(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 018 290 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.05.2016 Bulletin 2016/19

(51) Int Cl.:
F01D 5/14 *(2006.01)* ***F01D 5/30*** *(2006.01)*

(21) Application number: **15190456.2**

(22) Date of filing: **19.10.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA

(30) Priority: **05.11.2014 EP 14191932**

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(54) GAS TURBINE BLADE

(57) The invention relates to a gas turbine blade.

The invention starts from a gas turbine blade which comprises a blade platform having a blade trailing edge side, a blade convex side, a blade concave side and a blade leading edge side. A blade profile portion is connected to the blade platform. A groove is formed in the blade trailing edge side of the blade platform, wherein the groove runs form the blade concave side to the blade trailing edge side. The said groove begins on the blade concave side und exits on the blade trailing edge side.

To allow a gas turbine blade with very high thermal and mechanical load capacities, it is proposed in accordance with the invention that the groove (17) comprises a first portion (19) which is curved with respect to a mean camber line (21) of a trailing edge (22) of the blade profile portion (16).

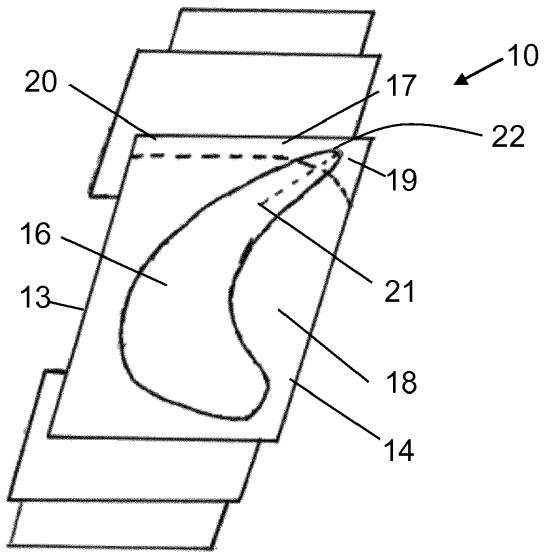

Fig. 2

EP 3 018 290 A1

Description

[0001] The invention relates to a gas turbine blade in accordance with the preamble of claim 1.

[0002] A gas turbine blade is described in US 6,390,775 B1. The said gas turbine blade comprises a blade platform having a blade trailing edge side, a blade convex side, a blade concave side and a blade leading edge side. A blade profile portion is connected to the blade platform. A groove is formed in the blade trailing edge side of the blade platform, wherein the groove runs form the blade concave side to the blade trailing edge side. Such grooves are normally called an "undercut". The said groove begins on the blade concave side und exits on the blade trailing edge side. The groove runs along a straight line and is at an angle of 90 degrees with respect to a mean camber line of a trailing edge of the blade profile portion. The said groove results in a reduced mechanical and thermal stress condition in a root trailing edge of the blade profile portion and a higher stressed condition in the groove. This is possible because the groove is located in a region of cooler metal temperature having greater material fatigue strength.

[0003] In view of this, it is in particular the object of the invention to propose a gas turbine blade with very high thermal and mechanical load capacities. This object is satisfied in accordance with the invention by a gas turbine blade having the features of claim 1.

[0004] The gas turbine blade comprises a blade platform having a blade trailing edge side, a blade convex side, a blade concave side and a blade leading edge side. A blade profile portion is connected to the blade platform. A groove is formed in the blade trailing edge side of the blade platform, wherein the groove runs form the blade concave side to the blade trailing edge side. In accordance with the invention, the groove comprises a first portion which is curved with respect to a mean camber line of a trailing edge of the blade profile portion. This leads advantageously to a very effective transfer of stress to the groove and so to a very low trailing edge stress.

[0005] The first portion of the groove in particular runs in a plane parallel to the surface of the blade platform. But it is also possible that the groove is inclined to said surface. Often the groove comprises not only the first portion, but also a second and perhaps a third portion. But it's also possible that the groove consists only of the first portion.

