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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/679,619	03/23/2010	Masayuki Takahama	SHP-009	7978
32628	7590	12/30/2019	EXAMINER	
KANESAKA BERNER AND PARTNERS LLP 2318 Mill Road Suite 1400 ALEXANDRIA, VA 22314-2848			SATANOVSKY, ALEXANDER	
			ART UNIT	PAPER NUMBER
			2857	
			NOTIFICATION DATE	DELIVERY MODE
			12/30/2019	ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MASAYUKI TAKAHAMA, NAOTAKA MIKAMI,
MASASHI INOUE, and YOSHIYUKI HAMAJI

Appeal 2018-007997
Application 12/679,619
Technology Center 2800

Before ADRIENE LEPIANE HANLON, MICHAEL P. COLAIANNI, and
CHRISTOPHER C. KENNEDY, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ appeal under 35 U.S.C. § 134(a) from the Examiner's decision non-finally rejecting claims 1, 2, 4, 5, 7, 9, 11–13, 15–17, 19, 21–26, 28–38, and 40 under 35 U.S.C. § 101 as directed to patent ineligible subject matter. We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We REVERSE.

STATEMENT OF THE CASE

The invention relates to a plant state monitoring method of determining whether or not a plant is normally operated, a computer

¹ Appellant identify Mitsubishi Hitachi Power Systems, LTD. as the real party in interest (Appeal Br. 2).

program used to monitor the state of a plant, and a plate state monitoring apparatus (Cl. 1, 5, 7; Spec. ¶ 1).

Independent claim 1, reproduced below from the Claims Appendix to the Appeal Brief, is illustrative of the subject matter on appeal.

1. A plant state monitoring method performed by a plant state monitoring apparatus, said plant state monitoring method comprising:

acquiring a quantity of operation state of a gas turbine power generation plant via at least one sensor which is provided at the gas turbine power generation plant and coupled to the plant state monitoring apparatus, the quantity of operation state comprising a rotation speed of a gas turbine in the gas turbine power generation plant;

storing the acquired quantity of operation state of the gas turbine power generation plant in a storage unit of the plant state monitoring apparatus;

determining, by a processing unit of the plant state monitoring apparatus, that the gas turbine power generation plant is in a start operation period when the rotation speed is greater than or equal to a lower limit rotation speed and less than a rated rotation speed, and determining that the gas turbine power generation plant is in a load operation period when the rotation speed is greater than or equal to the rated rotation speed, the lower limit rotation speed indicating that the gas turbine is started up, and the rated rotation speed indicating that the gas turbine has started a rated speed operation;

creating, by the processing unit, a first unit space, which is a set of data serving as a standard for determining whether or not the operation state of the gas turbine power generation plant during the start operation period is normal, based on the quantity of operation state of the gas turbine power generation plant during the start operation period;

creating, by the processing unit, a second unit space, which is a set of data serving as a standard for determining

whether or not the operation state of the gas turbine power generation plant during the load operation period is normal, based on the quantity of operation state of the gas turbine power generation plant during the load operation period;

calculating, by the processing unit, a Mahalanobis distance based on the quantity of operation state of the gas turbine power generation plant acquired when the operation state of the gas turbine power generation plant is evaluated;

determining, by the processing unit, whether the operation state of the gas turbine power generation plant is normal or abnormal, based on the Mahalanobis distance and a predetermined threshold value obtained from the first and second unit spaces; and

in response to a determination that the operation state of the gas turbine power generation plant is abnormal, displaying, on a control panel, information relating to abnormality of the operation state of the gas turbine power generation plant,

wherein

said creating the first unit space comprises creating the first unit space based on the quantity of operation state of the gas turbine power generation plant acquired during a first period before a first time when the operation state of the gas turbine power generation plant is evaluated during the start operation period;

the first period precedes the first time by a

first length of time; the first period shifts along with the first time;

said creating the second unit space comprises creating the second unit space based on the quantity of operation state of the gas turbine power generation plant acquired during a second period before a second time when the operation state of the gas turbine power generation plant is evaluated during the load operation period;

the second period precedes the second time by a second length of time; the second period shifts along with the second time;

said creating the first unit space comprises, in response to the first time being advanced forward in time,

shifting the first period forward in time corresponding to the advanced first time,

and

creating the first unit space without considering the quantity of operation state of the gas turbine power generation plant that was acquired and used to create the first unit space before, but no longer falls in the shifted first period; and

said creating the second unit space comprises, in response to the second time being advanced forward in time,

shifting the second period forward in time corresponding to the advanced second time, and

creating the second unit space without considering the quantity of

operation state of the gas turbine power generation plant that was acquired and used to create the second unit space before, but no longer falls in the shifted second period.

