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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte SIVA SIVAKUMARAN and GEIR LEIVSETH

Appeal 2018-002361
Application 12/940,497
Technology Center 3700

Before MICHAEL C. ASTORINO, PHILIP J. HOFFMANN, and
ROBERT J. SILVERMAN, *Administrative Patent Judges*.

SILVERMAN, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant¹ appeals from the Examiner's decision rejecting claims 1, 4, 6, 7, and 9–11. 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 “ANSALDO ENERGIA SWITZERLAND AG” as the real party in interest. Appeal Br. 2.

ILLUSTRATIVE CLAIM

1. A leaf seal located between a higher pressure region and a lower pressure region of a rotary machine, the leaf seal comprising:

an annular housing having an upstream side-cheek and a downstream side-cheek; and

an annular array of resilient leaves arranged between the upstream side-cheek and the downstream side-cheek for forming a seal between a static structure and a rotating component of the machine, the leaves extending from the housing in a first direction that is offset from a radial direction in a second direction of rotation of the rotating component, each leaf having

a radially outer end held within the housing,

a radially inner free end,

an upstream edge adjacent to an inner surface of the upstream side-cheek, and

a downstream edge adjacent to an inner surface of the downstream side-cheek;

wherein at least one of (a) the inner surface of the upstream side-cheek is parallel to the inner surface of the downstream side-cheek, (b) the inner surface of the upstream side-cheek is parallel to the upstream edges of the leaves, and (c) the inner surface of the downstream side-cheek is parallel to the downstream edges of the leaves;

wherein the upstream side-cheek and the downstream side-cheek each extend in the first direction between corresponding first and second ends of the upstream and downstream side-cheeks, respectively, the first end being proximal to the housing and the second end being opposite to the first end and distal from the housing;

wherein the upstream edges of the leaves and the adjacent upstream side-cheek define an upstream gap therebetween, and the downstream edges of the leaves and the

adjacent downstream side-cheek define a downstream gap therebetween;

wherein the upstream gap includes a first upstream gap portion proximate to the first end of the upstream side-cheek, and a second upstream gap portion proximate to the second end of the upstream side-cheek;

wherein the downstream gap includes a first downstream gap portion proximate to the first end of the downstream side-cheek, and a second downstream gap portion proximate to the second end of the downstream side-cheek;

wherein at least one of the inner surface of the upstream side-cheek and the inner surface of the downstream side-cheek is a frustoconical surface that is angled relative to the radial direction so that an apex of the cone is further towards the higher pressure region of the rotary machine than the base of the cone;

wherein the leaf edges adjacent each side-cheek inner surface define a respective similarly-oriented frustocone, wherein:

(i) if the free end of at least one of the leafs moves in the radially outward direction, the upstream gap decreases if the upstream side-cheek inner surface and the adjacent leaf edge are frustoconical, thereby increasing aerodynamic blow-up forces acting on the leaves, and the downstream gap increases if the downstream side-cheek inner surface and the adjacent leaf edge are frustoconical, thereby decreasing the aerodynamic blow-down forces acting on the leaves; and

(ii) if the free end of at least one of the leafs moves in the radially inward direction, the upstream gap increases if the upstream side-cheek inner surface and the adjacent leaf edge are frustoconical, thereby decreasing the aerodynamic blow-up forces acting on the leaves, and the downstream gap decreases if the downstream side-cheek inner surface and the adjacent leaf edge are frustoconical, thereby increasing the aerodynamic blow-down forces acting on the leaves; and

wherein (i) if the free end of the at least one of the leaflets moves in the radially outward direction, the first upstream gap portion of the at least one of the leaflets decreases less than the second upstream gap portion of the at least one of the leaflets, and the first downstream gap portion of the at least one of the leaflets increases less than the second downstream gap portion of the at least one of the leaflets; and

wherein (ii) if the free end of at least one of the leaflets moves in the radially inward direction, the first upstream gap portion of the at least one of the leaflets increases less than the second upstream gap portion of the at least one of the leaflets, and the first downstream gap portion of the at least one of the leaflets decreases less than the second downstream gap portion of the at least one of the leaflets.

REFERENCES

Name	Reference	Date
Grondahl	US 2004/0150165 A1	Aug. 5, 2004
Awtar et al. (“Awtar”)	US 2008/0272553 A1	Nov. 6, 2008

REJECTION

Claims 1, 4, 6, 7, and 9–11 are rejected under 35 U.S.C. § 103(a) as unpatentable over Grondahl and Awtar.

FINDINGS OF FACT

The findings of fact relied upon, which are supported by a preponderance of the evidence, appear in the following Analysis.

