Specification describes "replicate processing" as smoothing each replicate using "a quadratic least-squares procedure," which is a mathematical calculation. Spec. ¶¶ 49, 54–56.

As for the step in claim 1 of "performing . . . pixel processing . . .," the Specification indicates that each replicate comprises a plurality of pixels, and each pixel has an associated intensity value. Spec. ¶ 105. The Specification describes identifying outliers corresponding to noise spikes within a plurality of replicates by collectively evaluating the conditioned intensity values of the plurality of replicates as a function of pixel position. Spec. ¶¶ 107, 111–112. The Specification describes performing this

operation by calculating a first standardized residual for the difference between a first raw replicate and a smoothed version of the first replicate, and identifying pixel numbers corresponding to potential outliers in the first raw replicate where the standardized residual value exceeds a predetermined cutoff value, which involves mathematical calculations. Spec. ¶ 58. The Specification describes comparing the first raw replicate with a second raw replicate at least at the identified pixel numbers corresponding to potential outliers, to identify true outliers where the comparison exceeds a predetermined threshold value. Spec. ¶ 59.

The Specification further describes performing pixel adjustments "to transform the replicates by adjusting the intensity values of the plurality of replicates based upon a predetermined function" by computing the logarithm base-e of the intensity ("log(intensity)") for each pixel, implementing "an exponential to linear curve transformation over each replicate" (Spec. ¶ 112), and "mean centering the pixel values, such as by subtracting the mean log(intensity) from the (optionally compensated) log(intensity) values for each pixel of the subset" (Spec. ¶ 114), which involves mathematical calculations.

Consistent with this description in the Specification, the limitations in claim 1 of "performing . . . replicate processing . . ." and "performing . . . pixel processing . . .," recite mathematical concepts, and thus constitute abstract ideas.

Claim 1 also recites "performing . . . spike noise filtering . . . ." We again look to Appellants' Specification to inform our understanding of whether this element of claim 1 recites a judicial exception. The Specification describes eliminating cosmic noise spikes by recalculating the

quadratic functions used in the original smoothing process without using the outlier pixel intensity values, which involves mathematical calculations. Spec. ¶¶ 51, 77–81. Consistent with this description in the Specification, the step in claim 1 of "performing . . . spike noise filtering . . ." recites mathematical concepts, and thus constitute an abstract idea.

Claim 1 also recites "consolidating . . . the plurality of replicates into a consolidated spectrum." We again look to Appellants' Specification to inform our understanding of whether this element of claims 1 recites a judicial exception. The Specification explains that after elimination of cosmic spike noise, the replicates "are prepared for spectral analysis" by consolidating the replicates into a single spectrum by summing, combining, or otherwise merging the replicates "to yield a single spectrum that is free of cosmic spikes," which involves mathematical calculations. Spec. ¶¶ 52–53, 82. Consistent with this description in the Specification, the step in claim 1 of "consolidating . . . the plurality of replicates into a consolidated spectrum" recites mathematical concepts, and thus constitutes an abstract idea.

Claim 1 also recites "performing spectral analysis on the consolidated spectrum." As discussed above for the written description rejection, the Specification explains that spectroscopic methods, such as Raman spectroscopy, are well-known methods used in the art to identify—or classify—a given material by comparing spectral data obtained for the material to that of known materials. Spec. ¶¶ 3–4. As also discussed above, the Specification explains that such "spectral analysis" of spectral data collected and filtered to remove cosmic noise spikes according to Appellants' invention can be used for the "detection of biological and chemical materials." Spec. ¶ 32; *see also* Spec. ¶¶ 43–45 (describing

filtering of spectral data to remove noise spikes to prepare the data for spectral analysis).

Consistent with these disclosures in the Specification, "spectral analysis" as recited in claim 1 thus relates to a conventional process of analyzing spectral data by comparing the data to known spectral data, and identifying similarities and differences between the data sets. Performing "spectral analysis" as recited in claim 1 is therefore a mental process, which is an abstract idea. *In re BRCA1 & BRCA2-Based Hereditary Cancer Test Patent Litig.*, 774 F.3d 755, 763 (Fed. Cir. 2014) (concluding that concept of "comparing BRCA sequences and determining the existence of alterations" is an "abstract mental process"); *see also Classen Immunotherapies, Inc. v. Biogen IDEC*, 659 F.3d 1057, 1067 (Fed. Cir. 2011) (claim involving "the idea of collecting and comparing known information," without more, is directed to an abstract idea).