The Examiner maintains the rejection of claims 1, 2, 4, 5, 7, 9, 11–13, 15–17, 19, 21–26, 28–38, and 40 under 35 U.S.C. § 101 as being directed to patent ineligible subject matter. The Examiner’s findings and conclusions regarding the § 101 rejection are located on pages 2 to 8 of the Non-Final Action and pages 3 to 10 of the Answer.

The Examiner determines that claims 1, 5, and 7 are directed to the abstract idea of “monitoring an operation state of a gas turbine power generation plant using an algorithm/ mathematical relationship based on the

Mahalanobis distance with regards to a rotation speed of the gas turbine (Non-Final Act. 2). The Examiner finds that the following claim limitations in bold font are related to the abstract idea:

acquiring a quantity of operation state of a gas turbine power generation plant via at least one sensor which is provided at the gas turbine power generation plant and coupled to the plant state monitoring apparatus, the quantity of operation state comprising a rotation speed of a gas turbine in the gas turbine power generation plant:

storing the acquired quantity of operation state of the gas turbine power generation plant in a storage unit of the plant state monitoring apparatus;

determining, by a processing unit of the plant state monitoring apparatus, **that the gas turbine power generation plant is in a start operation period when the rotation speed is greater than or equal to a lower limit rotation speed and less than a rated rotation speed, and determining that the gas turbine power generation plant is in a load operation period when the rotation speed is greater than or equal to the rated rotation speed, the lower limit rotation speed indicating that the gas turbine is started up, and the rated rotation speed indicating that the gas turbine has started a rated speed operation;**

creating, by the processing unit, **a first unit space, which is a set of data serving as a standard for determining whether or not the operation state of the gas turbine power generation plant during the start operation period is normal, based on the quantity of operation state of the gas turbine power generation plant during the start operation period;**

creating, by the processing unit, **a second unit space, which is a set of data serving as a standard for determining whether or not the operation state of the gas turbine power generation plant during the load operation period is normal, based on the quantity of operation state of the gas turbine power generation plant during the load operation period;**

calculating, by the processing unit, **a Mahalanobis distance based on the quantity of operation state of the gas turbine power generation plant acquired when the operation state of the gas turbine power generation plant is evaluated;**

determining, by the processing unit, whether the operation state of the gas turbine power generation plant is normal or abnormal, based on the Mahalanobis distance and a predetermined threshold value obtained from the first and second unit spaces; and

in response to a determination that the operation state of the gas turbine power generation plant is abnormal, displaying, on a control panel, information relating to abnormality of the operation state of the gas turbine power generation plant, wherein said creating the first unit space comprises creating the first unit space based on the quantity of operation state of the gas turbine power generation plant acquired during a first period before a first time when the operation state of the gas turbine power generation plant is evaluated during the start operation period; the first period precedes the first time by a first length of time; the first period shifts along with the first time;

said creating the second unit space comprises creating the second unit space based on the quantity of operation state of the gas turbine power generation plant acquired during a second period before a second time when the operation state of the gas turbine power generation plant is evaluated during the load operation period;

the second period precedes the second time by a second length of time; the second period shifts along with the second time;

said creating the first unit space comprises, in response to the first time being advanced forward in time,

shifting the first period forward in time corresponding to the advanced first time,

creating the first unit space without considering the quantity of operation state of the gas turbine power generation plant that was acquired and used to create the first unit space before, but no longer falls in the shifted first period; and

said creating the second unit space comprises, in response to the second time being advanced forward in time,

shifting the second period forward in time corresponding to the advanced second time, and

creating the second unit space without considering the quantity of operation state of the gas turbine power generation plant that was acquired and used to create the second unit space before, but no longer falls in the shifted second period.

(Non-Final Act. 3 to 6).

The Examiner finds that the non-bolded terms in the copy of claim 1 above are “additional elements” (Non-Final Act. 6). The Examiner finds that the claim recites organizing information through mathematical correlations and is similar to the facts in *Parker v. Flook*, 437 U.S. 584 (1978) (Non-Final Act. 6). The Examiner finds that additional elements in claim 1 include: a sensor, a processing unit, a display unit, a control panel, and a storage unit (Non-Final Act. 7). The Examiner finds that these additional elements are well-understood, routine, and conventional activities previously known to the pertinent industry (Non-Final Act. 7). The Examiner finds that viewed as an ordered combination of elements, these additional claim elements do not add significantly more to the abstract idea so as to transform the abstract idea into a patent eligible application (Non-Final Act. 7). The Examiner finds that these additional elements and/or steps recite a process or apparatus, but at a high level of generality, and/or where the process or apparatus is well-understood, routine, and conventional in the art (Non-Final Act. 7). The Examiner finds that the recitation of a rotation speed of the turbine, and the gas turbine power generation plant is a mere field of use (Non-Final Act. 8).

