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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte CHARLES W. WAMPLER II,
DANIEL R. BAKER, MARK W. VERBRUGGE,
PATRICK FROST, BRIAN J. KOCH,
and PATRICIA M. LASKOWSKY

Appeal 2018-006701
Application 14/488,906
Technology Center 2800

Before KAREN M. HASTINGS, JAMES C. HOUSEL, and
JEFFREY R. SNAY, *Administrative Patent Judges*.

HOUSEL, *Administrative Patent Judge*.

DECISION ON APPEAL¹

Appellant² appeals under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 4–13 under 35 U.S.C. § 101 as being directed to patent ineligible subject matter. We have jurisdiction over the

¹ Our decision refers to the Specification (“Spec.”) filed September 17, 2014, the Examiner’s Final Office Action (“Final”) dated July 12, 2017, Appellant’s Appeal Brief (“Appeal Br.”) filed February 12, 2018, the Examiner’s Answer (“Ans.”) dated April 12, 2018, and Appellant’s Reply Brief (“Reply Br.”) filed June 12, 2018.

² Appellant is the Applicant, GM Global Technology Operations LLC., which is identified in the Appeal Brief as the real party in interest. Appeal Br. 3.

appeal under 35 U.S.C. § 6(b).

We AFFIRM.

STATEMENT OF THE CASE

The invention relates to methods of estimating at least one of the power capabilities of a battery “to provide a robust state of power predictor.” Spec. ¶¶ 3–4. Appellant discloses that this can be accomplished by obtaining impedance data from a battery, building an equivalent circuit that operates in a manner approximating the impedance data, determining at least one of the power capabilities of the equivalent circuit via linear regressions methods or “domain matrix exponentials, a Laplace transform, a Fourier transform, a Fourier series, or any other method of integrating a system of ordinary differential equations,” and estimating the at least one power capability of the battery based on the determination. *Id.* at ¶¶ 3–4, 13.

Claims 4 and 8, reproduced below from the Claims Appendix to the Appeal Brief (with some indentation added), are illustrative of the subject matter on appeal.

4. A method comprising:
 - obtaining impedance data from a battery;
 - building an equivalent circuit which operates in a manner approximating the battery impedance data;
 - determining at least one of the power capabilities of the equivalent circuit; and,
 - estimating at least one of the power capabilities of the battery based upon the determined power capabilities of the equivalent circuit, wherein the equivalent circuit is an R+N(R||C) circuit,
 - wherein estimating at least one of the power capabilities of the battery based upon the power capabilities of the equivalent circuit comprises:

imposing a constant input current, I upon the equivalent circuit;

solving for the voltage, $v_i(t)$ across capacitor C_i , according to

$$v_i(t) = v(0) \exp\left(\frac{-t}{R_i C_i}\right) + I R_i \left(1 - \exp\left(\frac{-t}{R_i C_i}\right)\right), \quad i = 1, \dots, N;$$

predicting an equivalent circuit power at time, t according to

$$Power(t) = I(V_0 + IR + v_1(t) + \dots + v_N(t)); \text{ and,}$$

correlating the equivalent circuit power at time, t to the power of the battery at time t .

8. A method comprising:
 - obtaining impedance data from a battery;
 - building an equivalent circuit which operates in a manner approximating the battery impedance data;
 - determining at least one of the power capabilities of the equivalent circuit; and,
 - estimating at least one of the power capabilities of the battery based upon the determined power capabilities of the equivalent circuit, wherein the equivalent circuit is an R+N(R||C) circuit, wherein the equivalent circuit is an R|| $(R+C)^N$ circuit.³

ANALYSIS

Legal Framework

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 long interpreted 35 U.S.C. § 101 to include

³ We note that this claim recites that the equivalent circuit is both an R+N(R||C)circuit and an R|| $(R+C)^N$ circuit. Appellant’s summary of the claimed subject matter of claim 8 merely repeats the limitations of claim 8 and directs attention to Specification paragraphs 10 and 38. Appeal Br. 4–5. However, neither of these paragraphs describe the equivalent circuit as both an R+N(R||C)circuit and an R|| $(R+C)^N$ circuit. Upon further prosecution of this application, the Examiner and Appellant should consider addressing this apparent inconsistency.

implicit exceptions: “[l]aws of nature, natural phenomena, and abstract ideas” are not patentable. *E.g.*, *Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 216 (2014).

In determining whether a claim falls within an excluded category, our inquiry focuses on the Supreme Court’s 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)). 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.”).

