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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
14/046,072 10/04/2013 Henry G. Ballard JR. JHN-839-2419 3612

30024 7590 11/02/2018
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Table with 1 column: EXAMINER

MIKUS, JASON

Table with 2 columns: ART UNIT, PAPER NUMBER

3745

Table with 2 columns: NOTIFICATION DATE, DELIVERY MODE

11/02/2018

ELECTRONIC

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte HENRY G. BALLARD JR.,
DOUGLAS FRANK BEADIE, and
JOHN DAVID MEMMER¹

Appeal 2018-002958
Application 14/046,072
Technology Center 3700

Before JOHN C. KERINS, EDWARD A. BROWN, and
ANNETTE R. REIMERS, *Administrative Patent Judges*.

REIMERS, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's decision to reject claims 1–11 and 13–22. Claim 12 has been canceled. We have jurisdiction under 35 U.S.C. § 6(b).

¹ The General Electric Company (“Appellant”) is the applicant as provided under 37 C.F.R. § 1.46 and is identified as the real party in interest. Appeal Brief 3 (“Appeal Br.”), filed Aug. 4, 2017.

We AFFIRM-IN-PART and designate our affirmance of the rejection of claims 1–11 and 13–15 under 35 U.S.C. § 101 as a NEW GROUND OF REJECTION pursuant to our authority under 37 C.F.R. § 41.50(b).

CLAIMED SUBJECT MATTER

The claimed subject matter “relates to clearance control in a turbine, such as a gas turbine.” Spec. ¶ 1; Figs. 1, 2. Claims 1, 8, 16, and 18 are independent.

Claims 8 and 16 are illustrative of the claimed subject matter and recite:

8. A method to design an inner annular shell which houses a rotating axial turbine comprising:

estimating rates of thermal radial expansion for each of the inner annular shell and the axial turbine which includes a turbine wheel and a row of buckets mounted to the wheel;

estimating a clearance between tips of the buckets and an interior surface attached to the inner annular shell aligned with the tips, wherein the clearance is estimated based on the rates of thermal radial expansion;

determining a surface area or volume of at least a portion of a cooling passage in the inner annular shell based on the clearance, and

generating a design of the cooling passage in which the cooling passage has the determined surface area or volume.

16. A method for clearance control in a gas turbine including an inner annular shell housing a turbine wheel supporting a row of turbine buckets, the method comprising:

during a startup stage of the gas turbine, thermally expanding in the inner annular shell at a rate faster than thermally expanding the turbine wheel and the row of turbine buckets;

directing compressed gas through an interior passage of the inner annular shell during the startup operation, and

controlling a clearance between tips of the turbine buckets and an inner surface of the inner annular shell or connected to the inner annular shell, wherein the control of the clearance is achieved, at least in part, based on a surface area and/or volume of the interior passage sized to cause the inner annular shell to achieve the faster thermal expansion, wherein the surface area or volume of the interior passage is configured to achieve the faster thermal expansion.

THE REJECTIONS

- I. Claims 8–11, 13–15, and 22 stand rejected under 35 U.S.C. § 112, second paragraph, for indefiniteness.
- II. Claims 1–11, 13–15, 21, and 22 stand rejected under 35 U.S.C. § 101, as being directed to patent-ineligible subject matter.²
- III. Claims 16–20 stand rejected under 35 U.S.C. § 103 as unpatentable over Bolms (US 7,246,993 B2, issued July 24, 2007) and Nakamura (US 2010/0247298 A1, published Sept. 30, 2010).

ANALYSIS

Rejection I – Indefiniteness

With respect to claim 8, the Examiner finds the phrase “generating a design of the cooling passage in which the cooling passage has the determined surface area or volume” renders the claim indefinite because “[i]t is unclear what is meant by the generation of a design as the

² The Examiner lists claims 1–15, 21, and 22 as being rejected. *See* Non-Final Office Action 5 (“Non-Final Act.”), dated Dec. 29, 2016. However, claim 12 is canceled. *See* Appeal Br. 8 (footnote 1), 15 (Claims App.).

specification does not detail what type of design would be generated,” and “[w]ithout a proper recitation of the type of design that is generated, i.e. blueprint, drawing, [or] printed structure, it is not known what is meant by the generation of a design.” Non-Final Act. 4.

A claim is properly rejected as being indefinite under 35 U.S.C. § 112 second paragraph if, after applying the broadest reasonable interpretation in light of the specification, the metes and bounds of a claim are not clear because the claim “contains words or phrases whose meaning is unclear.” *In re Packard*, 751 F.3d 1307, 1310 (Fed Cir. 2014). Here, we agree with Appellant “[t]he step for generating a design is sufficiently specific to inform a person of ordinary skill in the art that the step is one that generates a design of a cooling passage having a specific surface area or volume” (Appeal Br. 7), and “[t]he rejection wrongly attempts to limit the invention to a specific type of design” (*id.* at 8). The phrase “generating a design” is clear and claim 8 does not limit the type of design, such a consideration relates to the breadth, and not the indefiniteness, of the claim. *SmithKline Beecham Corp. v. Apotex Corp.*, 403 F.3d 1331, 1341 (Fed. Cir. 2005) (breadth is not indefiniteness).

