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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte DAVID J. CANDELORI and SAN QUACH

Appeal 2019-003858
Application 14/686,979
Technology Center 3700

Before MICHAEL L. HOELTER, ANNETTE R. REIMERS, and
WILLIAM A. CAPP, *Administrative Patent Judges*.

HOELTER, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals from the Examiner's decision to reject claims 1, 3–8, 10–19, and 21. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as “United Technologies Corporation.” Appeal Br. 1.

CLAIMED SUBJECT MATTER

The disclosed subject matter “relates to a gas turbine engine, and more particularly to turbine blade tip cooling arrangements that may be incorporated into a gas turbine engine.” Spec. ¶ 2. Apparatus claims 1, 10, and 13 are independent. Claim 1 is illustrative of the claims on appeal and is reproduced below.

1. A blade for a gas turbine engine comprising:

an airfoil having a tip with first and second walls radially extending to a terminal end surface at an outermost radial extremity of the tip, the first and second walls respectively adjacent to airfoil pressure and suction sides joined at leading and trailing edges and terminating at the terminal end surface, the first and second walls flush with an exterior airfoil surface providing the airfoil pressure and suction sides, the tip providing a recess having a depth from the terminal end surface of less than 40 mils (1.016 mm), the recess filled with a thermal barrier coating, the recess without any cooling holes, wherein the thermal barrier coating is generally flush with the terminal end surface and extends to the first and second walls.

EVIDENCE

Name	Reference	Date
Tomita	US 5,564,902	Oct. 15, 1996
Bunker	US 6,179,556 B1	Jan. 30, 2001
Updegrove et al (“Updegrove”)	US 6,502,303 B2	Jan. 7, 2003
Halfmann et al. (“Halfmann”)	US 6,974,308 B2	Dec. 13, 2005
Liang	US 8,303,254 B1	Nov. 6, 2012
Lee et al. (“Lee”)	US 2002/0090301 A1	July 11, 2002
Boury et al. (“Boury”)	US 2007/0025857 A1	Feb. 1, 2007
Hada	US 2010/0111704 A1	May 6, 2010

REJECTIONS

Claim 10 is rejected under 35 U.S.C. § 112(a) or 35 U.S.C. § 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement.²

Claims 1, 3–8, 11, and 12 are rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite.

Claims 1, 3, 4, 7, and 11, as far as they are definite and understood, are rejected under 35 U.S.C. § 103 as unpatentable over Halfmann, Bunker, and Liang.

Claims 5 and 6, as far as they are definite and understood, are rejected under 35 U.S.C. § 103 as unpatentable over Halfmann, Bunker, Liang, and Hada.

Claim 8, as far as it is definite and understood, is rejected under 35 U.S.C. § 103 as unpatentable over Halfmann, Bunker, Liang, and Tomita.

Claim 12, as far as it is definite and understood, is rejected under 35 U.S.C. § 103 as unpatentable over Halfmann, Bunker, Liang, and Updegrove.

Claim 10 is rejected under 35 U.S.C. § 103 as unpatentable over Lee, Bunker, and Liang.

Claims 13, 14, and 21 are rejected under 35 U.S.C. § 103 as unpatentable over Boury, Bunker, and Liang.

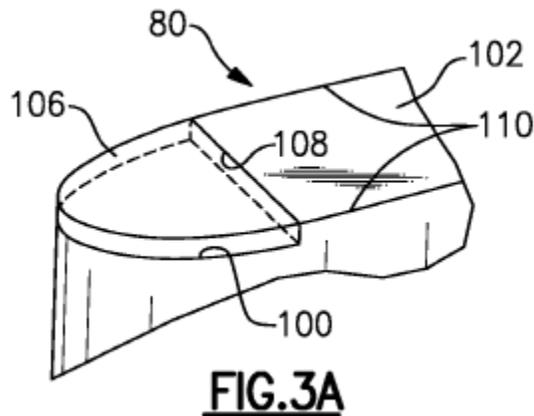
Claims 15–19 are rejected under 35 U.S.C. § 103 as unpatentable over Boury, Bunker, Liang, and Tomita.