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 176; *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, we turn 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 Office recently published revised guidance on the application of § 101. USPTO’s January 7, 2019 Memorandum, *2019 Revised Patent Subject Matter Eligibility Guidance* (“Memorandum”), 84 Fed. Reg. 50. Under that 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 recites a judicial exception and 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 generally Memorandum.

Analysis

Applying the guidance set forth in the Memorandum, we sustain the Examiner’s rejection under § 101 that claims 4–13 do not recite patent-eligible subject matter.

Revised Step 2A, Prong One—Directed to a Judicial Exception

The Memorandum instructs us first to determine whether each claim recites any judicial exception to patent eligibility. 84 Fed. Reg. at 54. The Memorandum identifies three judicially-excepted groupings: (1) mathematical concepts, (2) certain methods of organizing human activity such as fundamental economic practices, and (3) mental processes. *Id.* at 52.

The Examiner determines the steps recited in claim 4 are directed to mathematical relationships, citing various cases, such as *Digitech Image Techs., LLC v. Elecs. for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014). Final Act. 4–5. Independent claim 4 recites, among other things,

“determining at least one of the power capabilities of the equivalent circuit” and “estimating at least one of the power capabilities of the battery based upon the determined power capabilities of the equivalent circuit.” Claim 4 further recites that making the estimation comprises the use of mathematical equations, including a Laplace transform of an ordinary differential equation. See Spec. ¶¶ 18–20.

Digitech demonstrates that a process employing mathematical algorithms to manipulate existing information to generate additional information is abstract in certain circumstances. 758 F.3d at 1350–51. The determining and estimating steps of claim 4 are directed to this concept. Specifically, the steps regard the manipulation of information about parameters of an equivalent circuit to generate additional information (i.e., power capabilities) for a battery.

Indeed, Appellant’s arguments appear to concede that claim 4 recites an abstract idea, using an analysis similar to that set forth in Prong One of Step 2A of the Memorandum:

Independent claim 4 recites a mathematical equation. According to the MPEP, this means that claim 4 is “directed to” an abstract idea. For this reason, the rejection of claim 4 under 35 U.S.C. § 101 makes some sense. Note however, as shown above, being “directed to” an abstract idea does not damn a claim to patent ineligibility.

Appeal Br. 11. Although the above statements indicate claim 4 may be directed to an abstract idea, the last point made by Appellant appears to shift the analysis to whether the additional elements are sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application. We will discuss that issue below when analyzing the rejection under Prong Two of Step 2A and Step 2B of the Memorandum.

Appellant argues at pages 5–6 of the Reply Brief (citing a past panel decision) that the Examiner has not used facts and evidence to properly analogize the claims to cited cases. As noted above, the Examiner has compared claim 4 to *Digitech*, which is an apt analogy in light of the determining and estimating steps recited in the claim.

Independent claim 8 recites, among other things, “determining at least one of the power capabilities of the equivalent circuit” and “estimating at least one of the power capabilities of the battery based upon the determined power capabilities of the equivalent circuit.” The Examiner rejects claim 8 under § 101 for reasons similar to those for claim 4 (when one compares the rejection of cancelled claim 1 to the rejection of claim 4). Final Act. 6; *compare id.* 2–4 *with id.* 4–6.

Fundamentally, claim 8 is directed to mathematical concepts for substantially the same reasons as provided above regarding claim 4. Although claim 8 does not specifically recite mathematical relationships like claim 4, Appellant’s Specification demonstrates that the determining and estimating limitations use mathematical relationships to carry out those steps. Specifically, the Specification explains that various mathematical concepts (e.g., linear regression algorithms, domain matrix exponentials, Laplace transforms, Fourier transforms, Fourier series, “or any other method of integrating a system of ordinary differential equations”) can be used to determine at least one power capability of an equivalent circuit and estimate at least one of the power capabilities of a battery. Spec. ¶¶ 3–4, 10, 13, see Spec. ¶¶ 20–22, 25–27.

As a result, the defining and estimating steps of claim 4 recite mathematical concepts and, therefore, claim 4 recites an abstract idea.

Likewise, when interpreted in light of the Specification, the determining and estimating steps of claim 8 recite mathematical concepts and, therefore, claim 8 recites an abstract idea. Appellant does not argue dependent claims 5–7 and 9–13 separately from claims 4 and 8. Appeal Br. 11–17.

