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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/171,998	06/29/2011	Gregory Sechong Um	R2041-702219(10-1152)	6508

84250 7590 03/18/2019

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ART UNIT	PAPER NUMBER
3646	

NOTIFICATION DATE	DELIVERY MODE
03/18/2019	ELECTRONIC

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte GREGORY SECHONG UM and YURY N. GOLUBEV

Appeal 2017-009093
Application 13/171,998
Technology Center 3600

Before JAMESON LEE, MICHAEL R. ZECHER, and JUSTIN T. ARBES, *Administrative Patent Judges*.

ARBES, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

Appellants appeal under 35 U.S.C. § 134(a) from the final rejection of claims 1–20, the only claims pending in the application on appeal. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).[1]

We REVERSE.

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[1] Our decision will make reference to Appellants' Appeal Brief ("Br.," filed November 22, 2016), the Examiner's Answer ("Ans.," mailed March 7, 2017), and the Final Office Action ("Final Act.," mailed April 21, 2016).

INVENTION

Appellants' invention is directed to a method of detecting a plasma depletion in the ionosphere. Spec. ¶ 4. "Radio frequency signals transmitted by satellites (for example, geosynchronous global navigation satellites) to receivers on the Earth's surface are delayed as they travel through the Earth's ionosphere." *Id.* ¶ 1. Global positioning system (GPS) augmented systems estimate and correct for these delays, such as by using a network of dual frequency GPS receivers at reference stations to estimate delays, interpolating the measurements to a "predefined set of grid nodes, referred to as ionospheric grid points (IGPs)," and broadcasting the IGP data to users. *Id.* "The intersection of the line of sight from receiver to satellite and the shell defined by the IGPs is known as the user's ionospheric pierce point (IPP). A user interpolates the grid node delay to the IPP to obtain an estimate of the ionospheric delay at the IPP." *Id.* "[F]luctuations in the characteristics of the ionosphere," however, can cause errors in these large-scale delay estimations. *Id.* Plasma depletions ("strong reductions in the ionosphere F-region plasma density"), for example, are "small-scale phenomena, generally seen in only one satellite-user line-of-sight." *Id.* ¶¶ 2, 21. The Specification states that known methods of detecting and compensating for plasma depletions were unreliable. *Id.* ¶ 22. Appellants' invention is directed to a method of detecting a plasma depletion by calculating a "temporal slope of the IGP estimated delay" and a "local line-of-sight (IPP) temporal slope of delay" and comparing the two temporal slopes of delay to each other. *Id.* ¶ 24.

Claim 1 recites:

> 1. A method of detecting a plasma depletion in the ionosphere by a global positioning system (GPS) receiver, the method comprising:
>
> receiving, by an antenna system of the GPS receiver, at least one GPS signal along a line of sight that passes through at least a portion of the ionosphere, the at least one GPS signal including at least two signal components at different frequencies;
>
> receiving, by the antenna system, broadcast ionosphere grid point (IGP) data;
>
> extracting, by an initialization module of the GPS receiver, phase data from the at least one GPS signal to provide a phase input;
>
> determining, by the initialization module, an IGP-predicted temporal slope of delay at an ionosphere pierce point (IPP) along the line of sight based at least in part on the IGP data;
>
> determining, by the initialization module, a local temporal slope of delay at the IPP based at least in part on the phase data; and
>
> determining, by a detector module of the GPS receiver, whether the portion of the ionosphere through which line of sight passes is undergoing a plasma depletion based at least in part on the IGP-predicted temporal slope of delay and the local temporal slope of delay.

Br. 11 (Claims Appendix).

REJECTION

Claims 1–20 stand rejected as reciting patent-ineligible subject matter under 35 U.S.C. § 101. Final Act. 2–5; Ans. 3–6.

ISSUE

Appellants argue that the Examiner's rejection of claims 1–20 is in error. Br. 4–10. These arguments present us with the following issue: Did the Examiner err in concluding that the claims are directed to a patent-ineligible abstract idea and that there are no additional elements that transform the nature of the claim into a patent-eligible application?