STATEMENT OF LAW

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, 192 (1981)); “tanning, dyeing, making waterproof cloth, vulcanizing India rubber, smelting ores” (*id.* at 184 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 192 (“We view respondents’ claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula.”). 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. USPTO’s January 7, 2019 Memorandum, *2019 Revised Patent Subject Matter Eligibility Guidance* (“Memorandum”). 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 (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 are 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 Memorandum.

OPINION

Step 1

Appellant argues that the Examiner’s factual findings are flawed from the outset because the Examiner failed to consider step 1 of the *Alice/Mayo* analysis (Appeal Br. 23). Specifically, the Examiner does not find whether the claims are directed to a process, machine, manufacture, or composition of matter (Appeal Br. 23).

The Examiner responds that on page 7 of the Non-Final Action, the Examiner made findings that the claims were directed to an apparatus and process (Ans. 11). Appellant further contends that the portion referred to by the Examiner concerns the additional elements, not the initial patent

eligibility inquiry (i.e., step 1 in the *Alice/Mayo* analysis) (Reply Br. 8).

Although the Examiner's analysis seems a bit out of order, we find that the Examiner considered the claims as a whole and found that the claims were directed to a process and an apparatus statutory class of invention. The Examiner would not have applied step 2 of the *Alice/Mayo* analysis if the step 1 was not met. Appellant's argument is not persuasive of reversible error.

Step 2A Prong 1

Following the Memorandum, we now determine whether the claims recite a judicial exception. In light of the guidance, we agree with the Examiner that the claims recites "monitoring an operation state of a gas turbine power generation plan using [a] . . . mathematical relationship based on the Mahalanobis distance with regards to a rotation speed of the gas turbine" (Non-Final Act. 2). The Examiner's bolding of the claim limitations that represent the abstract idea of a mathematical relationship is listed earlier in this decision. Although, Appellant argues that the claims are not "directed to" an abstract idea in view of *McRO Inc. v. Bandai Namco Games America, Inc.*, 837 F.3d 1299 (Fed. Cir. 2016), the court's ultimate determination is based on what the claim is "directed to" (i.e., a final conclusion as to the scope of the claim). According to the Memorandum, at step 2A, prong 1 we decide only if the claim recites a judicial exception. We find that the Examiner properly finds that the claim's calculation of a Mahalanobis distance as part of the algorithm and, thus, recites an abstract idea of a mathematical relationship. We understand that calculating a Mahalanobis distance is related to statistical methods for determining the

distance between a data point and distribution of data, which is based on mathematical relationships.

Step 2A Prong 2

We next determine if the claim is integrate into a practical application. Appellant argues that as in the case of *McRO Inc. v. Bandai Namco Games America, Inc.*, 837 F.3d 1299 (Fed. Cir. 2016), the present claims do not recite an abstract idea (Appeal Br. 23). Appellant contends that the steps recited in claim 1 are directed to an improvement in computer-related technology (Appeal Br. 25). Appellant argues that the Specification discloses that the claimed subject matter improves, in non-limiting embodiments, another technology (i.e., gas turbine power generation) (Appeal Br. 25). Appellant argues that more than a generic computer is required to perform the recited functions because the recited activities in the claim are not previously known to the industry as evident by the lack of a rejection based on prior art (Appeal Br. 25). The claimed invention allows a person to accurately determine whether the operation state of a plant is normal or abnormal when a start operation is performed under operation conditions different from those when a rated load is applied, and when the performance of an apparatus decreases over time within an allowable range (Appeal Br. 25). Appellant contends that claim 1 recites a solution to a particular problem, as opposed to merely a claim to the idea of a solution or outcome (Appeal Br. 26). Appellant argues that claim 1 recites a particular solution based upon sensing the rotation speed of a gas turbine, determining particular operation periods based upon particular rotation speeds, creating first/second unit spaces within particular first and second periods that are

shifted in a particular manner, and calculating a Mahalanobis distance and determining whether the operation of the gas turbine power generation plant is normal or abnormal (Appeal Br. 26). Appellant contends that the patent-ineligible claim in *Electric Power Group LLC v. Alstom, S.A.*, 830 F.3d 1350 (Fed. Cir. 2016), did not recite any particular parameter for evaluation, or any particular operation periods or time periods that are determined in a particular manner unlike the present claims (App. Br. 27).

