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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ANDRÉS JOSE GARCIA-CRESPO and
PATRICK DANIEL NOBLE

Appeal 2019-000822
Application 13/532,713
Technology Center 3700

Before DANIEL S. SONG, STEFAN STAICOVICI, and
MICHELLE R. OSINSKI, *Administrative Patent Judges*.

SONG, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

The Appellant¹ appeals under 35 U.S.C. § 134(a) from the Examiner’s Final Office Action (“Final Act.”) rejecting claims 1–4, 7, 9, 10, 14, 16, 21, 23, and 26–32 in the present application. We have jurisdiction under 35 U.S.C. §§ 6(b) and 134(a).

We AFFIRM-IN-PART.

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 the United States Department of Energy. Appeal Brief (“App. Br.”) 2.

The claimed invention is directed to rotor interface geometry in turbomachine composite blades. Spec. ¶ 2. Independent claim 1 illustrative of the invention reads as follows:

1. A system, comprising:

a rotor, comprising:

a first disk post having a first retaining surface formed in an outer surface of the rotor;

a second disk post having a second retaining surface formed in the outer surface of the rotor; and

an axial slot formed in the outer surface of the rotor and disposed between the first and second retaining surfaces; and

a composite blade segment, comprising:

a blade; and

an axial mounting segment coupled to the blade, wherein the axial mounting segment comprises a plurality of laminated plies, and wherein the axial mounting segment comprises:

a first contact face having a first proximal end and a first distal end;

a second contact face having a second proximal end and a second distal end, wherein the first and second proximal ends are configured to be inserted within the axial slot to form a joint, the first and second distal ends are configured to remain outside of the axial slot when the joint is formed, the first and second proximal ends are configured to abut the first retaining surface of the first disk post and the second retaining surface of the second disk post, respectively, when the first and second proximal ends are inserted into the axial slot and when a turbomachine having the composite blade segment is in operation; and

a lower face coupling the first and second proximal ends of the first and second contact faces at respective first and second corners, wherein the lower face has a curved

surface that curves radially away from the blade between the first and second corners, *the first contact face has a first curved surface extending to or adjacent the first corner, and the second contact face has a second curved surface extending to or adjacent the second corner.*

App. Br. 17–18, Claims App. (emphasis added).

REJECTIONS²

The Examiner rejects various claims under pre-AIA 35 U.S.C. § 103(a) as follows:

1. Claims 1–3, 7, 9, 12, 20, 28, and 29 as unpatentable over McCaffrey (US 8,794,925 B2, iss. Aug. 5, 2014) in view of Potter (US 6,857,856 B2, iss. Feb. 22, 2005). Final Act. 3.
2. Claim 4 as unpatentable over McCaffrey in view of Potter and Scope (US 2008/0025843 A1, pub. Jan. 31, 2008). Final Act. 9.
3. Claim 10 as unpatentable over McCaffrey in view of Potter and Subramanian (US 7,597,838 B2, iss. Oct. 6, 2009). Final Act. 10.
4. Claim 14 as unpatentable over McCaffrey in view of Subramanian. Final Act. 12.
5. Claims 21 and 26 as unpatentable over McCaffrey in view of Potter and Wilson (US 4,790,723, iss. Dec. 13, 1988). Final Act. 14.
6. Claim 16 as unpatentable over McCaffrey in view of Subramanian, Potter, and Wilson. Final Act. 16.
7. Claim 23 as unpatentable over McCaffrey in view of Subramanian and Scope. Final Act. 18.

² We number the Examiner’s rejections in the order presented in the Final Office Action. We note that the Appellant utilizes different numbering in the headings within its Appeal Brief to identify the rejections.

8. Claim 27 as unpatentable over McCaffrey in view of Subramanian and Potter. Final Act. 20.

9. Claims 30 and 31 as unpatentable over McCaffrey in view of Scope. Final Act. 22.

10. Claim 32 as unpatentable over McCaffrey in view of Scope and Potter. Final Act. 24.

ANALYSIS

Only those arguments actually made by the Appellant have been considered in this decision. Arguments that the Appellant could have made but chose not to make have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(iv); *In re Jung*, 637 F.3d 1356, 1365–66 (Fed. Cir. 2011); *Ex parte Frye*, 94 USPQ2d 1072, 1075–76 (BPAI 2010 (precedential)).