ANALYSIS

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 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, we are guided by 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 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, 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 PTO recently 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. Specifically, at Step 2A, Prong One of the Guidance, we evaluate "whether the claim recites a judicial exception." *Id.* at 54. If so, at Step 2A, Prong Two, we "evaluate whether the judicial exception is integrated into a practical application." *Id.* Then, only if it is determined

that the claim is directed to a judicial exception, we "evaluate whether the claim provides an inventive concept" at Step 2B. *Id.* at 56.

The Examiner concludes that the claims are directed to an abstract idea because they recite "mathematical relationships / formulas of organizing information," citing as representative the "determining" steps of claim 1:

> determining, by the initialization module, an IGP-predicted temporal slope of delay at an ionosphere pierce point (IPP) along the line of sight based at least in part on the IGP data;
>
> determining, by the initialization module, a local temporal slope of delay at the IPP based at least in part on the phase data; and
>
> determining, by a detector module of the GPS receiver, whether the portion of the ionosphere through which line of sight passes is undergoing a plasma depletion based at least in part on the IGP-predicted temporal slope of delay and the local temporal slope of delay.

Ans. 3. The Examiner determines that the "initialization module" and "detector module" of the GPS receiver amount to merely a "generic computer (i.e. processor)" and the "mathematical operations [they perform] for determining plasma depletion in the ionosphere are no more than mere instructions to implement the idea on the generic computer." *Id.* at 4–5.

Appellants argue that the Examiner erred because, "[w]hile ionosphere depletion is a natural phenomenon and mathematical relationships are involved in its detection, the claims are not 'directed to' the natural phenomenon, an abstract idea, or a mathematical relationship or formula." Br. 5. Specifically, the claims "apply" the mathematical relationships and represent a "specific method of accurately detecting

plasma depletion in the ionosphere," which is an "improvement[] in computer-related technology" and a "specific implementation of a solution to a [known] problem in the wireless receiver arts." *Id.* at 6–7 (emphasis omitted). Appellants further contend that "[t]he plain focus of the claims is an improvement to receiver functionality, not to economic or other activities for which a generic processor is used in its ordinary capacity." *Id.* at 7–8.

We have reviewed the Examiner's rejection in light of Appellants' arguments that the Examiner erred. In reaching this decision, we have considered all evidence presented and all arguments made by Appellants. We are persuaded by Appellants' arguments regarding claims 1–20.

With respect to the first step of the *Alice/Mayo* test, claim 1 recites a method of detecting a plasma depletion comprising (1) receiving a GPS signal with at least two components at different frequencies, (2) receiving broadcast IGP data, (3) extracting phase data from the GPS signal, (4) "determining" an "IGP-predicted temporal slope of delay" based on the IGP data, (5) "determining" a "local temporal slope of delay" based on the phase data, and (6) "determining . . . whether the portion of the ionosphere through which line of sight passes is undergoing a plasma depletion" based on the two temporal slopes of delay.[2] Determining the IGP-predicted

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[2] Independent claims 9 and 18 recite similar limitations. Claim 9 recites "calculating" the two temporal slopes of delay, "comparing" them to each other, and "declaring . . . a depletion based at least in part on a difference between" them. Claim 18 recites an initialization module configured to "determine" the two temporal slopes of delay and a detection module configured to "detect a plasma depletion . . . based on a comparison" of the two temporal slopes of delay. The Examiner addresses the three claims
Footnote continued on next page.

temporal slope of delay and local temporal slope of delay are mathematical calculations, as Appellants acknowledge. *See id.* at 6 (arguing that "[w]hile mathematical relationships are involved, the claims as a whole are not directed to mathematical relationships or formulas"); Spec. ¶¶ 32–34 (providing exemplary equations by which the "local temporal slope of delay" may be "computed" and referring to those equations in describing exemplary calculations of the "grid temporal slope"). Therefore, at Step 2A, Prong One of the Guidance, we conclude that claim 1 recites mathematical concepts, and thus an abstract idea.

Although claim 1 recites an abstract idea, "[t]he 'directed to' inquiry . . . cannot simply ask whether the claims *involve* a patent-ineligible concept, because essentially every routinely patent-eligible claim involving physical products and actions *involves* a law of nature and/or natural phenomenon—after all, they take place in the physical world." *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335 (Fed. Cir. 2016). "Rather, the 'directed to' inquiry applies a stage-one filter to claims, considered in light of the specification, based on whether 'their character as a whole is directed to excluded subject matter.'" *Id.* (citations omitted). We must "look to whether the claims . . . focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery." *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016).

