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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* GABRIEL L. SUCIU, BRIAN D. MERRY, and  
JAMES D. HILL<sup>1</sup>

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Appeal 2018-005731  
Application 14/740,312  
Technology Center 3700

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Before EDWARD A. BROWN, MICHAEL L. HOELTER, 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 1–3, 6–11, 17, 18, and 20–25. Claims 4, 5, 12–16, and 19 have been canceled.<sup>2</sup> We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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<sup>1</sup> United Technologies Corporation (“Appellant”), is the applicant as provided under 37 C.F.R. § 1.46 and is identified as the real party in interest. Appeal Brief 1 (“Appeal Br.”), filed Jan. 3, 2018.

<sup>2</sup> We note that claim 20 improperly depends from canceled claim 19. *See* Appeal Br. 11, Claims App.

CLAIMED SUBJECT MATTER

The claimed subject matter “relates generally to a cooling system for cooling turbine stages in a gas turbine engine, and more specifically to a system for utilizing compressor bleed air to cool at least one turbine stage.” Spec. ¶ 1, Figs. 1–3. Claims 1, 6, and 17 are independent.

Claims 1 and 6 are illustrative of the claimed subject matter and recite:

1. A gas turbine engine comprising:
  - a compressor section having a plurality of compressor stages;
  - a combustor fluidly connected to said compressor section;
  - a turbine section fluidly connected to said combustor section, the turbine section having at least one stage;
  - a compressor bleed structure disposed in one of said plurality of compressor stages and operable to remove air from said compressor stage;
  - a heat exchanger having an input connected to said compressor bleed, and an output connected to an active cooling system of at least one turbine stage;
  - wherein said compressor stage in which the compressor bleed structure is disposed includes airflow at a pressure above a minimum pressure threshold, and wherein said airflow has a temperature above a maximum temperature threshold; and
  - wherein the turbine section includes at least a second stage, and wherein the output of the heat exchanger is connected to an interior passageway of a turbine stator.

6. A gas turbine engine comprising:
  - a compressor section having a plurality of compressor stages;
  - a combustor fluidly connected to said compressor section;
  - a turbine section fluidly connected to said combustor section, the turbine section having at least one stage;
  - a compressor bleed structure disposed in one of said plurality of compressor stages and operable to remove air from said compressor stage;
  - a heat exchanger having an input connected to said compressor bleed, and an output connected to an active cooling system of the at least one turbine stage; andwherein said compressor stage in which the compressor bleed structure is disposed includes airflow at a pressure above a minimum pressure threshold, wherein said minimum pressure threshold is defined as a magnitude of pressure required to prevent backflow of a cooling fluid entering said active cooling system of said at least one turbine stage and wherein said airflow has a temperature above a maximum temperature threshold, wherein the maximum temperature threshold is an upper bound of an optimum cooling temperature range.

### THE REJECTIONS<sup>3</sup>

- I. Claims 24 and 25 stand rejected under 35 U.S.C. § 112(a) as failing to comply with the written description requirement.
- II. Claims 1–3, 7–11, and 22–25 stand rejected under 35 U.S.C. § 112(b) as being indefinite.

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<sup>3</sup> In the Final Office Action, the drawings are objected to under 37 C.F.R. § 1.83(a). *See* Final Office Action 3–4 (“Final Act.”), dated Sept. 22, 2017. However, the objection is not within the jurisdiction of the Board. *See* 37 C.F.R. § 1.181.

III. Claim 6 stands rejected on the ground of non-statutory obviousness-type double patenting as unpatentable over the claims of Suciu (US Application No. 14/729,002, filed June 2, 2015).

IV. Claim 6 stands rejected under 35 U.S.C. § 102(a)(2) as anticipated by Bourassa (US 9,512,780 B2, issued Dec. 6, 2016).

V. Claims 1–3, 7–11, 17, 18, and 20–25 stand rejected under 35 U.S.C. § 103 as unpatentable over Bourassa and Foust (US 8,495,883 B2, issued July 30, 2013).