We next determine whether claim 1 as a whole integrates the recited mathematical concepts and mental process into a practical application. 2019 Guidance, 84 Fed. Reg. 54–55. In so doing, we look to whether an additional element or combination of elements recited in the claim—beyond the mathematical concepts and mental process—integrate the mathematical concepts and mental process into a practical application. *Id.*

Claim 1 recites "collecting . . . a plurality of replicates of spectral data . . ." and "communicating the plurality of replicates of spectral data to a processing device." These elements of claim 1 relate to data gathering using conventional equipment, and therefore add only insignificant extra-solution activity to the recited mathematical concepts and mental process. *CyberSource. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1375 (Fed Cir. 2011).

The further recitation in claim 1 of "a processor of a processing device" is merely directed to a generic processor. *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (holding that merely implementing a mathematical principle on a general purpose computer is a patent ineligible abstract idea).

The elements of claim 1 in their entirety, therefore, recite data gathering using conventional equipment, manipulating the data through processes that involve mathematical concepts using a generic processor, and the mental process of analyzing the manipulated data by comparing it to known data. Claim 1 as a whole, therefore, does not apply, rely on, or use the recited mathematical concepts and mental process in a manner that imposes a meaningful limit on the mathematical concepts and mental process, and thus does not integrate the mathematical concepts and mental process into a practical application. 2019 Guidance, 84 Fed. Reg. 54; *Diehr*, 450 U.S. 192 n.14 (explaining that the process in *Flook* was ineligible not because it contained a mathematical formula, but because it did not integrate the formula into the process as a whole in a way that transformed the process into an inventive application of the formula).

As discussed above, Appellants argue that the claimed invention provides a technical solution to the problem of random noise spikes in spectral data by removing the noise spikes, which improves the accuracy of spectral analysis performed on the data, and therefore "sits squarely on *Diehr*." The technical solution achieved by Appellants' claims, however, is embodied in the recited mathematical concepts and mental process themselves, and relates to an improved algorithm for processing and analyzing spectral data. Unlike the situation in *Diehr* where the claimed process transformed raw, uncured synthetic rubber into precision-molded

synthetic rubber products by using a mathematical formula to control operation of a mold, the method of claim 1 does not effect a transformation of an article to a different state or thing. *Diehr*, 450 U.S. 184. Rather, claim 1 is similar in nature to the patent ineligible claims at issue in *Parker v. Flook*, 437 U.S. 584 (1978), which required (1) collecting data (i.e., "[d]etermining the present value of [a] process variable" such as temperature), (2) subjecting the data to a mathematical operation to "[d]etermin[e] a new alarm base," and (3) on the basis of the result of that operation, making a determination. *Flook,* 437 U.S. at 585, 597. Like the claims in *Flook*, claim 1 requires (1) collecting data (collecting or obtaining spectral data), (2) subjecting the data to mathematical operations (performing replicate processing, pixel processing, spike noise filtering, and consolidating), and (3) on the basis of the results of that operation, making a determination (performing spectral analysis).

Appellants argue that the "claimed invention is analogous to *McRO*[4], i.e., the claimed invention utilizes a specific claimed algorithm that is different than that applied in the prior art." App. Br. 24. Appellants argue that "the claimed invention explicitly recites a fundamentally different way to evaluate spectral data by providing a new and unique process of identifying and eliminating cosmic spike noise that cannot otherwise be avoided due to the nature of CCD devices in imaging systems." App. Br. 24–25.

Unlike *McRO*, however, where the court held that the claims at issue were not directed to an abstract idea, but were directed to an improvement in

[4] *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1316 (Fed. Cir. 2016).

computer-related technology, the method of claim 1 recites abstract ideas (including mathematical concepts and a mental process) as discussed above, and is not directed to an improvement in computer-related technology (discussed more fully below). *McRO,* 837 F.3d at 1316. Claim 1 recites mathematical concepts in combination with a conventional step of performing spectral analysis—a step that itself is an abstract mental process, and cannot be characterized as improving any computer-related technology. In other words, even if we view claim 1 as directed to a new combination of abstract ideas—the combination remains abstract and, thus, not patent eligible. Here, we find controlling clear Federal Circuit precedent that a "claim for a *new* abstract idea is still an abstract idea." *Synopsis, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1151 (Fed. Cir. 2016).