Rejections 1–3 and 5

The Examiner rejects claims 1–3, 7, 9, 12, 20, 28, and 29 as unpatentable over McCaffrey in view of Potter, finding that McCaffrey discloses a system as substantially claimed in independent claim 1. Final Act. 3–5. The Examiner concedes that “McCaffrey does not explicitly disclose the first contact face has a first curved surface extending to or adjacent the first corner, and the second contact face has a second curved surface extending to or adjacent the second corner.” Final Act. 5; *see also* App. Br. 17–18, Claims App’x. The Examiner relies on Potter, finding that it discloses

wherein the first contact face (i.e. area pointed to by r in figure 4) has a first curved surface extending to or adjacent the first corner (i.e. area where the profile curves down), and the second contact face (i.e. area pointed to by r in figure 4) has a second curved surface extending to or adjacent the second corner (i.e. area where the profile curves down) in order to prevent delamination of composites plies.

Final Act. 5, citing Potter col. 1, ll. 46–63; col. 2, ll. 1–7, 28–33.

The Examiner concludes that it would have been obvious to a person of ordinary skill in the art to have

modif[ied] the first and second contact faces of McCaffrey wherein the first contact face has a first curved surface extending to or adjacent the first corner (i.e. of McCaffrey), and the second contact face has a second curved surface extending to or adjacent the second corner (i.e. of McCaffrey), as taught by Potter.

Final Act. 5.

According to the Examiner, such modification is merely “the use of a known technique (in this case the use of a curved contact face to mount[] a blade segment as taught by Potter), to improve a similar device[] . . . so as to provide an optimum load path for stress by curving the contact face as taught by Potter.” Final Act. 6, citing Potter, col. 1, ll. 52–62.

The Appellant argues that the Examiner’s rejection and reasoning “ignores the teachings of McCaffrey, which specifically discloses that the contact surface 88 forms an angle with respect to the blade root centerline . . . so that ‘all ply transitions upon the attachment ply layer group 84 occur in the compression zone as represented inboard of the line CE.’” App. Br. 8, quoting McCaffrey, col. 5, ll. 4–7; Fig. 5. In that regard, the Appellant points out that McCaffrey discloses that “[i]f the critical interlaminar stress is contained within the ‘compression zone,’ the allowable Interlaminar

Tensile (ILT) and Interlaminar Shear (ILS) stress can be increased by a factor of 5-10. Thus making highly loaded blade attachments possible.” App. Br. 9, quoting McCaffrey, col. 5, ll. 37–48 (emphasis omitted).

The Appellant argues that in contrast, in Potter, “the circular shape of the jacket 112 changes where and how the jacket 112 compresses against the rotary disk 101,” such that “the circular shape of Potter’s blade 100 diffuses and concentrates compressive forces at different points about the jacket 112.” App. Br. 9–10, citing Potter, Fig. 4. According to the Appellant, if McCaffrey is modified in view of Potter as suggested, “McCaffrey would no longer place all ply transitions in the compression zone nor contain the critical interlaminar stress within the compression zone. McCaffrey therefore teaches away from a modification of the shape of the root region 60 as suggested by the Examiner.” App. Br. 10. Thus, the Appellant argues that the suggested modification “would nullify McCaffrey’s teaching of placing all ply transitions in the compression zone and containing the critical interlaminar stress within the compression zone as illustrated in FIGS. 5 and 6” (Reply Br. 4), and “would eliminate the advantages taught by McCaffrey, or in other words the innovation described in McCaffrey.” Reply Br. 3.

We generally agree with the Appellant. “A reference that ‘merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into’ the claimed invention does not teach away.” *Meiresonne v. Google*, 849 F.3d 1379, 1382 (Fed. Cir. 2017) (quoting *Galderma Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 738 (Fed. Cir. 2013)). The Examiner responds McCaffrey merely discloses “a desirable alternative of having a seemingly straight contact surface 88” (Ans. 2), and that it “does not criticize, discredit, or otherwise

discourage the solution claimed.” Ans. 3. However, as the Appellant points out, the disclosure of McCaffrey is not expressing mere general preference, but instead, is focused on providing structure with the compression zone described therein so as to attain the disclosed benefit of reduced stresses. “A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.” *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). In view of the focused disclosure in McCaffrey with respect to the disclosed compression zone that is planar, and the benefits thereof, a person of ordinary skill would have been “led in a direction divergent from the path that was taken by the applicant.” *Id.*

Moreover, the invention of Potter is constructed very differently than the invention of McCaffrey, the attachment mechanism of Potter having a loop 111 formed of continuous matrix layers 20 that surround an insert/core 108, which is received within a jacket 112, and this assembly is inserted into the cavity 130 of the rotary disk 101. *See* Potter, col. 3, l. 61–col. 5, l. 5; col. 4, ll. 21–29, 60–67; Fig. 4. Although the Examiner reasons that the configuration of McCaffrey would be modified to include curved contact surfaces in view of Potter to “provide an optimum load path” (Potter, col. 1, ll. 52–62), it is clear from Potter that the benefit disclosed therein is attributable to the disclosed jacket 112, and not to the curved upper portion of the loop 111. The Examiner further responds that “McCaffrey teaches that other interfaces may be alternatively provided (i.e. see col 5, ll 35-36).” Ans. 3. However, the Appellant is correct that the portion of McCaffrey’s

disclosure relied upon pertains to allowing for different angles of the planar contact surface. *See* Reply Br. 4.

