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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/969,715	08/19/2013	Jason P. Bommer	13-0268-US-NP	1257

122219 7590 09/27/2019

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EXAMINER	
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ART UNIT	PAPER NUMBER
2857	

NOTIFICATION DATE	DELIVERY MODE
09/27/2019	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JASON P. BOMMER, DENNIS M. LEWIS, and GENEVIEVE J. HANKINS

Appeal 2017-011667
Application 13/969,715
Technology Center 2800

Before LINDA M. GAUDETTE, DONNA M. PRAISS, and N. WHITNEY WILSON, *Administrative Patent Judges*.

WILSON, *Administrative Patent Judge.*

DECISION ON APPEAL

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's September 16, 2016 decision finally rejecting claims 1–18, 20, and 21 ("Final Act."). We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We affirm.

[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies The Boeing Company as the real party in interest (Appeal Br. 2).

CLAIMED SUBJECT MATTER

Appellant's disclosure relates to methods for determining quality factor ("Q") of large reverberant cavities and using determined quality factors in determining other information associated with the large reverberant cavities (Spec. ¶ 1). The Specification states that Q of a large reverberant cavity may be used to describe the ability of the cavity to store energy. Higher Q indicates a lower rate of energy loss relative to the stored energy (*id.*). According to the Specification, an analytical expression for Q of a simple cavity may be based on a mathematical model of volume, surface area, and wall conductivity, but complex cavities may be extremely difficult to model mathematically because, for instance, a complex cavity may be difficult to characterize in terms of true volume (Spec. ¶ 2). In addition, losses are said to be difficult to estimate, making it difficult to determine Q of a complex cavity (*id.*).

The claimed subject matter relates to methods for computing a quality factor by utilizing antennas and network analyzers, aircraft which includes avionics that, at least, determine a quality factor for a larger reverberant cavity of the aircraft, and network analysis machines for analyzing a reverberant cavity. Details of the claimed invention are set forth in independent claims 1, 20, and 21, which are reproduced below from the Claims Appendix to the Appeal Brief:

> 1. A method comprising:
>
> collecting a data set of field characterization measurements at a network analyzer collected via an antenna located inside a reverberant cavity excited by signals having multiple discrete electromagnetic frequencies;

performing a number (n) of circular shifts on the data set by a frequency step (Δf) and computing a covariance-based coefficient at each shift until the coefficient indicates a lack of correlation; and

computing a quality factor (Q) of the reverberant cavity as fc/(Δf x n), where fc is a center frequency of the data set.

20. An aircraft comprising:

a plurality of structures with complex reverberant cavities;

a plurality of antennas in the cavities; and

aircraft avionics for using the antennas to excite the cavities with signals having multiple discrete electromagnetic frequencies and obtain data sets of field characterization measurements for each cavity; and for each cavity location perform a number (n) of circular shifts on the data set by a frequency step (Δf) and compute a covariance-based coefficient at each shift until the coefficient indicates a lack of correlation; and compute a quality factor (Q) at the location as fc/(Δf x n), where fc is a data set center frequency.

21. A network analysis machine for analyzing a reverberant cavity, the machine comprising a signal generator for generating signals on first and second ports that excite the cavity at multiple discrete electromagnetic frequencies; a receiver for reading signals on the first and second ports; and a processor programmed to process the received signals to collect a data set of power measurements at the location; perform a number (n) of circular shifts on the data set by a frequency step (Δf) and compute a covariance-based coefficient at each shift until the coefficient indicates a lack of correlation; and compute a quality factor (Q) of the reverberant cavity as fc/(Δf x n), where fc is a center frequency of the data set.

REJECTION

Claims 1–18, 20, and 21 are rejected under 35 U.S.C. § 101 on the grounds that the claimed invention is directed to a judicial exception, without significantly more.[2]

DISCUSSION

Rejection 2 - Rejection under § 101

Legal background. 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 interpreted § 101 to include implicit exceptions: "[l]aws of nature, natural phenomena, and abstract ideas" are not patentable. *E.g.*, *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, the Supreme Court's two-step framework, described in *Mayo* and *Alice*, guides our analysis. *Id.* at 217–18 (citing *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 75–77 (2012)). In accordance with that framework, we first determine what concept 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, or protecting against risk.").

[2] The prior art rejections were withdrawn by the Examiner in the Answer (Ans. 2). Claim 19 was cancelled (Advisory Action dated Apr. 18, 2017 2). Thus, the only rejection on appeal is the rejection under § 101.

Concepts determined to be abstract ideas, and thus patent ineligible, 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)). Concepts determined to be patent eligible include physical and chemical processes, such as "molding rubber products" (*Diamond v. Diehr*, 450 U.S. 175, 191 (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 claim at issue recited 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 187; *see also id.* at 191 ("We view respondents' claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula."). Having said that, the Supreme Court also indicated 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, the analysis moves to the second step of the *Alice* and *Mayo* framework, where "we must 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). "[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention." *Id.*

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

> (1) any judicial exceptions, including certain groupings of abstract ideas (i.e., mathematical concepts, certain methods of organizing human activity such as a fundamental economic practice, or mental processes); and
>
> (2) additional elements that integrate the judicial exception into a practical application (*see* MPEP § 2106.05(a)–(c), (e)–(h)).