[0006] In an aspect of the invention, the first portion of the groove runs along a circular arc. The radius of the circular arc in particular is between5 and 20 mm. This leads to a particularly low trailing edge stress.

[0007] In an aspect of the invention, the groove comprises a second portion which runs from the blade convex side to the blade concave side of the blade platform. The second portion of the groove in particular is straight and has a constant depth between 2 and 15 mm. The combination of the first and second portion of the groove leads to a particularly low trailing edge stress. It's also possible that the second portion of the groove is curved.

[0008] The second portion of the groove in particular has a constant height between 4 and 10 mm.

[0009] The second portion of the groove in particular runs in the same plane as the first portion of the groove. It's also possible that there is an third, intermediate section which connects the first and the second portion of the groove.

[0010] An inner part of the groove has for example a substantially round or elliptical cross-section, an outer part of the groove has for example a rectangular cross-section, whereby the outer and inner part of the groove merge into each other. But other forms of cross sections are also possible.

[0011] Further advantages, features and details of the invention result with reference to the following description of embodiments and with reference to the drawings in which elements which are the same or have the same function are provided with identical reference numerals.

[0012] There are shown:

Fig. 1 a side view of a gas turbine blade from a concave side of the turbine blade,

Fig. 2 a top view of the turbine blade of Fig. 1,

Fig. 3 a part of a sectional view of the turbine blade of Fig. 2 and

Fig. 4 a cross-section of a groove of the turbine blade of Fig. 1.

[0013] In accordance with Fig. 1, a gas turbine blade 10 comprises a blade platform 11 having a blade trailing edge side 12, a blade convex side 13 (not visible in Fig. 1, see Fig. 2), a blade concave side 14 and a blade leading edge side 15. A blade profile portion 16 is connected to the blade platform 11. The sides of the blade platform 11 are labeled according to their position relative to the blade profile portion 16. A groove 17 is provided in the blade platform 11, such that the groove runs from the blade concave side 14 to the blade convex side 13. The groove 17 runs in a plane parallel to a surface 18 (see also Fig. 2) of the blade platform 11.

[0014] In accordance with Fig. 2 the groove 17 (indicated as a dotted line) comprises a first portion 19 and a second portion 20. The first portion of the groove 19 begins at the blade concave side 14 and runs along a circular arc, so it is curved with respect to a mean camber line 21 of a trailing edge 22 of the blade profile portion 16. The said circular arc has a radius R (see Fig. 3). The radius R is for example between 5 and 20 mm.

[0015] The first portion of the groove 19 merges into the second portion of the groove 20 which ends at the blade convex side 13. The second portion of the groove 20 runs in the same plane as the first portion of the groove 19. It has a depth t (see Fig. 3 or 4) which lies for example between 2 and 15 mm.

[0016] In accordance with Fig. 4, the second portion of the groove 20 has a cross-section which comprises an inner part 23 with a round cross-section and an outer part 24 with a rectangular cross section. It's also possible that the inner part of the cross section of the second portion of the groove has an elliptical cross section.

[0017] The second portion of the groove 20 has a height h in the direction of the blade profile portion 16) which lies for example between 4 and 10 mm.

[0018] The first portion of the groove 19 has similar cross sections, whereby different cross sections has different depths. The different depths are caused by different outer parts of the groove.

Claims

1. A gas turbine blade comprising:

- a blade platform (11) having
  a blade trailing edge side (12),
  a blade convex side (13),
  a blade concave side (14) and
  a blade leading edge side (15);
- a blade profile portion (16) connected to the blade platform (11);
- a groove (17) formed in the blade trailing edge side (12) of the blade platform (11), wherein the groove (17) runs form the blade concave side (14) to the blade trailing edge side (12),

characterized in that
the groove (17) comprises a first portion (19) which is curved with respect to a mean camber line (21) of a trailing edge (22) of the blade profile portion (16).