Accordingly, we do not sustain the Examiner’s rejection of claims 8–11, 13–15, and 22, as being indefinite.

Rejection II – Patent-Ineligible Subject Matter

Claims 1–11 and 13–15

Appellant does not offer arguments in favor of claims 2–7, 9–11, and 13–15 separate from those presented for independent claims 1 and 8. *See* Appeal Br. 8–10; *see also* Reply Br. 2–3.³ We select claim 8 as the representative claim, and claims 1–7, 9–11, and 13–15 stand or fall with claim 8.⁴ 37 C.F.R. § 41.37(c)(1)(iv). Appellant presents separate arguments for claims 21 and 22, which are separately addressed below.

In rejecting claim 8 under 35 U.S.C. § 101, the Examiner applies the two-step framework set forth in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 132 S. Ct. 1289, 1296–97 (2012) and reiterated in *Alice Corp. Pty. Ltd. v. CLS Bank International*, 134 S. Ct. 2347, 2355 (2014), which considers, in the first step, whether the claims are “directed to” a patent-ineligible concept, e.g., an abstract idea, and then, in a second step, whether the claims, individually and as an ordered combination, recite an inventive concept—an element or combination of elements sufficient to ensure the claims amount to “significantly more” than the abstract idea and transform the nature of the claims into a patent-eligible concept.

³ Reply Brief (“Reply Br.”), filed Jan. 26, 2018.

⁴ Claim 8 is similar to claim 1 in that both claims recite the steps of “estimating rates of thermal radial expansion,” “estimating a clearance,” and “determining a surface area or volume” or “calculating a volume or a surface area.” Appeal Br. 14–15 (Claims App.). As claim 8 is more limiting by reciting, among other things, “generating a design of the cooling passage in which the cooling passage has the determined surface area or volume,” we select claim 8 as the representative claim. *See id.*

Pursuant to the first step of the *Alice* analysis, the Examiner determines “[c]laim 8 is directed to the abstract idea of estimating, determining, and generating a design,” which entails nothing more than “mathematical functions and/or pure mental steps.” Non-Final Act. 5. The Examiner explains (1) “the estimation and determination function can be considered a purely mathematical operation and is not subject matter eligible for patent protection”; and (2) claim 8 “do[es] not recite specific manipulation of the data in relation to other structure which ties the steps to a practical application.” *Id.*; *see also id.* at 3 (citing *Parker v. Flook*, 437 U.S. 584 (1978)). Pursuant to the second step of the analysis, the Examiner determines claim 8 “do[es] not include additional elements that are sufficient to amount to significantly more than the judicial exception because the estimations and determinations based on said estimations are things that can be routinely performed by a computer or in a person’s head.” *Id.* at 5.

Appellant contends claim 8 is not directed to abstract idea. Appeal Br. 9. More specifically, Appellant contends (1) the Examiner’s characterization of the claimed invention “ignores substantive requirements of [the claims] such as estimating ‘the rate of thermal expansion of each of a stator and rotor’, estimating ‘a clearance between the rotor and stator based on the rates of thermal expansion’, and calculating a volume ‘of at least a portion of a cooling passage in the stator or rotor based on the clearance’”⁵ (*id.*); (2) “[t]he values and estimations are not merely the result of collecting information because the volume and area of the cooling passage does not yet

⁵ These limitations are recited in claim 1 and Appellant notes similar limitations are recited in claim 8. *See* Appeal Br. 9.

exist until the method is performed” (*id.*); (3) “there has been no credible showing that the estimations and calculations recited in the claims can be performed as a mental process by humans” (*id.*); (4) “the claims do not broadly cover a pure mathematical algorithm” and “will not preempt any mathematical algorithm or general method of design” (*id.*); and (5) “the claims are directed to a specific application (a cooling passage in a stator)” (*id.* at 10). *See also* Reply Br. 2–3.

To the extent the Examiner asserts if claim 8 can be performed by a computer then claim 8 is directed to an abstract idea, we agree with Appellant the Examiner’s assertion is a mis-statement of the law. *See* Reply Br. 2. We note, however, the Examiner appears to be asserting if the steps were carried out by a computer, then the functions used by the computer to carry them out are routine and conventional with respect to the *second* step of the analysis. *See* Non-Final Act. 5.