² As per the Examiner, “the rejections of claims 16–19 under 35 U.S.C. [§] 112(a) or 35 U.S.C. [§] 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement, are withdrawn.” Ans. 4.

ANALYSIS

*The rejection of claim 10
as failing to comply with the written description requirement*

The Examiner addresses “the last three lines” of independent claim 10 which “recite that the thermal barrier coating extends to ‘at least a portion of the suction side.’” Final Act. 6. The Examiner understands “[t]he scope of the underlined claim language” to include the barrier coating “extending along the entire suction side 88.” Final Act. 6. The Examiner states that this extension along the entirety of the suction side “is not disclosed in the application as originally filed.” Final Act. 6. Appellant disagrees with the Examiner’s rejection stating that the recited barrier coating extending along “at least a portion of the suction side” “is shown in Figure 3A.” Appeal Br. 7. Appellant’s Figure 3A is replicated below.



The above enlarged perspective view from Appellant’s originally filed application illustrates barrier coating 106 located within recess 100 and extending along edge 108 from (near) pressure side to (far) suction side 86, 88 (not shown).

Our reviewing court has provided instruction that “drawings alone may provide a ‘written description’ of an invention as required by § 112.”

Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 1565 (Fed. Cir. 1991). Further, “written description is about whether the skilled reader of the patent disclosure can recognize that what was claimed corresponds to what was described.” *Alcon Research Ltd. v. Barr Labs., Inc.*, 745 F.3d 1180, 1191 (Fed. Cir. 2014). Additionally, and as referenced by Appellant (*see* Appeal Br. 7), “[o]ur case law is clear that an applicant is not required to describe in the specification every conceivable and possible future embodiment of his invention.” *Rexnord Corp. v. Laitram Corp.*, 274 F.3d 1336, 1344 (Fed. Cir. 2001).

In view of Appellant’s Figure 3A, and the above instructions from our reviewing court, it is concluded that one skilled in the art would “recognize that what was claimed corresponds to what was described.” *See above*. Thus, we do not agree with the Examiner that the claimed phrase “at least a portion of” lacks written description support because, as per the Examiner, there is no additional description of the barrier coating “extending along the entire suction side 88.” Final Act. 6. Accordingly, we do not sustain the Examiner’s rejection of claim 10 as failing to comply with the written description requirement.

*The rejection of claims 1, 3–8, 11, and 12
as being indefinite*

The pertinent portion of claim 1 recites, “the first and second walls respectively adjacent to airfoil pressure and suction sides joined at leading and trailing edges and terminating at the terminal end surface.” The Examiner finds that “[i]n amended claim 1, line 4, ‘and terminating’ is unclear as to which element this refers to.” Final Act. 8. This is because “[b]ased on the grammatical structure of the claim, this could refer to the

leading edge, the trailing edge, or the leading and trailing edge,” but notes that “based on previous claim 2, ‘and terminating’ referred to the pressure and suction sides.” Final Act. 8.

Appellant states that “and terminating” refers to the “sides” and not to the “edges.” *See* Appeal Br. 8. Appellant contends that, grammatically speaking, “[t]he leading and trailing edges are not the active nouns in the phrase.” Appeal Br. 8. “Rather, the conjunction (‘and’) shows that the phrase describes two features (‘joined at,’ and ‘terminating at’) of the pressure and suction sides.” Appeal Br. 8. Further, “[t]he specification states ‘[t]he pressure and suction sides terminate at the terminal end surface,’ but makes no analogous statement regarding the leading or trailing edges.” Appeal Br. 8 (referencing Spec. ¶¶ 9, 22).

We agree with Appellant that a construction of this claim language which is also consistent with Appellant’s Specification is a limitation directed to certain walls being adjacent to certain sides, and it is these sides that are “joined at” certain edges and also that terminate at an end surface. In view of the above, and assisted by Appellant’s Specification in this endeavor, we do not find Appellant’s use of “and terminating” to be indicative of indefinite claim language. Accordingly, we do not sustain the Examiner’s rejection of claims 1, 3–8, 11, and 12 as being indefinite.