Therefore, in view of the above considerations, we reverse Rejection 1 because it fails to fully consider McCaffrey as would be understood by one of ordinary skill, and the rejection appears to be based on impermissible hindsight. Rejections 2, 3, and 5 rely on the same combination of McCaffrey and Potter, and the Examiner's reliance on tertiary references for limitations set forth in various dependent claims does not remedy the above discussed deficiency in the combination of McCaffrey and Potter. Therefore, these rejections are also reversed.

In summary, Rejections 1–3 and 5 are reversed.

Rejections 4 and 6–8

The Examiner rejects independent claim 14 as unpatentable over McCaffrey in view of Subramanian, finding that McCaffrey discloses a system as substantially claimed, but concedes that McCaffrey does not disclose the recited limitation of claim 14 requiring

one or more first plies of the plurality of laminated plies has the plurality of fibers extending along a first axis, one or more second plies of the plurality of laminated plies has the plurality of fibers extending along a second axis, and the first and second axes are crosswise to one another.

Final Act. 12–13; *see also* App. Br. 20, Claims App'x.

The Examiner relies on Subramanian, finding that it discloses first plies having fibers extending along a first axis, and second plies having fibers extending along a second axis, wherein “the first and second axes are crosswise to one another (i.e. as is known in the art of fibers of a ply, see col

2, ll 55-60 and as further evident by US Patent Application Publication 2007/0031258 paragraph [0016] the known orientating of fibers to tailor mechanical strength).” Final Act. 14.

The Examiner concludes that it would have been obvious to a person of ordinary skill in the art to have modified the mounting segment of McCaffrey so that the first plies are provided with fibers extending along a first axis, and second plies are provided with fibers extending along a second axis, wherein the first and second axes are crosswise to one another,

as taught by Subramanian, as it is noted that the use of a known technique (in this case the use of the orientation of fibers in [] composites as taught by Subramanian), to improve a similar device[] (in this case the use of the orientation of the fibers of McCaffrey so as to tailor the mechanical strength of the composite blade segment) was an obvious extension of prior art teachings.

Final Act. 14.

We agree with the Examiner.

The Appellant argues that although Subramanian discusses fibers, it does not disclose fibers that are crosswise to each other. App. Br. 12.

However, we agree with the Examiner that Subramanian teaches

the formation of three dimensioned fibers within the plies of a composite as part of what is well known in the art and of the formation of composite forms. It is well known in the art, as one having ordinary skills understands, that the strength or overall characteristics of a composite may be manipulated by the orientation of fibers within the composite.

Ans. 5.

Accordingly, considering Subramanian’s explicit disclosure of providing fibers in the through-thickness direction of composites, and 3-D fiber architectures, we agree with the Examiner that orienting fibers in the

claimed manner would have been obvious to one of ordinary skill, and that the application of Subramanian's 3-D fiber teachings to the layers of McCaffrey would result in "having fibers (i.e. of a 3-D form and in each layer) extending along different axes and including crosswise extensions." Ans. 4, citing Subramanian col. 2, ll. 63–65.

The Appellant also argues that Subramanian disparages such fiber providing methods disclosed in the cited passage by stating that they "require trade-offs in in-plane mechanical properties and result in significant increases in fiber and/or manufacturing costs" so as to teach away from using these methods so that a person of ordinary skill in the art would not combine it with McCaffrey. App. Br. 12, quoting Subramanian, col. 2, ll. 63–65 (emphasis omitted); *see also* Reply Br. 5. We disagree. "[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). Acknowledging that using a particular method to orient fibers may involve technical trade-offs and increase cost is merely observing the realities of engineering and manufacturing wherein consideration of such trade-offs are par for the course. *See also In re Farrenkopf*, 713 F.2d 714, 718 (Fed. Cir. 1983) ("That a given combination would not be made by businessmen for economic reasons does not mean that persons skilled in the art would not make the combination because of some technological incompatibility. Only the latter fact would be relevant.").

The Appellant further argues that "it is unclear why one of ordinary skill in the art would want to penetrate McCaffrey's plies with fibers" because "McCaffrey teaches placing all ply transitions in the compression

zone and containing the critical interlaminar stress within the compression zone” such that “McCaffrey does not need fibers that penetrate the plies in order to resist separation of the plies.” Reply Br. 5. However, we first observe that the root region disclosed in McCaffrey appears to already include fibers in that McCaffrey discloses that the blade, which includes the root region, may be made of Ceramic Matrix Composite. McCaffrey, col. 2, ll. 49–51. More importantly, we also observe that McCaffrey’s root region 60 is not only the compression zone, but includes vertically extending portions that would benefit from fibers and orientation thereof. *See* McCaffrey Figs. 2, 4.