We agree with the Examiner claim 8 is directed to an abstract idea. “[M]ental processes are a subcategory of unpatentable abstract ideas.” *Synopsis, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1146 (Fed. Cir. 2016) (internal citation and quotation marks omitted). Although Appellant notes correctly claim 8 requires steps relating to estimating “the rate of thermal expansion of each of a stator and rotor,” estimating “a clearance between the rotor and stator based on the rates of thermal expansion,” and calculating a volume “of at least a portion of a cooling passage in the stator or rotor based on the clearance,” each of these steps can be performed as a mental process by humans. Even if crediting Appellant’s contention the values and estimations are not merely the result of collecting information, such values and estimations are not precluded in claim 8 from being derived

from a mental process by humans. Although the last step of claim 8 recites “generating a design of the cooling passage in which the cooling passage has the determined surface area or volume,” there is nothing in the claim to require the design to be a physical structure or to require this step to be a physical step. As such, all the steps of claim 8 can be performed as a mental process by humans.

In response to Appellant’s contention claim 8 does not preempt any mathematical algorithm or general method of design, we note although preemption may inform patent ineligibility, its absence does not demonstrate patent eligibility. *See Fair Warning, IP, LLC v. Iatric Sys., Inc.*, 839 F.3d 1089, 1098 (Fed. Cir. 2016). We are not persuaded by Appellant’s preemption argument because for claims covering a patent ineligible concept, preemption concerns “are fully addressed and made moot” by an analysis under the Mayo/Alice framework. *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1379 (Fed. Cir. 2015). The Examiner performs such an analysis in the rejection and we conduct such an analysis under the Mayo/Alice framework *supra*.

To be complete, we address Appellant’s contention claim 8 is directed to a specific application of a cooling passage in a stator and includes details of a process to arrive at a design of a cooling passage. *See Appeal Br. 10*. In regard to the limitation “generating a design of the cooling passage in which the cooling passage has the determined surface area or volume,” we note such “generating” either implements the abstract idea or is merely insignificant post-solution activity. *See Parker v. Flook*, 437 U.S. 584, 590 (1978) (“The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable

process exalts form over substance.”); *cf Mayo*, 132 S. Ct. at 1298 (“Purely ‘conventional or obvious’ ‘[pre]-solution activity’ is normally not sufficient to transform an unpatentable law of nature into a patent-eligible application of such a law”).

For the above reasons, Appellant fails to apprise us of error in the Examiner’s determination claim 8 is directed to patent-ineligible subject matter. Accordingly, we sustain the Examiner’s rejection of claim 8 as being directed to patent-ineligible subject matter. We further sustain the Examiner’s rejection of claims 1–7, 9–11, and 13–15, which fall with claim 8. However, as our reasoning differs from or supplements the Examiner’s, we designate our affirmance as a new ground of rejection under 37 C.F.R. § 41.50(b).

Claims 21 and 22

Claim 21 depends from claim 1 and claim 22 depends from claim 8. Appeal Br. 16 (Claims App.). Claim 21 recites the step of “further comprising forming the cooling passage in the stator or the rotor having the calculated volume or the calculated surface area for the at least a portion of the cooling passage,” and claim 22 recites the step of “further comprising forming the cooling passage in the inner annular shell based on the design of the cooling passage and having the determined surface area or the determined volume of the at least a portion of the cooling passage.” *Id.*

As Appellant points out, claims 21 and 22 require physically forming a cooling passage and the Examiner fails to explain how the positive recitation of a physical element does not affect whether the claim is “directed to” an abstract idea. *See* Appeal Br. 10; Reply Br. 3. We thus do

not sustain the Examiner's rejection of claims 21 and 22 as being directed to patent-ineligible subject matter.

Rejection III – Obviousness over Bolms and Nakamura

The Examiner finds Bolms discloses a method for clearance control in a gas turbine including an inner annular shell housing a turbine wheel supporting a row of turbine bucket, the method comprising: (1) directing compressed gas through an interior passage of the inner annular shell during the startup operation; and (2) controlling a clearance between tips of the turbine buckets and an inner surface of the inner annular shell or connected to the inner annular shell, wherein the control of the clearance is achieved, at least in part, based on a surface area and/or volume of the interior passage sized to cause the inner annular shell to achieve the faster thermal expansion, and wherein the surface area or volume of the interior passage is configured to achieve the faster thermal expansion. Final Act. 6 (citing Bolms col. 1, ll. 18–21; Figs. 1, 6); *see also id.* at 8.

The Examiner acknowledges “Bolms does not explicitly teach thermally expanding the inner annular shell at a rate faster than thermally expanding the turbine wheel and the row of turbine buckets during a startup stage of the gas turbine.” *Id.* at 6; *see also id.* at 8. The Examiner concludes, however, it would be obvious to “modify the method of operation of Bolms to take place during the startup stage of the gas turbine engine to take advantage of the steady state starting temperature of the engine components.” *Id.* at 6; *see also id.* at 8.