Appellant argues that like *McRO* the instant application recites an ordered combination of claimed steps, using unconventional rules that improve the computer itself and the claims are not directed to an abstract idea (Appeal Br. 27). Appellant contends that the unconventional rules include the “shifting” steps recited in the claim 1 where the first time period (or second time period) is shifted forward in time corresponding to the advanced first time (or second time) and then creating a first (or second) unit space without considering the quantity of operation state of the gas turbine power generation plant (Appeal Br. 27–28). Appellant argues that the computer itself is improved by using the unconventional shifting steps in claim 1 that reduce the storage area necessary for the device and make it possible to use the computer hardware sources (Appeal Br. 30).

The Examiner finds that the court in *McRO* found that the claims were directed to an abstract idea similar to concepts previously found abstract by the courts (Ans. 17). The Examiner finds that unlike *McRO*, the current claims are not directed to an improvement in computer-related technology (Ans. 17). The Examiner finds that the claims are not focused on the specific means or method that improves the relevant technology (Ans. 17). The Examiner finds that the claimed invention does not improve other

technology because no particular technology or technological process is recited that would make the claims qualify as “significantly more” than the abstract idea by reciting features pertinent to such a particular technology or technological process in a manner analogous to a rubber molding technology in *Diamond v. Diehr*, 450 U.S. 175 (1981) (Ans. 13). The Examiner finds that the facts of this appeal are closest to *Parker v. Flook*, 437 U.S. 584 (1978) (Ans. 15).

Claim 1 is directed to a method of monitoring a gas turbine power generation plant that acquires a quantity of operation state variables comprising the rotation speed of a gas turbine, storing the acquired quantity of operation state in a storage unit, using a processing unit to determine whether the plant is in start-up mode or load operation mode based on the gas turbine rotation speed, creating a first unit space and a second unit space, which is a set of data used to determine whether the plant is operating normally, calculating the Mahalanobis distance and using the distance along with values in the first and second unit space to determine whether the plant is operating normally or abnormally, and displaying the results. Claim 1 further recites the first and second unit spaces are created during first and second periods, respectively. The first period occurs before a first time when the operation state of the gas turbine power generation plant is evaluated during the start operation period (claim 1). The second period occurs before a second time when the operation state of the gas turbine power generation plant is evaluated during a load operation period (claim 1). The first and second periods precede the first and second time by a first length of time (claim 1). The first and second periods shift along with the first and second times (claim 1). Claim 1 recites that shifting the first and

second periods forward in time corresponding to the advanced first time and creating first and second unit spaces without considering the quantity of the operation state of the gas turbine power generation plant that was acquired and used to create the first and second unit spaces, respectively, before, but no longer falls in the shifted first and second periods, respectively (claim 1).

As disclosed in the Specification, it known in the art to use Mahalanobis distances and unit spaces to determine whether an abnormal operation arises in a power plant (§ 3). The prior art method includes a start-up portion and a rated load portion of the power plant cycle together so that a normal operation may be inaccurately characterized as abnormal (§ 3). The prior art method requires a plurality of unit spaces for each season (§§ 3, 64). The plurality of unit spaces take up storage space on the storage unit (§ 64).

In contrast to the prior art method, the Specification describes that “shifting” steps in the claim provide a more accurate determination of whether the plant is operating normally because such shifting permits abnormal weather conditions to be reflected in the unit space determination (Spec. § 84). The Specification discloses that because first and second periods are shifted along, it is not necessary to prepare a plurality of unit spaces (Spec. § 85). Therefore, the shifting steps in the claims reduce the storage area of the unit space in the storage unit 13 provided in the plant state monitoring apparatus (Spec. § 85).

In other words, the claimed method differs from the generic method used to assess a normal operation in a gas turbine power plant. Based on this finding, *Flook* would not apply to the facts because the claimed method differs from the prior art method. *McRO*, 837 F.3d at 1314 (“This [McRO

invention] is unlike *Flook*, *Bilski*, and *Alice* where the claimed computer-automated process and the prior method were carried out in the same way.”). Rather, we find that the ordered combination of steps and apparatus limitations in the claims that include the shifting step are tied to a practical application that provides a beneficial reduction in storage space and better accuracy in determining whether a gas turbine power generation plant is operating normally. As such, Appellant’s claims are similar to the facts in *McRO*. In light of this finding, we find that the claims are patent eligible under § 101 and reverse the Examiner’s rejection.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 2, 4, 5, 7, 9, 11–13, 15–17, 19, 21–26, 28–38, and 40	101	Eligibility		1, 2, 4, 5, 7, 9, 11–13, 15–17, 19, 21–26, 28–38, and 40

REVERSED