2. A gas turbine blade in accordance with claim 1, **characterized in that**
the first portion of the groove (19) runs along a circular arc.

3. A gas turbine blade in accordance with claim 2, **characterized in that**
a radius R of the circular arc is between 5 and 20 mm

4. A gas turbine blade in accordance with claim 1, 2 or 3, **characterized in that**
the groove (17) comprises a second portion (20) which runs from the blade convex side (13) to the blade concave side (14) of the blade platform (11).

5. A gas turbine blade in accordance with claim 4, **characterized in that**
the second portion of the groove (20) has a depth t between 2 and 15 mm.

6. A gas turbine blade in accordance with claim 5, **characterized in that**
the second portion of the groove (20) has a height h between 4 and 10 mm.

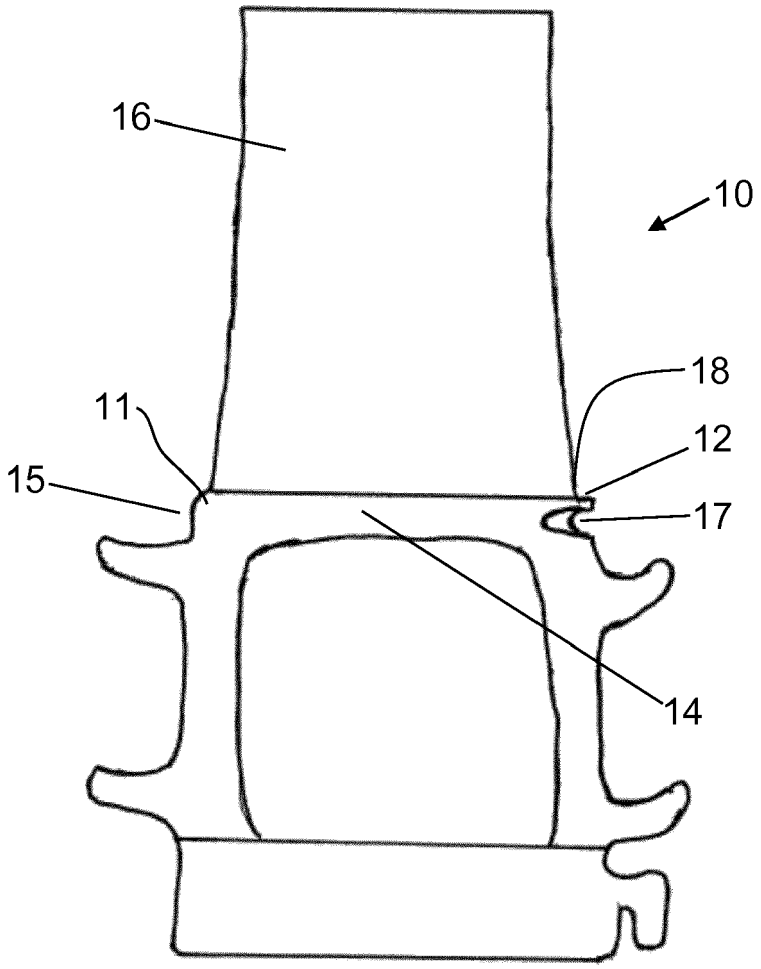

Fig. 1

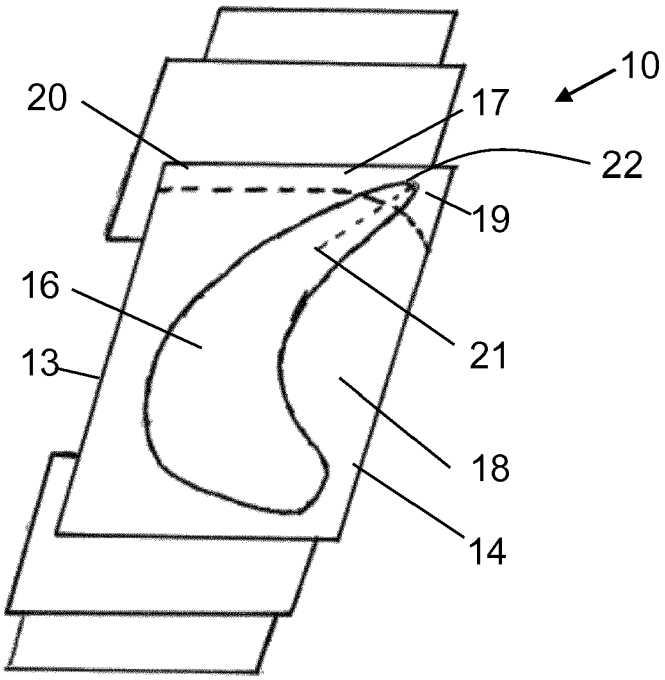

Fig. 2

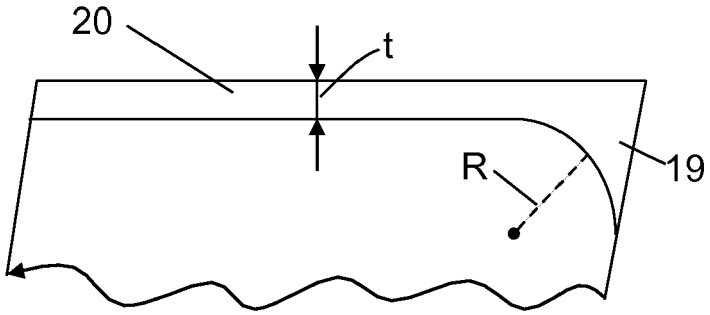

Fig. 3

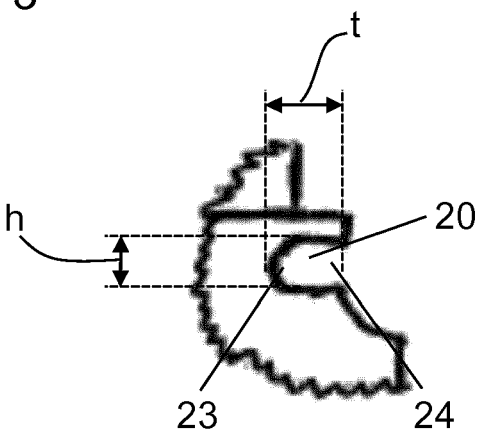

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 0456