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together. *See* Final Act. 2–3; Ans. 3–4. Although we refer herein to the language of claim 1, our analysis applies equally to claims 9 and 18.

Therefore, we proceed to Step 2A, Prong Two of the Guidance to determine whether additional elements of the claim integrate the mathematical concepts into a practical application, considering the claim as a whole and giving weight to all additional elements, whether or not they are conventional. *See* Guidance 54–55. Such additional elements may reflect an improvement in the functioning of a computer, or an improvement to other technology or technical field. *Id.* We agree with Appellants and conclude that the elements of the claims reflect a specific improvement in the functioning of a GPS receiver, specifically the way in which a GPS receiver detects whether a plasma depletion (a physical phenomenon) is occurring in the ionosphere at its particular line-of-sight. *See* Br. 6–7. Claim 1 recites receiving a GPS signal from which phase data is extracted, receiving broadcast IGP data, using the IGP data and phase data to determine the "IGP-predicted temporal slope of delay" and "local temporal slope of delay," and "determining . . . whether the portion of the ionosphere through which line of sight passes is undergoing a plasma depletion" based on the two temporal slopes of delay. As Appellants point out, performing the recited calculations and detecting steps allows the receiver to make a "more precise determination" of when a plasma depletion is occurring and to "make additional error correction beyond that achievable from large-scale ionosphere information alone." *See id.*

Our conclusion is supported by the Specification, which describes, in detail, both the overall problem with compensating for ionospheric delay and the problem of detecting and compensating for plasma depletions in the ionosphere at a particular line-of-sight. *See* Spec. ¶¶ 1–3, 21. The

Specification describes the deficiencies with known methods to account for the latter as follows:

> Plasma depletions are small-scale (local) phenomena of the ionosphere and as a result, receivers on the ground in different locations "see" different depletion events. Depletions are not modeled or accounted for in large-scale ionosphere information. However, many navigation and positioning systems rely on ground-based receiver data to estimate GPS satellite signal delay and the presence of depletions can cause significant large-scale delay errors. Therefore, there is a need for a method of accurately and reliably detecting plasma depletions in the ionosphere and removing them before the large-scale delay estimation.
>
> A number of processes for detecting and compensating for plasma depletions have been proposed; however, several of these suffer from high rates of false alarms and misdetections, and are therefore unreliable. . . .

Id. ¶¶ 21–23, 25. The Specification then describes how the disclosed method is able to more accurately detect plasma depletions. *Id.* ¶¶ 25, 28–39. These disclosures support the conclusion that the claim elements improve the functioning of a GPS receiver in detecting plasma depletions. *See Visual Memory LLC v. NVIDIA Corp.*, 867 F.3d 1253, 1259–60 (Fed. Cir. 2017) (patent-eligible claims were "directed to a technological improvement: an enhanced computer memory system," and "the specification discusses the advantages offered by the technological improvement"); *McRO*, 837 F.3d at 1307–08, 1313 (patent-eligible claims recited "rules that define [an] output morph weight set stream as a function of phoneme sequence and time of said phoneme sequence," and "[a]s the specification confirms, the claimed improvement . . . is allowing computers to produce 'accurate and realistic lip synchronization and facial expressions

in animated characters' that previously could only be produced by human animators'" (citation omitted)).

Because the additional elements of claim 1 integrate mathematical concepts into a practical application, we determine that claim 1 is not directed to an abstract idea. *See* Guidance, Step 2A, Prong Two. For the same reasons, each of independent claims 9 and 18, and dependent claims 2–8, 10–17, 19, and 20, also integrates mathematical concepts into a practical application. Accordingly, we do not sustain the Examiner's rejection of claims 1–20 under 35 U.S.C. § 101.

CONCLUSION

Appellants have persuaded us of error in the Examiner's decision to reject claims 1–20 under 35 U.S.C. § 101.

DECISION

For the above reasons, the Examiner's decision to reject claims 1–20 is reversed.

REVERSED