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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte GUNNAR LEIF SIDEN and CLINT L. INGRAM

Appeal 2016-002607
Application 13/036,084
Technology Center 3700

Before MICHELLE R. OSINSKI, NATHAN A. ENGELS, and BRENT M. DOUGAL, *Administrative Patent Judges*.

ENGELS, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from a rejection of claims 1, 4, 11, 12, 15, 22, 28, and 31–35. We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

STATEMENT OF THE CASE

According to Appellants' Specification, "[t]he present [A]pplication relates generally to gas turbine engines and more particularly relates to a joint between adjacent annular can combustors to promote mixing of the respective combustion streams downstream thereof before entry into the first stage of the turbine." Spec. ¶ 101. Claim 1, reproduced below, is illustrative of the claimed subject matter:

> 1. A mixing joint for adjacent can combustors of a gas turbine engine, the mixing joint comprising:
>
> a first can combustor with a first combustion flow and a first wall;
>
> a second can combustor with a second combustion flow and a second wall, wherein the first can combustor and the second can combustor meet at a joint between the first wall and the second wall; and
>
> a flow disruption surface positioned between the first wall and the second wall and configured to promote mixing of the first combustion flow and the second combustion flow within a flow mixing region positioned downstream of the first wall and the second wall, wherein the flow disruption surface comprises a first set of spikes defined by a downstream edge of the first wall and a second set of spikes defined by a downstream edge of the second wall.

THE REJECTION

Claims 1, 4, 11, 12, 15, 22, 28, and 31–35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable in view of Brown (US 2,702,454; Feb. 22, 1955); Nakamura et al. (JP 2009-197650; Sept. 3, 2009); Barton et al. (US 7,159,383 B2; Jan. 9, 2007); Shibata et al. (US 6,830,436 B2; Dec. 14, 2004), Brausch et al. (US 6,360,528 B1; Mar. 26, 2002); and Charron et al. (US 2010/0037617 A1; Feb. 18, 2010).

ANALYSIS

Appellants argue the cited combination of references fails to teach or suggest can combustors of a gas turbine engine having a mixing joint with a "flow disruption surface" as claimed in independent claim 1. *See* Appeal Br. 5–6. In relevant part, claim 1 recites a "flow disruption surface . . . compris[ing] a first set of spikes defined by a downstream edge of the first wall and a second set of spikes defined by a downstream edge of the second wall."

The Examiner finds Brown discloses a joint 50 between can combustors having ends that are cut back in an upstream direction thereby "increasing the mixing distance of the flow mixing region." Final Act. 6. The Examiner explains that by increasing the mixing distance, the curved, cut-back shapes of the ends of Brown's adjacent can combustors promote mixing and therefore constitute flow disruption surfaces. Ans. 5. Further, the Examiner concludes it would have been obvious to modify Brown's joint in view of secondary references that teach using spiked edges to affect airflow at a turbine engine's exhaust, explaining:

> improving a particular device (adjacent can combustors having a mixing joint) based upon the teachings of such improvement in Barton, Brausch, Shibata, and Charron, would have been obvious to one of ordinary skill in the art, i.e., applying these known "improvement" techniques in the same manner to the adjacent can combustors having a flow disruption surface of Brown, [as evidenced by] Nakamura, and the results would have been predictable and readily recognized.

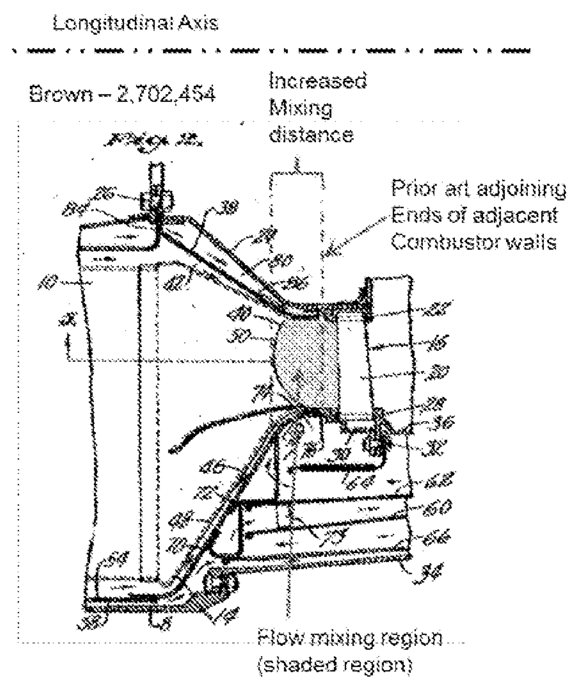
Final Act. 8.