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2012/251331 A1 (DIETRICH DOUGLAS JAMES [US] ET AL) 4 October 2012 (2012-10-04) * figures 6-11 * * paragraphs [0025], [0032] *	1-6	INV. F01D5/14 F01D5/30
X,D	US 6 390 775 B1 (PAZ EDUARDO ENRIQUE [US]) 21 May 2002 (2002-05-21) * figures * * column 2, line 45 - line 55 * * column 3, line 24 - line 28 * * column 3, line 31 - line 35 *	1	
A	US 2008/063529 A1 (MILLER WILLIAM JOHN [US] ET AL) 13 March 2008 (2008-03-13) * figures 1-3 *	1-6	

TECHNICAL FIELDS SEARCHED (IPC)

F01D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 March 2016	Georgi, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 19 0456

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02-03-2016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012251331 A1	04-10-2012	US 2012251331 A1	04-10-2012
		WO 2012135512 A1	04-10-2012
US 6390775 B1	21-05-2002	EP 1219778 A2	03-07-2002
		JP 2002213205 A	31-07-2002
		KR 20020053743 A	05-07-2002
		US 6390775 B1	21-05-2002
US 2008063529 A1	13-03-2008	DE 102007042829 A1	27-03-2008
		JP 2008069781 A	27-03-2008
		KR 20080024998 A	19-03-2008
		US 2008063529 A1	13-03-2008

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6390775 B1 **[0002]**