Therefore, in view of the above considerations, we affirm the Examiner’s rejection of independent claim 14 as set forth in Rejection 4. The Appellant does not submit separate arguments directed to the limitations of dependent claims depending from independent claim 14, which stand rejected under Rejections 6 and 8. Accordingly, Rejections 6 and 8 are also affirmed.

As to Rejection 7 that rejects dependent claim 23, the Appellant relies on arguments submitted relative to McCaffrey and Scope in response to the Examiner’s rejection of claim 30 (in Rejection 9), and argues that the applied references do not disclose a constant radius that extends to, or is adjacent the first and second corners as required by claim 23. App. Br. 14. However, as discussed in detail *infra* relative to Rejection 9, we find the Appellant’s arguments unpersuasive. Accordingly, we affirm Rejection 7 as well.

In summary, Rejections 4 and 6–8 are affirmed.

Rejections 9 and 10

The Examiner rejects claims 30 and 31 as unpatentable over McCaffrey in view of Scope. Final Act. 22. The Examiner finds that McCaffrey discloses a system as substantially claimed in independent claim 30, but concedes that McCaffrey does not disclose the limitation of claim 30 reciting that “the curved surface of the lower face has a constant radius.” Final Act. 23; *see also* App. Br. 22, Claims App’x. The Examiner finds that Scope disclose mounting of blades wherein the lower curved surface has a constant radius. Final Act. 23; *see also* Scope, Fig. 6.

The Examiner concludes that it would have been obvious to a person of ordinary skill in the art to have modified the lower face of the mounting segment of McCaffrey such that the curved surface of the lower face has a constant radius as claimed, concluding

as taught by Scope, [] it is noted that the use of a known technique (in this case the use of a curve lower face having a constant radius as taught by Scope), to improve a similar device[] (in this case the use of the constant curve lower face of McCaffrey, so as to provide minimum stress in the lower face of blade segment, see Scope paragraph [0030]) was an obvious extension of prior art teachings.

Final Act. 23.

The Examiner further explains that

McCaffrey already teaches a curved lower section extending between corners (see annotated figure 4 of McCaffrey below). The modification of this curving to have a constant radius, as taught by Scope, would extend to these corners (i.e. of that annotated figure 4 of McCaffrey) and for the purpose of minimizing hoop stress in the lower face.

Ans. 6.

The Appellant argues that “Scope does not disclose a constant radius that either extends to or is adjacent the first and second corners,” and instead, “discloses multiple radii between the first and second corners.” App. Br. 13, referring to annotated version of Scope, Fig. 6. Accordingly, the Appellant argues that “Scope is unable to correct the deficiencies of McCaffrey.” App. Br. 13.

We agree with the Examiner. It is clear that McCaffrey discloses a generally arced lower face, which appears to be substantially semi-circular (i.e., arc having a constant radius). *See* McCaffrey Fig. 4; *see also In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979) (drawings can be relied upon for what they reasonably disclose and suggest to one of ordinary skill in the art); *In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972). However, McCaffrey does not explicitly disclose that the arced lower face is in fact, semi-circular. As such, the Examiner relied on Scope for disclosing “a fully semi circular end face 69 would be ideal.” Scope, ¶ 30; Fig. 6. Shaping the arced lower face of McCaffrey to be fully semi-circular (to any extent that it is not semi-circular) would have been “an obvious extension of prior art teachings” (Final Act. 23), and applying the “fully semi circular end face” teaching of Scope to McCaffrey would result in such a fully semi-circular end face extending to the corners of McCaffrey. *See* McCaffrey, Fig. 4.

The Examiner also sets forth alternative bases for concluding that claim 30 would have been obvious based on claim interpretation and comparison of Figures 5 and 6 of Scope. Ans. 6. Although we agree with the Appellant that such bases are unfounded (Reply Br. 6), these alternative bases are not dispositive in view of our agreement with the Examiner for the reasons discussed above.

Therefore, in view of the above considerations, we affirm Rejection 9 as to independent claim 30. The Appellant does not submit separate arguments directed to the limitations of dependent claim 31. Accordingly, claim 31 falls with claim 30. The Appellant also does not submit separate arguments directed to Rejection 10 that rejects claim 32. Accordingly, Rejection 10 is also affirmed.

CONCLUSIONS

1. Rejections 1–3 and 5 are REVERSED.
2. Rejections 4 and 6–10 are AFFIRMED.

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

AFFIRMED-IN-PART