Revised Step 2A, Prong Two – Practical Application

Having determined that claims 4–13 recite the abstract idea of mathematical concepts, we next look to determine whether the claims recite “additional elements that integrate the judicial exception into a practical application.” MPEP § 2106.05(a)–(c), (e)–(h); Memorandum, 84 F.3d at 53–54. Integration into a practical application requires an additional element or a combination of additional elements in the claim to “apply, rely on, or use 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 exception.” Memorandum, 84 Fed. Reg. at 53–54; *see also id.* at 55 (setting forth exemplary considerations indicative that an additional element or combination of elements may have integrated the judicial exception into a practical application).

Here, the Examiner determines that the additional elements of claims 4 and 8 are insufficient to amount to significantly more than the judicial exception. Final Act. 5–6. Specifically, the Examiner determines that the additional elements are recited at a high level of generality and there is no indication that the combination of elements provides a technological improvement or improves the functioning of a computer. *Id.*

The additional steps of claims 4 and 8 are “obtaining impedance data from a battery” and “building an equivalent circuit which operates in a manner approximating the battery impedance data.” The Examiner’s

determination that these steps are recited with a high level of generality is correct. The step of “obtaining impedance data from a battery” is a generic step of gathering information, specifically battery impedance data that can be considered insignificant extra-solution activity. Memorandum, 84 Fed. Reg. at 55, fn. 31.

The step of building an equivalent circuit is essentially a design step in which a circuit is built to approximate a battery based on the gathered impedance data. Appellant argues the limitation of “building an equivalent circuit” is not limited to an abstraction (e.g., constructing a virtual circuit) but “the most reasonable interpretation is that the equivalent circuit is a real tangible circuit.” Appeal Br. 11. This argument is unpersuasive. Appellant does not cite to the Specification or other source to support their proffered definition of “building an equivalent circuit.” In fact, the Specification supports an interpretation that “building an equivalent circuit” encompasses virtual circuits “built” by a control system. Specifically, paragraph 11 of the Specification discloses that “a real-time state estimator” determines the necessary number and value of the equivalent circuit components and paragraph 12 discloses that the real-time state estimator maintains an estimate of resistor, capacitor, and voltage values for the equivalent circuit. Paragraph 10 of the Specification discloses that a control system and sensors obtain impedance data from a battery and that, based on the impedance data, an equivalent circuit is constructed by determining a relation of battery current to battery voltage over time and solving for a necessary number and value of each equivalent circuit component, which appears to imply that the latter calculations can be performed by the control system. Thus, “building an equivalent circuit” is not as limited as Appellant asserts.

Appellant also argues that “[c]laim 4 is tied to the particular application of a battery” and thus claim 4 is not abstract because “claim 4 cannot be performed in the absence of a battery.” Appeal Br. 14. This argument is also unpersuasive because it is an attempt to limit use of the abstract idea to a particular environment or field of use, which is insufficient to transform a judicial exception into eligible subject matter. *See Alice*, 573 U.S. at 222 (“[Limiting the use of an abstract idea to a particular technological environment] is ‘not enough for patent eligibility.’”) (internal citations and quotation omitted); *Bilski*, 561 U.S. at 610–11 (“[T]he prohibition against patenting abstract ideas ‘cannot be circumvented by attempting to limit the use of the formula to a particular technological environment’ or adding ‘insignificant postsolution activity’”) (quoting *Diehr*, 450 U.S. at 191–92); *Elec. Power Grp., LLC v. Alstom, SA*, 830 F.3d 1350, 1354 (Fed Cir. 2016) (“[Limiting the claims to the particular technological environment of power-grid monitoring is, without more, insufficient to transform them into patent-eligible applications of the abstract idea at their core.”); *Ultramercial, Inc. v. Hulu, LLC*, 772 F.3d 709, 716 (Fed. Cir. 2014) (“Narrowing the abstract idea of using advertising as a currency to the Internet is an ‘attempt[] to limit the use’ of the abstract idea ‘to a particular technological environment,’ which is insufficient to save a claim.”) (quoting *Alice*, 573 U.S. at 219–20).