Alternatively, the Examiner relies on Nakamura for disclosure of controlling a clearance between tips of the turbine buckets and an inner

surface of the inner annular shell or connected to the inner annular shell, wherein the control of the clearance is achieved, at least in part, based on a surface area and/or volume of the interior passage sized to cause the inner annular shell to achieve the faster thermal expansion, and wherein the surface area or volume of the interior passage is configured to achieve the faster thermal expansion. Final Act. 7 (citing Nakamura Abstract, ¶ 9); *see also id.* at 8. The Examiner concludes it would have been obvious to “modify the clearance control system of Bolms with the explicit teaching of controlling clearance between turbine components as taught in Nakamura for the purpose of affecting the radial expansion of turbine parts during operation.” *Id.* at 7 (citing Nakamura ¶ 13); *see also id.* at 8–9.

Appellant’s contentions, reiterated below, are persuasive. As Appellant points out, Bolms and Nakamura do not disclose the limitations “during a startup stage of the gas turbine, thermally expanding in the inner annular shell at a rate faster than thermally expanding the turbine wheel and the row of turbine buckets” and “the control of the clearance is achieved, at least in part, based on a surface area and/or volume of the interior passage sized to cause the inner annular shell to achieve the faster thermal expansion” as recited in claim 16, and the limitation “a cooling fluid passage internal to the stator having an internal surface area and/or an internal volume sized to cause the stator to expand radially at a faster rate than the radial expansion of the rotor during a startup stage of the turbine,” as recited in claim 18. Appeal Br. 11.

Appellant explains even if the Examiner is correct in stating, in the Answer, Bolms implicitly teaches passive clearance control and Nakamura explicitly teaches turbomachine components can be specifically sized to

affect thermal expansion, “Bolms and Nakamura do not disclose, suggest or provide motivation to size an interior passage such that an annular shell, during turbine startup, expands at a faster rate than the rotating rotor housed in the annular shell.” Reply Br. 5. According to Appellant, the Examiner only establishes there is expansion of components in the turbines of Bolms and Nakamura, without a comparison of the components as claimed (i.e., rates of thermal expansion). Stated differently, even if the Examiner is correct in his findings with respect to the disclosures of Bolms and Nakamura, the Examiner fails to establish the teachings of these references would arrive at the claimed invention, namely causing an inner annular shell or a stator to expand radially at a faster rate than the radial expansion of a turbine wheel or a rotor during a startup stage of the turbine.

Based on the record presented, we thus are persuaded the Examiner erred in rejecting independent claims 16 and 18 as being unpatentable over Bolms and Nakamura. Accordingly, we do not sustain the Examiner’s rejection of claims 16 and 18, and claims 17, 19, and 20 depending therefrom, as being unpatentable over Bolms and Nakamura.

DECISION

We REVERSE the decision of the Examiner to reject claims 8–11, 13–15, and 22 for indefiniteness.

We AFFIRM the decision of the Examiner to reject claims 1–11 and 13–15 under 35 U.S.C. § 101, as being directed to patent-ineligible subject matter and designate the affirmance as a NEW GROUND OF REJECTION.

We REVERSE the decision of the Examiner to reject claims 21 and 22 under § 101, as being directed to patent-ineligible subject matter.

We REVERSE the decision of the Examiner to reject claims 16–20 as unpatentable over Bolms and Nakamura.

FINALITY OF DECISION

This decision contains new grounds of rejection pursuant to 37 C.F.R. § 41.50(b). Section 41.50(b) provides “[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review.” Section 41.50(b) also provides:

When the Board enters such a non-final decision, the Appellant, within two months from the date of the decision, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

(1) *Reopen prosecution.* Submit an appropriate amendment of the claims so rejected or new Evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the prosecution will be remanded to the examiner. The new ground of rejection is binding upon the examiner unless an amendment or new Evidence not previously of Record is made which, in the opinion of the examiner, overcomes the new ground of rejection designated in the decision. Should the examiner reject the claims, appellant may again appeal to the Board pursuant to this subpart.

(2) *Request rehearing.* Request that the proceeding be reheard under § 41.52 by the Board upon the same Record. The request for rehearing must address any new ground of rejection and state with particularity the points believed to have been misapprehended or overlooked in entering the new ground of rejection and also state all other grounds upon which rehearing is sought.

Further guidance on responding to a new ground of rejection can be found in the Manual of Patent Examining Procedure § 1214.01.

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv). *See* 37 C.F.R. § 41.50(f).

AFFIRMED-IN-PART; 37 C.F.R. § 41.50(b)