## ANALYSIS

### *Rejection I – Written Description*

The Examiner finds that the Specification fails to disclose the subject matter of claims 24 and 25. Final Act. 4–5. Appellant does not present arguments directed to the rejection, and thus, has waived any such arguments. *See* Appeal Br. 5–7; Reply Br. 1–2.<sup>4</sup> Accordingly, the rejection is summarily affirmed.

### *Rejection II – Indefiniteness*

#### *Claims 1–3 and 9–11*

The Examiner determines that “[c]laim 1 recites, at line 9, ‘at least one turbine stage’ where it is unclear if the at least one turbine stage is equivalent to the at least one stage of the turbine section of lines 4–5.” Final Act. 5.

Appellant contends that “[t]he claim clearly defines a structure of a turbine having at least one stage, and then refers to connecting to an active

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<sup>4</sup> Reply Brief (“Reply Br.”), filed May 14, 2018.

cooling system of at least one turbine stage.” Appeal Br. 5. As such, Appellant argues that “[t]here is no lack of clarity as to what structure is being defined in the claim.” *Id.*

The Examiner responds that

the limitation “at least one stage” of line 5 may correspond to Stages 1 and 2 and the limitation “at least one turbine stage” of line 9 may correspond to Stage 2, for example, or may correspond to Stage 3. Similarly, the at least one turbine stage of line 9 may also correspond to a turbine stage of another gas turbine engine’s turbine stage. It thus remains unclear whether the “at least one stage” of line 5 and the “at least one turbine stage” of line 9 correspond to the same stage(s) or distinct and different stages.

Ans. 3.<sup>5, 6</sup>

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 that the phrase “at least one turbine stage” would have been understood to refer to the at least one stage of the turbine section that is recited at line 4 of the claim.

Accordingly, the Examiner’s rejection of claim 1, and claims 2, 3, and 9–11 depending therefrom, as being indefinite is not sustained.

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<sup>5</sup> Examiner’s Answer (“Ans.”), dated Apr. 19, 2018.

<sup>6</sup> We note that there is no page 2 in the Examiner’s Answer.

*Claims 7 and 8*

The Examiner determines that “[c]laims 7 and 8 recite ‘approximately 100%’ wherein it is unclear what constitutes *approximately* 100%. It could be 50% or greater, 60% or greater, etc.” Final Act. 5; *see also* Ans. 4–5.

Appellant contends that “one of skill in the art would have understood, and will understand, that the reference to approximately 100% accounts for minor variations due to manufacturing tolerances” and that “the mere presence of the word approximately does not render the claim indefinite.” Appeal Br. 5.

Appellant’s contentions are unpersuasive. As an initial matter, we agree that there is no per se rule that the term “approximately” renders a claim indefinite. However, the courts have held that “[c]laim language employing terms of degree has long been found definite where it provided enough certainty to one of skill in the art when read in the context of the invention.” *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1370 (Fed. Cir. 2014). As the term “approximately” is similar to the term “about,” we note that the courts have held that “[t]he meaning of the word ‘about’ is dependent on the facts of a case, the nature of the invention, and the knowledge imparted by the totality of the earlier disclosure to those skilled in the art. We are also mindful that the word ‘about’ may lead to indefiniteness under § 112, ¶ 2.” *Eiselstein v. Frank*, 52 F.3d 1035, 1040 (Fed. Cir. 1995). Here, the Specification does not define the term “approximately.” *See Spec., passim*. In addition, Appellant directs us to nothing in the Specification that informs an ordinary artisan as to the scope of the term “approximately,” relative to the percentage of gas bled by the compressor which is relevant to claims 7 and 8. As to the possibility that

close prior art can provide evidence as to the scope of the term “approximately” that would be understood to an ordinary artisan, Appellant has not cited any close prior art, which discloses “approximately” relative to a percentage of gas bled by a compressor.

Thus, the rejection of claims 7 and 8 as being indefinite is sustained.

*Claim 22*

The Examiner determines that “[c]laim 22 recites ‘the cooling flow’ without antecedent basis.” Final Act. 6.