Nor do the additional elements, when considered individually and as an ordered combination, reflect an improvement to the functioning of a computer, or to any other technology or technical field. *See Memorandum*, 84 Fed. Reg. at 55, fn. 25. Appellant contends that “claim 4 is geared toward the disclosed intent/problem ‘to provide a robust state of power

predictor’ and achieves the non-monopolizing, inventive solution by the limited, particular implementation of the specified method.” Appeal Br. 12 (citing Spec.). This improvement of providing “a robust state of power predictor” is general in nature and appears to be the result of applying the mathematical concepts (i.e., the judicial exception itself). However, “a claimed invention’s use of the ineligible concept to which it is directed cannot supply the inventive concept that renders the invention ‘significantly more’ than that ineligible concept.” *BSG Tech LLC v. Buyseasons, Inc.*, 899 F.3d 1281, 1290 (Fed. Cir. 2018). Nor is the judicial exception particularly limited or non-monopolizing by reciting obtaining battery impedance data (i.e., generic data gathering) and building the equivalent circuit, as recited in claims 4 and 8, which encompass gathering impedance data and designing a virtual equivalent circuit based on the impedance data.

We note that the mere use or presence of mathematical concepts does not render a claimed invention patent ineligible. A claimed invention, however, needs to include elements sufficient to ‘transform’ the claimed abstract idea into a patent-eligible application instead of merely being the use of the judicial exception. As explained by the Federal Circuit in *Digitech*, although an application of a mathematical formula to a known structure or process may be deserving of patent protection (758 F.3d at 1350, quoting *Diehr*, 450 U.S. at 187) and “[a] claim may be eligible if it includes additional inventive features such that the claim scope does not solely capture the abstract idea,” (*id.*, citing *Alice*), a claim does not become eligible “merely by adding the words ‘apply it’” (*id.*, quoting *Bancorp Servs., LLC v. Sun Life Assurance Co. of Can. (U.S.)*, 687 F.3d 1266, 1276 (Fed. Cir. 2012)).

As discussed above, the additional elements of claims 4 and 8 are recited at a high level of generality and do not provide a technological improvement. Therefore, claims 4 and 8 do not integrate the judicial exception into a practical application that imposes a meaningful limit on the judicial exception so that the claim does more than monopolize the judicial exception. Claims 4 and 8 instead appear to be the mere application of the abstract idea (i.e., use of mathematical concepts to determine at least one power capabilities of an equivalent circuit and estimate at least one power capability of a battery). “If a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory.” *Flook*, 437 U.S. at 595 (quoting *In re Richman*, 563 F.2d 1026, 1030 (CCPA 1977)). In other words, claims 4 and 8 are no more than a drafting effort designed to monopolize the judicial exception. As a result, the additional elements do not integrate the judicial exception into a practical application.

Step 2B—Inventive Concept

Because we determine that claims 4–13 are directed to an abstract idea and they do not include additional elements that integrate the abstract idea into a practical application, we look to whether each claim provides an inventive concept, i.e., adds a specific limitation beyond the judicial exception that is not “well-understood, routine, conventional” in the field. Memorandum, 84 Fed. Reg. at 56.

Appellant provides no indication that the data gathering and equivalent circuit building, when considered individually and as an ordered combination, are done in an unconventional way or present an unconventional combination. *See id.* As discussed above, these additional

elements are specified at a high level of generality. Also, the improvement argued by Appellant appears to be a result of merely applying the judicial exception (i.e., the use of mathematical concepts to determine at least one power capability of an equivalent circuit and estimate at least one power capability of a battery), as discussed above.

Appellant presents what it calls a “Statement of Facts” at page 18 of the Appeal Brief and requests the Decision to address them. We treat this list as arguments that have been addressed by the analysis above. Moreover, to the extent Appellant argues the claims are patent eligible under § 101 because there is no prior art rejection under §§ 102 or 103 (Appeal Br. 18, “SF6”), such an argument is unpersuasive. “The question therefore of whether a particular invention is novel is ‘wholly apart from whether the invention falls into a category of statutory subject matter.’” *Diehr*, 450 U.S. at 190 (quoting *In re Bergy*, 596 F.2d 952, 961 (CCPA 1979) (emphasis deleted)). The Supreme Court further stated:

In this case, it may later be determined that the respondents' process is not deserving of patent protection because it fails to satisfy the statutory conditions of novelty under § 102 or nonobviousness under § 103. A rejection on either of these grounds does not affect the determination that respondents' claims recited subject matter which was eligible for patent protection under § 101.

Id. at 191.

Accordingly, Appellant’s arguments do not identify a reversible error in the Examiner’s rejection of claims 4–13 under 35 U.S.C. § 101. The claims ensnare the basic idea of using mathematical concepts to determine at least one power capability of an equivalent circuit and use that determination to estimate at least one power capability of a battery and do not recite

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additional elements that integrate those mathematical concepts into a practical application or provide an inventive concept.

DECISION

The decision of the Examiner 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).

AFFIRMED