Appellants argue that "[a]lthough some 'natural' mixing may occur due to the increased axial distance between the joint 50 and the first stage turbine nozzle 20 [in Brown], the joint 50 itself does not promote mixing of the respective combustion flows because it is still a blunt joint that induces a wake flow." Appeal Br. 12 (emphasis omitted). According to Appellants, Brown's "blunt joint 50 does not have a shape or include any feature that promotes mixing of the combustion gas flows." Appeal Br. 12.

Consistent with Appellants' argument, Appellants' Specification recognizes that prior art combustor joints have some natural mixing between the joints and the turbine, but the Specification states that "[p]ractically speaking, the axial distance between the exit of the can combustors and the leading edge of a first stage nozzle [of the turbine] is relatively small such that little mixing actually may take place before entry into the turbine." Spec. ¶ 103. Further, the Specification describes the need for an improved combustor joint "without increasing the axial distance between the combustor and the turbine" (Spec. ¶ 105), and Appellants' Specification describes the claimed solution to that problem as a "flow disruption surface" that uses its shape or geometry (e.g., the claimed "sets of spikes") on the downstream edge of the joint itself to enhance mixing (*see* Spec. ¶¶ 123 (describing sets of chevron-like spikes formed by the walls of adjacent can combustors), 126 ("various geometries of the flow disruption surfaces 155 of the mixing joint 150 enhance the mixing of the combustion flows . . . without increasing the axial distance")).

Reading the claimed "flow disruption surface . . . compris[ing] a first set of spikes defined by a downstream edge of the first and a second set of spikes defined by a downstream edge of the second wall" in light of

Appellants' Specification, we conclude that the broadest reasonable interpretation of the claimed "flow disruption surface" does not include a conventionally shaped joint edge that relies on axial distance, instead of the edge's shape, to improve mixing. As depicted in the Examiner's annotated version of Brown's Figure 2, reproduced below, Brown teaches increasing the size of the "flow mixing region" (indicated with shading) by moving combustor joint 50 from the dashed line labeled "prior art adjoining ends of adjacent combustor walls" in an upstream direction resulting in an "increased mixing distance." Final Act. 3 (capitalization omitted). Brown does not, however, describe the shape of the downstream edges of its combustor joints, nor does Brown teach or suggest changing the shape of the downstream edge to affect mixing.



Brown Fig. 2 with Examiner Annotations (Final Act. 3)

Figure 2 of Brown is a longitudinal section view of a portion of a flame tube of a combustor and a turbine nozzle.

Considering the Examiner's rejection of claim 1 in light of Appellants' arguments and the evidence of record, we agree with Appellants that the Examiner has not established that it would have been obvious to a person of ordinary skill to modify the shape of the downstream edge of Brown's joint. Brown and Nakamura recognize the existence of wake downstream from the joint between can combustors, but we find no teaching or suggestion in the cited art that the joint's surface itself may be used to improve mixing. Accordingly, because we disagree with the Examiner's finding that Brown teaches a flow disruption surface, we determine that the Examiner's reasoning as to why one of ordinary skill in the art would have considered an alternative flow disruption surface to be an improvement applicable to Brown's joint (Final Act. 7–8) lacks rational underpinnings. Accordingly, we are persuaded of error in the Examiner's rejection of claims 1, 4, 11, 12, 15, 22, 28, and 31–35.

DECISION

We reverse the Examiner's rejection of claims 1, 4, 11, 12, 15, 22, 28, and 31–35.

REVERSED