ANALYSIS

Independent Claim 1

The Appellant contends that Grondahl fails to teach or suggest the two “wherein” clauses that conclude claim 1:

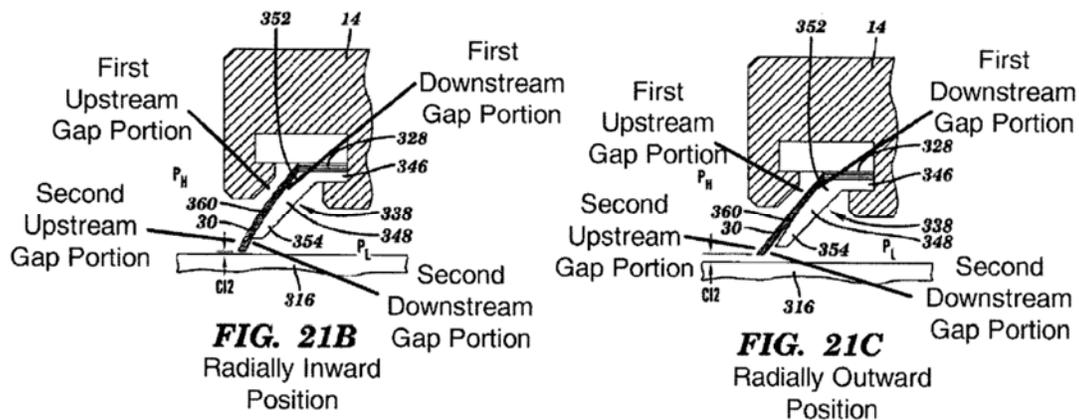
wherein (i) if the free end of the at least one of the leaflets moves in the radially outward direction, the first upstream gap

portion of the at least one of the leafs decreases less than the second upstream gap portion of the at least one of the leafs, and the first downstream gap portion of the at least one of the leafs increases less than the second downstream gap portion of the at least one of the leafs; and

wherein (ii) if the free end of at least one of the leafs moves in the radially inward direction, the first upstream gap portion of the at least one of the leafs increases less than the second upstream gap portion of the at least one of the leafs, and the first downstream gap portion of the at least one of the leafs decreases less than the second downstream gap portion of the at least one of the leafs.

See Appeal Br. 11–16.

The Appellant (*see* Appeal Br. 16, Reply Br. 5–6) and the Examiner (*see* Answer 2, 4–5) agree that the changed disposition of Grondahl’s “leaf seal members 24” having “a free end or portion 30,” from Figure 2B to Figure 2C of Grondahl, illustrates the movement of such elements in a “radially outward direction” (per the first “wherein” clause of claim 1). The Appellant (*see* Appeal Br. 16; Reply Br. 5) and the Examiner (*see* Answer 4) further agree that relevant features are properly identified in the Appellant’s annotated version of Figures 21B and 21C, which is reproduced below:



The foregoing version of Grondahl’s Figures 21B and 21C, as annotated by the Appellant, show the portions of the depicted embodiment that

correspond to the identified claim limitations, with the leaves in a “radially inward” position (Fig. 21B) and a “radially outward” position (Fig. 21C).

With regard to the first part of the first “wherein” clause, claim 1 states: “if the free end of the at least one of the leafs moves in the radially outward direction, the first upstream gap portion of the at least one of the leafs decreases less than the second upstream gap portion of the at least one of the leafs.”

As seen in Figures 21B and 21C, above, the deflections of the free ends of Grondahl’s leaves are larger, proximate their tips, than proximate their “fixed portion[s] 328” (*see* Grondahl ¶ 72). Accordingly, in Grondahl’s Figures 21B and 21C, in “radially outward” movement, the “first upstream gap portion” of the free end of a leaf (being more proximate the fixed end thereof) decreases less than the “second upstream gap portion” of the free end of the leaf (the latter being more proximate the tip thereof). This is what the first part of the first “wherein” clause of claim 1 recites.

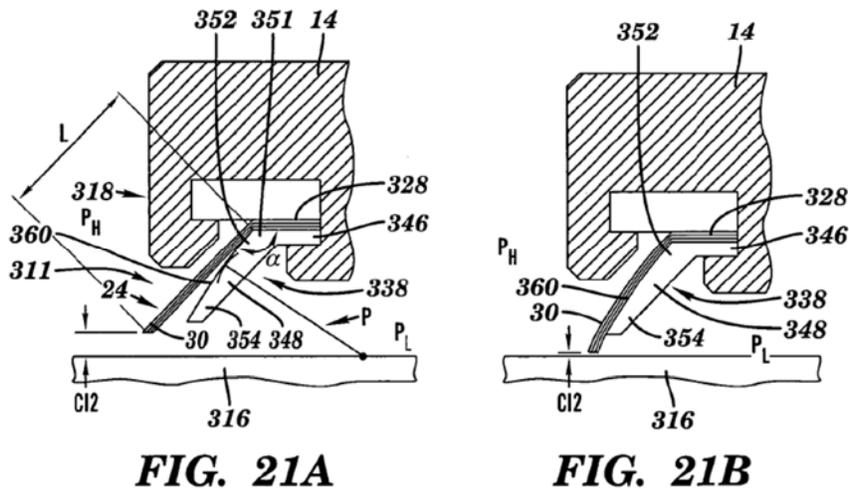
Turning to the second part of the first “wherein” clause, and applying the same condition (i.e., “if the free end of the at least one of the leafs moves in the radially outward direction”), the claim states: “the first downstream gap portion of the at least one of the leafs increases less than the second downstream gap portion of the at least one of the leafs.” In view of the behavior of the portions of the Grondahl leaf, as indicated by Figures 21B and 21C, Grondahl’s “first downstream gap portion” (being more proximate the fixed end) increases less than the “second downstream gap portion” (being less proximate the fixed end). Again, this behavior is what the identified limitation of claim 1 requires.

