The opinion in support of the decision being entered today was ***not*** written for publication and is ***not*** binding precedent of the Board.

Paper No. 33

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JORGEN FERBER and BERNHARD WEIGAND

Appeal No. 2004-1622
Application No. 09/431,178

HEARD: December 9, 2004

Before FRANKFORT, STAAB and MCQUADE, Administrative Patent Judges.

MCQUADE, Administrative Patent Judge.

DECISION ON APPEAL

Jorgen Ferber et al. appeal from the final rejection (Paper No. 20) of claim 1, the sole claim pending in the application.

THE INVENTION

The invention relates to a component, e.g., a turbine blade, having coolant passages for counteracting high thermal loading. Claim 1 reads as follows:

1. A component which can be subjected to high thermal loading and to which a hot-gas flow can be admitted during operation, the component comprising:

at least one hot-gas side for exposure to the hot-gas flow and a cold-gas side not for exposure to the hot-gas flow;

component cooling passages connecting the hot-gas side and the cold-gas side so that when a cooling medium flows from the cold-gas side to the hot-gas side, the cooling medium, when passing through a component passage, absorbs heat from the component and draws off the heat to the hot-gas side;

wherein at least one of the component cooling passages has a length, a hot-side orifice, a cold-side orifice, and a circular cross section over the entire length of the at least one component cooling passage, which cross section increases continuously from the cold-gas side to the hot-gas side, the at least one component cooling passage enclosing an opening half angle so that the at least one component cooling passage is frustoconical;

wherein the opening half angle of the at least one component cooling passage is essentially constant over the length of the passage;

wherein the opening half angle is between 0.2° and 2.5°; and

wherein a ratio of the cross-sectional area of the hot-side orifice of the at least one component cooling passage to the cross-sectional area of the cold-side orifice of the at least one component cooling passage is less than 1.2.

THE EVIDENCE

The item relied on by the examiner as evidence of obviousness is:

Howald	3,527,543	Sep. 08, 1970

The item relied on by the appellants as evidence of non-obviousness is:

The 37 CFR § 1.132 Declaration of Rolf Dittmann filed January 24, 2002 (Paper No. 11).

THE REJECTION

Claim 1 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Howald.

Attention is directed to the main and reply briefs (Paper Nos. 23 and 26) and the answer (Paper No. 24) for the respective positions of the appellants and the examiner regarding the merits of this rejection.[1]

DISCUSSION

[1] In the answer (see page 6), the examiner asserts that the orifices of the instant application (and presumably those set forth in claim 1) are inherently elliptical. This assertion appears to be based on an assumption that the cooling passage orifices are disposed on the airfoil of a turbine blade. Claim 1, however, is not so limited. The underlying specification describes the turbine blade shown in the drawings merely as an example of the sort of component addressed by the appellants, and indicates that portions of the exemplary turbine blade other than the airfoil, such as the blade platform, may contain cooling passages.

As framed and argued by the appellants, the dispositive issue in the appeal is whether Howald would have rendered obvious within the meaning of § 103(a) a component meeting the limitation in claim 1 requiring that "a ratio of the cross-sectional area of the hot-side orifice of the at least one component cooling passage to the cross-sectional area of the cold-side orifice of the at least one component cooling passage is less than 1.2." The appellants do not dispute the examiner's assessment that Howald teaches, or would have suggested, a component meeting the remaining limitations in the claim. Of the ratio in question, the appellants' specification states that

> [i]t proves to be favorable if the discharge cross section of the cooling passage is less than 120% of the inlet cross section, this on the one hand for production reasons, so that the variation in the power density of the cutting beam over the material thickness to be penetrated is kept within practible limits, and in order not require too short a focal width of the collimating optics used [page 8].

The following passage from the Howald reference fairly summarizes the component disclosed therein:

> [b]riefly and in its broader aspects the invention is characterized by a structural member, the "outer" surface of which defines a flow path for a hot gas stream moving therepast at a relatively high velocity. The opposite surface of this member defines, at least in part, a chamber. Means are provided for pressurizing a coolant, preferably air, within this chamber to a pressure somewhat greater than the static pressure of the gas stream flowing therepast. Discrete

> holes [44] are provided through the member so that the coolant may flow from the pressurized chamber to the "outer" surface thereof [column 2, lines 37 through 47].

Howald teaches that "[m]any interrelated factors contribute to the effectiveness of the holes 44 in providing the desired cooling action" (column 5, lines 6 and 7). The factors discussed include the cross-sectional shape of the holes, the diameter of the holes, the angular disposition of the holes relative to the outer surface, the arrangement of the holes on the outer surface, the included angle of the holes, and the length to diameter ratio of the holes (see, for example, column 2, line 53, through column 3, line 15; column 5, lines 7 through 18 and 62 through 68; and column 6, lines 14 through 24).

Although Howald does not mention the ratio of the cross-sectional areas of the hot-side and cold-side orifices as a factor contributing to the effectiveness of the coolant holes, the examiner submits that

> [s]ince the originally filed disclosure of the instant application fails to even mention any criticality associated with the claimed range for the abovementioned ratio of areas, it is reiterated that it would not have been inventive to discover the optimum range or another workable range for the abovementioned ratio of areas by routine experimentation. . . .
>
> It would thus have been obvious at the time of the invention to perform routine experimentation in order to optimize the relative areas of the hot-side orifice and the cold-side orifice of Howald to a particular

> range of values, even to the range of between 1 and 1.2 as claimed by appellants in the instant application, in order to optimize the performance of the structural members or buckets being cooled while achieving particular desired levels of entrainment of cooling within the hot gas boundary layer, for example [answer, page 5].

The examiner's conclusion of obviousness ostensibly rests on the well established principle that the discovery of an optimum value of a variable in a known process is normally obvious, with exceptions occurring where the parameter optimized was not recognized to be a result effective variable or where the results of optimizing a known result effective variable were unexpectedly good. In re Antonie, 559 F.2d 618, 620, 195 USPQ 6, 8-9 (CCPA 1977).

In the present case, it is true that the ratio of the cross-sectional areas of the hot-side and cold-side orifices depends on some of the cooling effectiveness factors, e.g., length and included angle of the hole, mentioned by Howald. Moreover, one of ordinary skill in the art would have expected that changes in these factors made to achieve a desired level of cooling effectiveness would produce corresponding changes in the ratio of the cross-sectional areas of the hot-side and cold-side orifices. Howald, however, does not even mention this ratio, let alone attach any importance thereto, in connection with the design of

the coolant holes, and certainly does not contemplate the specific manufacturing advantage disclosed by the appellants for ratios less than 1.2. Thus, in the absence of impermissible hindsight, Howald does not justify the examiner's implicit conclusion that the ratio of the cross-sectional areas of the hot-side and cold-side orifices is an art-recognized result effective variable relative to cooling effectiveness. Hence, Howald fails to establish a prima facie case of obviousness with respect to the subject matter recited in claim 1.[2] Accordingly, we shall not sustain the standing 35 U.S.C. § 103(a) rejection of this claim.

[2] This being so, it is unnecessary to delve into the merits of the appellants' evidence of non-obviousness.

SUMMARY

The decision of the examiner to reject claim 1 is reversed.

REVERSED

CHARLES E. FRANKFORT Administrative Patent Judge	)	
LAWRENCE J. STAAB Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
JOHN P. MCQUADE Administrative Patent Judge	)	

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REVERSED

September 15, 2005