Appellant argues that “[b]y virtue of being a cooling channel of an active cooling system, there is necessarily a ‘cooling flow’ through the interior passageway” and that “as it is a single passageway, there cannot be multiple flows.” Appeal Br. 5.

Appellant’s contentions are unpersuasive. We first note that claim 22 and its parent claim 1 do not recite a “cooling channel” or require “a single passageway.” See Appeal Br. 9, 11, Claims App. Further, claim 1 recites the transitional phrase “comprising” and, as the Examiner explains,

[i]t is unclear from the claim language if the cooling flow is related to the airflow or output of the heat exchanger of claim 1, i.e., if the interior passageway is required to be configured to expel the output of the heat exchanger, or if the cooling flow is separate from the output of the heat exchanger configured to expel a separate cooling flow such as a cooling flow of engine oil.

Ans. 4.

Thus, the rejection of claim 22 as being indefinite is sustained.

*Claim 24*

The Examiner determines that “[c]laim 24 recites ‘the optimum cooling temperature range’ without antecedent basis.” Final Act. 6. Appellant does not present arguments directed to this rejection, and thus, has waived any such arguments. Accordingly, the rejection of claim 24 as being indefinite is summarily affirmed.

*Claims 23 and 25*

The Examiner indicates that these claims “are rejected at least by virtue of dependency on one of the claims discussed above.” Final Act. 6. As we find no error in the rejection of claims 22 and 24 for the reasons discussed above, the rejection of claims 23 and 25 as being indefinite is also sustained.

*Rejection III – Obviousness-Type Double Patenting*

Claim 6 is rejected on the ground of non-statutory obviousness-type double patenting. Final Act. 7–8. Appellant states that “[s]hould the Board find the rejections of the remaining claims improper, and should the provisional double patenting rejection ripen, Appellant intends to cancel claim 6.” Thus, Appellant does not present arguments directed to the rejection and has waived any such arguments. Accordingly, the rejection is summarily affirmed.

*Rejection IV – Anticipation by Bourassa*

The Examiner finds that Bourassa discloses a gas turbine engine having all the limitations of claim 6. Final Act. 9–10 (citing Bourassa Figs. 1–3; 7:32–34; 9:30–31). In particular, the Examiner determines that the limitation

*said compressor stage . . . includes airflow at a pressure above a minimum pressure threshold, and wherein said airflow has a temperature above a maximum temperature threshold; wherein said minimum pressure threshold is defined as a magnitude of pressure required to prevent backflow of a cooling fluid entering said active cooling system of said at least one turbine stage*

is a functional limitation and finds that Bourassa’s gas turbine engine “is capable of providing said function in that air must be at a pressure sufficient to move the bleed airflow through the heat exchanger to the active cooling system of the turbine.” Final Act. 9–10 (citing Bourassa 8:16–26, Figs. 2–3). The Examiner determines that the limitation “said airflow has a temperature above a maximum temperature threshold, wherein the maximum temperature threshold is an upper bound of an optimum cooling temperature range” is also a functional limitation and that “Bourassa’s gas turbine engine is capable of supporting an airflow with a temperature greater than an optimum cooling temperature range in that it is designed to cool the bleed airflow at heat exchanger 162 to a lower temperature, i.e. an optimum cooling temperature range.” *Id.* at 10 (citing Bourassa 7:58–8:15; *In re Schreiber*, 128 F.3d 1473, 1477–78 (Fed. Cir. 1997); MPEP. § 2114). Alternatively, the Examiner finds that “[a]s Bourassa teaches substantially identical structure as the claimed invention that is capable of providing the claimed function(s), [c]laim 1 is rejected as anticipated.” *Id.* (citing *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977); MPEP. § 2112.01).

As an initial matter, Appellant contends that “[t]he rejection is incorrect as the [E]xaminer has improperly relied on inherency of a feature that is not inherent in the structure of Bourassa.” Appeal Br. 6. We agree with Appellant that “the test for inherency is not whether a structure ‘is

capable of’ anticipating the claims, but whether the described structure *necessarily* includes the claimed feature.” *Id.* However, the Examiner *also* determines that the limitations at issue are functional limitations and finds that Bourassa’s gas turbine engine is capable of performing the claimed functions. *See* Final Act. 9–10.