We now turn to the second “wherein” clause of claim 1:

wherein (ii) if the free end of at least one of the leafs moves in the radially inward direction, the first upstream gap portion of the at least one of the leafs increases less than the second upstream gap portion of the at least one of the leafs, and the first downstream gap portion of the at least one of the leafs decreases less than the second downstream gap portion of the at least one of the leafs.

The Examiner agrees that “the [Appellant] has correctly identified that a transition from Grondahl figure 21A to 21B corresponds to wherein clause[] ‘ii’ in claim 1,” i.e., the circumstance of a leaf that moves “radially inward.”

Answer 2. Figures 21A and 21B of Grondahl are presented below:



Grondahl’s Figures 21A and 21B depict the embodiment with leaves in what the Appellant and the Examiner regard as a “radially outward” position (Fig. 21A) and “radially inward” position (Fig. 21B).

In view of the same identification of features applied above (to Figures 21B and 21C), Figures 21A and 21B show that, in a leaf’s “radially inward” movement, the “first upstream gap portion” of the free end of a leaf (being more proximate the fixed end thereof) increases less than the “second upstream gap portion” of the free end of the leaf (being more proximate the

tip thereof). This is what the first part of the second “wherein” clause of claim 1 recites.

Turning to the second part of the second “wherein” clause, and applying the same condition (i.e., “if the free end of the at least one of the leafs moves in the radially inward direction”), Grondahl’s “first downstream gap portion” (being more proximate the fixed end) decreases less than the “second downstream gap portion” (being less proximate the fixed end). Again, this disposition is what the second portion of the second “wherein” clause of claim 1 requires.

In view of the foregoing analysis, the Appellant does not persuade us of error in the rejection of independent claim 1 under 35 U.S.C. § 103(a).

Dependent Claims 4, 6, 7, and 9–11

The Appellant states that “[d]ependent claims 4, 6, 7 and 9–11 recite additional distinguishing features over the proposed combination of Grondahl and Awtar.” Appeal Br. 17. However, of these claims, the Appellant presents arguments only with regard to dependent claim 11, which recites:

11. A leaf seal according to claim 1, wherein each leaf is formed of a monolithic structure,

wherein each leaf has a continuous, uninterrupted cross-section between the first upstream gap portion and the first downstream gap portion, and

wherein each leaf has a continuous, uninterrupted cross-section between the second upstream gap portion and the second downstream gap portion.

The Appellant contends that neither Grondahl nor Awtar discloses or suggests the features of “each leaf” being “formed of a monolithic structure” and having the claimed “continuous, uninterrupted cross-section[s].”

Appeal Br. 17–19. According to the Appellant, Grondahl fails to meet these limitations, because, “[a]s shown in Figs. 21A–21C of Grondhal [sic], the leafs are individual segments that are sequentially arranged one after another in the aggregate.” *Id.* at 17. As to Awtar, the Appellant argues (Reply Br. 7–8) that Awtar’s “compliant plate member 16,” of Figure 1 thereof, is riven by gaps (“multiple slots 20”) (*see* Awtar ¶¶ 14–15) that preclude satisfaction of the identified limitations of claim 11.

In response to the Appellant’s argument concerning the Grondahl reference, the Examiner states:

[The Appellant’s] analysis appears to examine multiple leaves as if they were one leaf, which is clearly improper as the claim recites “each leaf” individually. In Grondahl, Figures 21A–21C (which *do* show the cross-section in question) . . . show *all of the leaves* of the seal, which creates the stacked structure in the illustrations (*see also*, Figures 15–19 and 24). When examined fairly, *each leaf* in that stack has a continuous, uninterrupted cross-section, which is between the second upstream gap portion and the second downstream gap portion (again, this is the radially outer portion of the leaves). The individual leaves are not interrupted in the axial direction. There are gaps between leaves, but the claim only considers “each leaf”, separately.

Answer 6–7.

We agree with the Examiner’s interpretation of the claim language, and the Examiner’s findings that “each leaf” in the cited portions of Grondahl is “formed of a monolithic structure” and possesses “a continuous, uninterrupted cross-section between the first upstream gap portion and the first downstream gap portion” and “a continuous, uninterrupted cross-section between the second upstream gap portion and the second downstream gap portion.”

Therefore, the Appellant does not persuade us of error in the rejection of dependent claims 4, 6, 7, and 9–11 under 35 U.S.C. § 103(a).

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
1, 4, 6, 7, 9–11	103(a)	Grondahl, Awtar	1, 4, 6, 7, 9–11	

TIME PERIOD FOR RESPONSE

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