Only if a claim (1) recites a judicial exception and (2) does not integrate that exception into a practical application, do we then look to whether the claim:

> (3) adds a specific limitation beyond the judicial exception that is not "well-understood, routine, conventional" in the field (*see* MPEP § 2106.05(d)); or
>
> (4) simply appends well-understood, routine, conventional activities previously known to the industry, specified at a high level of generality, to the judicial exception.

See Guidance.

We address three separate groups of claims: claims 1–18 (which recite a method), claim 20 (which recites an aircraft), and claim 21 (which recites a network analysis machine). Appellant argues claims 1–18 together, so that claims 2–18 will stand or fall with claim 1.

Claims 1–18

Guidance Step 1

There is no dispute that claims 1–18 fall within a statutory category, as these claims each recite a method. For purposes of this analysis, we focus on independent claim 1.

Guidance Step 2A, Prong 1

Under Step 2A of the Guidance, we first consider whether the claims recite a judicial exception. Claim 1 recites two steps involving mathematical manipulation of data: (1) "performing a number (n) of circular shifts on the data set by a frequency step (Δf) and computing a covariance-based coefficient at each shift until the coefficient indicates a lack of correlation," and (2) "computing a quality factor (Q) of the reverberant cavity as fc/(Δf x n), where fc is a center frequency of the data set." Each of the foregoing steps recites mathematical calculations, which is sufficient to conclude that claim 1 recites mathematical concepts, which are identified in the Guidance as abstract ideas.

Guidance Step 2A, Prong 2

Having determined that the claims recite a judicial exception, our analysis under the Guidance turns to determining whether there are additional elements that integrate the exception into a practical application. *See* MPEP § 2106.05(a)–(c), (e)–(h). "A claim is not 'directed to' a judicial exception, and thus is patent eligible, if the claim as a whole integrates the recited judicial exception into a practical application." Guidance at 53–54.

A claim integrates the judicial exception into a practical application when it applies, relies on, or uses the judicial exception "in a manner that imposes a meaningful limit on the judicial exception, such that the claim is more than a drafting effort designed to monopolize the judicial exception." *Id.*

The additional elements in claim 1 are: (1) "collecting a data set of field characterization measurements at a network analyzer," (2) "collected via an antenna located inside a reverberant cavity." Thus, the claim recites a reverberant cavity, an antenna, a network analyzer, and the collection of a data set of field characterization measurements.

The additional elements recited in claim 1 are used to determine Q in a reverberant cavity. However, while the claimed method is said to permit the determination of Q for a complex cavity, a determination of which is said to otherwise be difficult to make, the claim provides no explanation or guidance as to what the significance of the Q value is, or what use can be made of it. While the Specification provides some description of how determination of the Q value can have specific technical value (Spec. ¶¶ 44–61), claim 1 is not so limited. If the claim recited specific applications of the judicial exception (for example, determining the fuel level in a fuel tank), the analysis might have been different. The Examiner finds that the additional elements are insignificant extrasolution activity, and also finds that the physical elements described in claim 1 are cited "with a high level of generality in order to collect [the] data used to perform the abstract idea" (Final Act. 11–12). Although Appellant argues that those physical elements are set forth in a specific configuration (i.e., a network analyzer which receives data from an antenna, where the antenna is located inside a reverberant cavity), we agree with the Examiner that the claim does not set

forth adequate structure for these elements to provide anything more that "a high level of generality" to collect the data used to perform the abstract idea.

Our analysis of the facts presented in this appeal is consistent with the analysis in *Flook*. As noted by the Supreme Court in that case, in order to be patent eligible, the process itself, not merely the mathematical algorithm, must be new and useful, and the novelty of the algorithm is not a determining factor in determining eligibility. 437 U.S. at 592. In this case, Appellant has not alleged that the physical components used in its method or their relative arrangement are new.

Guidance Step 3. The Examiner finds that the non-abstract elements recited in claim 1 do not add a specific limitation beyond the judicial exception that is not well understood, routine, and conventional in the field, and append those elements to the judicial exception at a high level of generality (Ans. 6–7). The Examiner finds that the arrangement of the additional elements was described, for example, in a prior U.S. Published Patent Application (Ans. 13–14). Appellant does not dispute these findings (*see* Reply Br. 1–3). Accordingly, we conclude that claim 1 does not describe patent eligible subject matter. Appellant does not separately argue the patentability of dependent claims 2-18 (Appeal Br. 29). Therefore, these claims stand or fall with independent claim 1. 37 C.F.R. § 41.37(c)(1)(iv).

Claim 20

Guidance Step 1

There is no dispute that claim 20 falls within a statutory category, as it recites an aircraft (i.e., an article of manufacture).