Appellant argues that: (1) “[t]he claim includes explicit definitions of the minimum pressure threshold and the maximum temperature threshold”; (2) “[i]n light of the explicitly described thresholds, the maximum temperature threshold and the minimum pressure threshold must both be exceeded by the fluid in the compressor at the bleed stage, and an ‘arbitrary threshold’ of 1 atm is not sufficient to establish anticipation”; (3) “[t]he claim further explicitly defines that the temperature of the compressor stage is above an upper bound of an optimum cooling temperature range”; and

(4) [w]ith regards to the specific structure of Bourassa, the mere fact that Bourassa includes a heat exchanger for cooling the bleed gas does not establish that the bled gas is above a minimum temperature threshold. Indeed, if gas is bled at or near an upper bound of a temperature threshold it may still be beneficial to cool the gas to a lower temperature within the optimum cooling range. In such a case, a heat exchanger would still be present but the claimed feature would not have been met.

Appeal Br. 6.

To the extent that Appellant is arguing Bourassa’s gas turbine engine is not capable of performing the recited function, that argument is unpersuasive. The Examiner correctly points out: (1) “the claims[] and the Specification do[] not set forth what a ‘minimum pressure threshold’ and a ‘maximum temperature threshold’ [are] to mean, comprise, or represent”; (2) “Appellant fails to describe what the claimed ‘minimum pressure threshold’ or the claimed ‘maximum temperature threshold’ is in reference to”; (3)

“[the] air entering the compressor of a gas turbine engine such as Bourassa’s is at ambient conditions,” “[t]he air that enters the compressor is thereafter compressed, necessarily increasing in temperature and pressure,” and “[t]he air which is removed from the compressor and fed to the heat exchanger has been compressed and is therefore at a temperature and pressure above that of the ambient air (i.e., the minimum pressure threshold being the pressure of ambient air *before* it is compressed)”; and

(4) [t]he airflow flowing through the [Bourassa’s] system has an inherent temperature. There is necessarily a first temperature after the airflow is removed from the compressor stage and before the airflow is fed through the cooling heat exchanger and a second (lower) temperature of the airflow after cooling by the heat exchanger upon exiting the (cooling) heat exchanger. Additionally, the airflow must transition from the first temperature to the second temperature within the heat exchanger. These temperatures are necessarily present in the working system of Bourassa. With respect to the rejection over Bourassa, the output of the heat exchanger, i.e. the cooled air, is defined as being at the optimum cooling temperature range which has an upper bound serving as the maximum temperature threshold. The air at the compressor bleed structure is clearly at a temperature greater than the temperature threshold since the function of the Bourassa’s heat exchanger is to cool incoming air from the compressor bleed structure.

Ans. 5–6. Stated differently, the Examiner determines that Bourassa’s gas turbine engine is capable of operating at the claimed pressure and temperature ranges or above or below the claimed pressure or temperature thresholds, and Appellant does not provide evidence or persuasive argument to show that the structure of Bourassa’s gas turbine engine is not capable of operating at those pressure and temperature ranges or above or below those pressure or temperature thresholds.

In summary, and based on the record presented, we are not persuaded the Examiner erred in rejecting independent claim 6 as anticipated by Bourassa. Accordingly, we sustain the Examiner's rejection of claim 6 as anticipated by Bourassa.

*Rejection V – Obviousness over Bourassa and Foust*

*Claims 1–3, 7–11, and 21–25*

Appellant does not offer arguments in favor of dependent claims 2, 3, 7–11, and 21–25 separate from those presented for independent claim 1. *See* Appeal Br. 6–7. We select claim 1 as the representative claim, and claims 2, 3, 7–11, and 21–25 stand or fall with claim 1.