*The rejection of claims 1, 3, 4, 7, and 11
as unpatentable over Halfmann, Bunker, and Liang*

Appellant argues claims 1, 3, 4, 7, and 11 (i.e., all the claims) together. *See* Appeal Br. 4–6. We select independent claim 1 for review, with the remaining claims standing or falling with claim 1. *See* 37 C.F.R. § 41.37(c)(1)(iv).

Claim 1 recites a recess in the terminal end surface of a blade, with “the recess *filled* with a thermal barrier coating . . . wherein the thermal barrier coating is *generally flush* with the terminal end surface.” Emphasis added. Appellant correctly states, “[a]ll words in a claim must be considered.” Reply Br. 1 (referencing MPEP § 2143.03). Here, we are instructed that words of approximation, such as “generally,” are descriptive terms commonly used in patent claims to avoid mathematical precision or a strict correlation with the specified parameter.³ See *Anchor Wall Sys. v. Rockwood Retaining Walls, Inc.*, 340 F.3d 1298, 1311 (Fed. Cir. 2003). Thus, we understand the above limitation to recite a recess “filled” with a coating, but whose coating is also “generally flush” with the terminal end surface of the blade. In other words, the coating need not completely fill the recess because “generally flush” allows for some difference between the upper surface of the coating and the end surface of an adjoining non-recessed blade portion.⁴

The Examiner primarily relies on Halfmann for disclosing the limitations of claim 1, including a blade “tip providing an unnumbered recess shown near 32” (and depicted in Figures 1 through 6 of Halfmann). Final Act. 9. However, Halfmann does not disclose this recess “filled with a thermal barrier coating” as recited. Final Act. 10. Liang is recited for this teaching with the Examiner specifically identifying “thermal barrier coating 31” in “recess 28” of Liang, both of which are depicted in Figure 4

³ “The claim term ‘generally flush’ is not an exact term, and allows some degree of variation from being exactly flush.” Ans. 7.

⁴ Appellant’s Specification states, “the thermal barrier coating is generally flush with the terminal end surface” and also states that it may be “radially below” or “radially beyond” this terminal end surface. Spec. ¶¶ 16, 27.

thereof. Final Act. 11; *see also* Ans. 5, 6. Thereafter, the Examiner provides a reason to combine Halfmann (as modified by Bunker) with the teachings of Liang. *See* Final Act. 11, Ans. 8.

Appellant contends

it would not have been obvious to modify Halfmann in the way proposed by the Examiner because the cited feature of Bunker is a squealer pocket, and filling a squealer pocket with thermal barrier coating until the coating was generally flush with the terminal end surface would defeat its purpose as a squealer pocket. In other words, if a squealer pocket is filled with thermal barrier coating until the coating is generally flush with the terminal end surface, the airfoil functionally does not have a squealer pocket.

Appeal Br. 4; *see also id.* at 5. Although Appellant's logic appears sound, it behooves us to investigate "the cited feature of Bunker" (i.e., "a squealer pocket") referenced by Appellant above. Bunker teaches that a squealer pocket improves "overall turbine efficiency" (Bunker 2:34–37) while also teaching that the open depth of such a pocket (i.e., "a" or "b" in Bunker Fig. 3) "is in the range between about 0.03 inches to about 0.3 inches." Bunker 3:51–56. For emphasis, 0.03 inches equates to 0.762 mm, or approximately 1/32 of an inch. In view of the above, Appellant does not explain how Bunker, by teaching a squealer pocket of such small depth, fails to likewise disclose a squealer pocket that is also "generally flush" as recited.

Clearly, Liang discloses a squealer pocket filled with a thermal barrier coating (*see* Liang Fig. 4), but Liang fails to provide an indication of the open depth of the pocket (neither does Halfmann). The Examiner addresses this deficiency by noting that Bunker teaches the above recess range. *See* Final Act. 11, Ans. 5, 8. The Examiner further notes that "[c]laim 1 does not

require that the measurement of the depth of the recess includes the thermal barrier coating depth or thickness, as Appellant’s argument suggests.”⁵

Ans. 9. Instead, as claim 1 is understood, although the depth of the recess may vary, the coating is to fill the recess to such an extent that the exposed surface of the coating is “generally flush with the terminal end surface” of the blade. Liang teaches filling a pocket while Bunker teaches an open depth of such pocket.⁶ *See* Final Act. 10–11. As such, Appellant does not explain how the cited combination fails to satisfy the above limitation, i.e., “the recess filled with a thermal barrier coating . . . wherein the thermal barrier coating is generally flush with the terminal end surface” of the blade.