Guidance Step 2A, Prong 1

Under Step 2A of the Guidance, we first consider whether the claims recite a judicial exception. Claim 20 recites two steps involving mathematical manipulation of data: (1) "perform a number (n) of circular shifts on the data set by a frequency step (Δf) and compute a covariance-based coefficient at each shift until the coefficient indicates a lack of correlation," and (2) "compute a quality factor (Q) at the location as fc/(Δf x n), where fc is a center frequency of the data set." Each of the foregoing steps recites mathematical manipulation of data, which is sufficient to conclude that claim 1 recites mathematical concepts, which are identified in the Guidance as an abstract idea.

Guidance Step 2A, Prong 2

Having determined that the claims recite a judicial exception, our analysis under the Guidance turns to determining whether there are additional elements that integrate the exception into a practical application. *See* MPEP § 2106.05(a)–(c), (e)–(h). The additional elements in claim 20 are: (1) "an aircraft"; (2) a plurality of structures with complex reverberant cavities"; (3) "a plurality of antennas in the cavities"; and (4) "aircraft avionics for using the antennas to excite the cavities with signals having multiple discrete electromagnetic frequencies" to (5) "obtain data sets of field characterization measurements for each cavity."

The additional elements recited in claim 20 are used to determine Q in cavities of the recited aircraft. However, the claim provides no explanation or guidance as to what the significance of the Q value is, or what use can be made of it. While the Specification provides some description of how determination of the Q value can have specific technical value (Spec. ¶¶ 44–61), claim 20 is not so limited. If the claimed aircraft recited specific

applications of the judicial exception (for example, determining the fuel level in a fuel tank), the analysis might have been different. The Examiner finds that the additional elements simply refer to a particular field of use of the abstract idea and, therefore, do not add significantly more to the abstract idea (Final Act. 12). Appellant does not challenge this finding (*see* Appeal Br. 30).

Accordingly, we determine that the preponderance of the evidence of record supports a determination that claim 20 is directed to an abstract idea. In this case, Appellant has not alleged that the physical components used in its method or their relative arrangement are new.

Guidance Step 3. The Examiner finds that the non-abstract elements recited in claim 20 do not add a specific limitation beyond the judicial exception that is not well understood, routine, and conventional in the field (e.g. an aircraft with a plurality of complex reverberant cavities). Appellant does not dispute these findings. Accordingly, we conclude that claim 20 does not describe patent eligible subject matter.

Claim 21

Guidance Step 1

There is no dispute that claim 21 falls within a statutory category, as it recites a network analysis machine (i.e., an article of manufacture).

Guidance Step 2A, Prong 1

Under Step 2A of the Guidance, we first consider whether the claims recite a judicial exception. Claim 21 recites two steps involving mathematical manipulation of data: (1) "perform a number (n) of circular

shifts on the data set by a frequency step (Δf and compute a covariance-based coefficient at each shift until the coefficient indicates a lack of correlation," and (2) "compute a quality factor (Q) of the reverberant cavity as fc/(Δf x n), where fc is a center frequency of the data set." Each of the foregoing steps recites mathematical manipulation of data, which is sufficient to conclude that claim 1 recites mathematical concepts, which are identified in the Guidance as an abstract idea.

Guidance Step 2A, Prong 2

Having determined that the claims recite a judicial exception, our analysis under the Guidance turns to determining whether there are additional elements that integrate the exception into a practical application. *See* MPEP § 2106.05(a)–(c), (e)–(h). The additional elements in claim 21 are: (1) "a network analysis machine"; (2) "a signal generator for generating signals on first and second ports that excite the cavity a multiple discrete electromagnetic frequencies"; (3) "a receiver for reading signals on the first and second ports"; and (4) "a processor programmed to process the received signals to collect a data set of power measurements at the location."[3]

Our analysis essentially parallels the analysis for claim 20. While claim 21 does recite some physical components (as set forth above), the claim provides no explanation or guidance as to what the significance of the Q value is, or what use can be made of it. While the Specification provides some description of how determination of the Q value can have specific technical value (Spec. ¶¶ 44–61), claim 21 is not so limited. If the claimed

[3] We note that the term "the location" appears to lack antecedent basis. The Examiner and Appellant may wish to review this upon resumption of prosecution.

network analysis machine recited specific applications of the judicial exception (for example, determining the fuel level in a fuel tank), the analysis might have been different. However, the Examiner finds that the additional elements are recited at a high level of generality and do not add significantly more to the abstract idea (Final Act. 13). Appellant does not challenge this finding and, in fact, concedes that the claimed network analysis machine "may be a commercial off the shelf network analyzer that generates s-parameters in a conventional manner," but then analyzes the data using the abstract idea (Appeal Br. 30).

Guidance Step 3. Our analysis at this step is essentially the same as for claim 20, and reaches the same result. The Examiner finds that the non-abstract elements recited in claim 21 do not add a specific limitation beyond the judicial exception that is not well understood, routine, and conventional in the field, and Appellant does not dispute these findings. Accordingly, we conclude that claim 21 does not describe patent eligible subject matter.

CONCLUSION

In summary:

Claims Rejected	Basis	Affirmed	Reversed
1–18, 20, and 21	§ 101	1–18, 20, and 21	
Overall Outcome		1–18, 20, and 21	

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

AFFIRMED