Appellants argue that "unlike *Electric Power Group*, and analogous to *Enfish*[5], the claimed invention improves the computer as a tool in a technical process for collecting and analyzing a spectrum of a sample being evaluated, e.g., using Raman spectroscopy." App. Br. 30–31. The court in *Electric Power*, however, explained that "the claims at issue [in *Enfish*] focused not on asserted advances in uses to which existing computer capabilities could be put, but on a specific improvement—a particular database technique—in how computers could carry out one of their basic functions of storage and retrieval of data." *Electric Power*, 830 F.3d at 1354 (citing *Enfish*, 822 F.3d at 1335–36). The court in *Electric Power* further explained that "[t]he present case is different: the focus of the claims is not on such an improvement in computers as tools, but on certain independently abstract ideas that use computers as tools." *Electric Power*, 830 F.3d at 1354.

[5] *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327 (Fed. Cir. 2016).

Like the claims in *Electric Power*, and unlike the claims at issue in *Enfish*, the focus of claim 1 is not on a specific improvement in how computers carry out their basic functions, but, rather, the focus is on mathematical concepts that use computers as tools. More specifically, as discussed above, claim 1 recites the mathematical concepts of "performing . . . replicate processing . . . ," "performing . . . pixel processing . . .," "performing . . . spike noise filtering . . . ," and "consolidating . . . the plurality of replicates into a consolidated spectrum." Claim 1 further recites using "a processor of the processing device" to perform the replicate processing, pixel processing, and spike noise filtering. Claim 1 thus recites using a computer to perform mathematical calculations and operations, which does not improve how the computer carries out its basic functions. Consequently, like the claims in *Electric Power*, claim 1 is not directed to an improvement in computers as tools.

Although Appellants also argue that "claim 1 cannot reasonably be construed as purely, a mental process," even if this were the case, claim 1 nonetheless recites mathematical concepts, as discussed above. App. Br. 29.

Appellants' further argument that the Examiner improperly distills the claims into a "gist" (App. Br. 23–24) ignores the Examiner's detailed analysis at pages 10 to 11 of the Final Action.

Appellants' arguments, therefore, do not persuade us that claim 1 integrates the recited mathematical concepts into a practical application.

We now look to whether claim 1 adds a specific limitation beyond the mathematical concepts and mental process that is not well-understood, routine, or conventional in the field, or simply appends well-understood, routine, conventional activities previously known to the industry, specified

at a high level of generality, to the mathematical concepts and mental process. 2019 Guidance, 84 Fed. Reg. 56–57.

As discussed above, the recitations in claim 1 of "collecting . . . a plurality of replicates of spectral data . . ." and "communicating the plurality of replicates of spectral data to a processing device" relate to data gathering using conventional equipment. As also discussed above, the further recitation in claim 1 of a processor of a processing device is merely directed to a generic processor. Further, as discussed above, the claim appends to the method a conventional step ("performing spectral analysis") that is accomplished by an activity routine in the art.

Claim 1 therefore, does not add specific limitations beyond the recited mathematical concepts and mental process that are not well-understood, routine, or conventional in the field, and simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the mathematical concepts and mental process. *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1369 (Fed. Cir. 2018).

Because claim 1 recites subject matter judicially excepted from patent eligibility, does not integrate the judicially excepted subject matter into a practical application, and simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicially excepted subject matter, we sustain the Examiner's rejection of claims 1–5, 7–15, 17, and 21–23 under 35 U.S.C. § 101.

DECISION

We affirm the Examiner's rejection of claims 1–5, 7–14, and 21–23 under 35 U.S.C. § 112, first paragraph, and rejection of claims 1–5, 7–15,

17, and 21–23 under 35 U.S.C. § 101, and reverse the Examiner's rejection of claims 15 and 17 under 35 U.S.C. § 112, first paragraph.

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

AFFIRMED