Appellant argues that “it would not have been obvious to use the measurements taken from Bunker with the thermal barrier coating of Liang because applying [] Liang’s thermal barrier coating as the Examiner proposes would change the effective depth of Bunker’s squealer tip.”

Appeal Br. 5. In other words, according to Appellant, a skilled person “would have used a deeper squealer cavity than disclosed in Bunker.”

Appeal Br. 5. Appellant’s argument is not persuasive because Bunker’s depth values “a” and “b” are measures of the open depth of the squealer pocket and do not take into account the thickness of any material that may have been located within the pocket to bring the pocket up to this open

⁵ Appellant argues, “[a]dding a thermal barrier coating to the cavity of Bunker would decrease the depth of the cavity.” Reply Br. 2.

⁶ Appellant argues that “Liang does not disclose ‘the recess filled with a thermal barrier coating,’” and thus “the recess is not filled.” Reply Br. 2. However, Appellant is addressing this “filled” limitation in a vacuum and is not also taking into account the following claim language regarding the coating also being “generally flush” as addressed in our claim construction discussion above.

depth. *See* Bunker Fig. 3. In other words, neither measurement addresses the thickness of a material that may have filled a deeper recess to this open depth value. Further, Appellant does not present any argument that the recited arrangement has an effect on air flow or turbine operation different from that resulting from the above combination of Halfmann, Bunker, and Liang. Accordingly, we sustain the Examiner's rejection of claims 1, 3, 4, 7, and 11 as being obvious in view of Halfmann, Bunker, and Liang.

The rejection of (a) claims 5 and 6 as unpatentable over Halfmann, Bunker, Liang, and Hada; (b) claim 8 as unpatentable over Halfmann, Bunker, Liang, and Tomita; and, (c) claim 12 as unpatentable over Halfmann, Bunker, Liang, and Updegrove

Appellant does not separately argue these rejections, only stating that “[n]one of Hada, Tomita, and Updegrove correct the problems with Halfmann, Bunker, and Liang as applied to claim 1.” Appeal Br. 6. Accordingly, we sustain the rejections of these claims.

*The rejection of claim 10
as unpatentable over Lee, Bunker, and Liang*

Appellant contends, “[a]s explained above with regard to claims 1 and 13, a skilled person would use a deeper recess than disclosed in Bunker to account for the thickness of Liang's thermal barrier coating.” Appeal Br. 6. Appellant's argument regarding the combination of Bunker and Liang is not persuasive for the same reasons discussed above. *See also* Ans. 11. We sustain the Examiner's rejection of claim 10 as being obvious over Lee, Bunker, and Liang.

The rejection of (a) claims 13, 14, and 21 as unpatentable over Boury, Bunker, and Liang; and, (b) claims 15–19 as unpatentable over Boury, Bunker, Liang, and Tomita

Appellant presents no argument regarding the rejections of these claims. *See* Appeal Br. *generally*. Accordingly, we sustain these rejections.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
10	112(a)	Written description		10
1, 3–8, 11, 12	112(b)	Indefinite		1, 3–8, 11, 12
1, 3, 4, 7, 11	103	Halfmann, Bunker, Liang	1, 3, 4, 7, 11	
5, 6	103	Halfmann, Bunker, Liang, Hada	5, 6	
8	103	Halfmann, Bunker, Liang, Tomita	8	
12	103	Halfmann, Bunker, Liang, Updegrove	12	
10	103	Lee, Bunker, Liang	10	
13, 14, 21	103	Boury, Bunker, Liang	13, 14, 21	
15–19	103	Boury, Bunker, Liang, Tomita	15–19	
Overall Outcome⁷			1, 3–8, 10–19, 21	

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

⁷ 37 C.F.R. § 41.50(a)(1) states: “The affirmance of the rejection of a claim on any of the grounds specified constitutes a general affirmance of the decision of the examiner on that claim.”

Appeal 2019-003858
Application 14/686,979

AFFIRMED