The Examiner finds that Bourassa discloses a gas turbine engine having all the limitations of claim 1 except for the limitation “wherein the output of the heat exchanger is connected to an interior passageway of a turbine stator.” Final Act. 11–12. The Examiner finds that “Foust teaches wherein the output 46b, 46[c], 46d of the heat exchanger 52 is connected to an interior passageway of a turbine stator 26b, 26c, 26d.” *Id.* at 12–13 (citing Foust Fig. 1). The Examiner concludes that it would have been obvious to modify the gas turbine engine of Bourassa “with the active cooling system and associated turbine section taught by Foust wherein the output of the heat exchanger is connected to an interior passageway of a turbine stator in order to provide cooling air to multiple stationary vanes and rotating blades.” *Id.* at 13 (citing Foust 3:53–4:37).

Appellant contends that “Bourassa provides no indication that the turbine stages include interior passages” and that “the internal passages of Foust are expressly designed to utilize compressor exit air.” Appeal Br. 7.

This argument is unpersuasive in that the Examiner relies on Bourassa for disclosing “a compressor bleed structure disposed in one of said plurality of compressor stages and operable to remove air from said compressor stage” (Final Act. 11) and on Foust for disclosing “the output 46b, 46[c], 46d of the heat exchanger 52 is connected to an interior passageway of a turbine stator 26b, 26c, 26d” (*id.* at 13). *See In re Keller*, 642 F.2d 413 (CCPA 1981); *In re Merck & Co.*, 432 F.3d 261 (Fed. Cir. 1986); *see also* Ans. 7.

Appellant argues that “[o]ne of skill in the art, having the benefit of the teachings of Foust would not have found it obvious to incorporate the interior cooling passages of Foust, which are designed to work with compressor exit air, in the system of Bourassa which does not provide compressor exit air.” Appeal Br. 7; *see also* Reply Br. 1–2.

In this case, the Examiner finds that it would have been obvious to modify the gas turbine engine of Bourassa with the teachings of Foust “to provide cooling air to multiple stationary vanes and rotating blades.” Final Act. 13. Appellant does not provide evidence or persuasive argument as to why Bourassa’s gas turbine engine would not operate if cool air is directed to an interior passageway of a turbine stator. *See In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997) (“[A]ttorney argument [is] not the kind of factual evidence that is required to rebut a prima facie case of obviousness”); *see also* Ans. 7.

For these reasons, we sustain the Examiner’s rejection of claim 1 as unpatentable over Bourassa and Foust. We further sustain the rejection of claims 2, 3, 7–11, and 21–25, which fall with claim 1.

*Claims 17, 18, and 20*

Appellant states that “[w]ith regards to claims 17–20, the [E]xaminer again relies on the same combination and the rejection is improper for the same reasons.” Appeal Br. 7.<sup>7</sup> Thus, Appellant relies on arguments presented for claim 1. *See id.* at 6–7

As discussed above, we find no deficiencies in the Examiner’s rejection of independent claim 1. Accordingly, for the same reasons discussed above for claim 1, we likewise sustain the Examiner’s rejection of claims 17, 18, and 20 as unpatentable over Bourassa and Foust.

DECISION

We AFFIRM the decision of the Examiner to reject claims 24 and 25 under 35 U.S.C. § 112(a) as failing to comply with the written description requirement.

We REVERSE the decision of the Examiner to reject claims 1–3 and 9–11 under 35 U.S.C. § 112(b) as being indefinite.

We AFFIRM the decision of the Examiner to reject claims 7, 8, and 22–25 under 35 U.S.C. § 112(b) as being indefinite.

We AFFIRM the decision of the Examiner to reject claim 6 on the ground of non-statutory obviousness-type double patenting.

We AFFIRM the decision of the Examiner to reject claim 6 as anticipated by Bourassa.

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<sup>7</sup> We consider the inclusion of canceled claim 19 to be an inadvertent typographical error.

Appeal 2018-005731  
Application 14/740,312

We AFFIRM the decision of the Examiner to reject claims 1–3, 7–11, 17, 18, and 20–25 as unpatentable over Bourassa and Foust.

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

AFFIRMED