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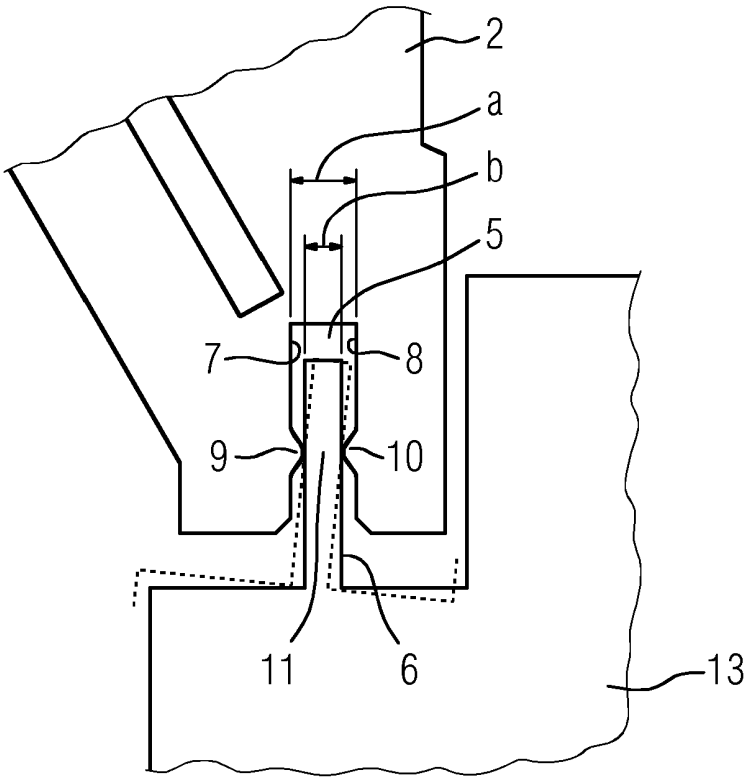
(71) Applicant: **Siemens Aktiengesellschaft**
80333 München (DE)

(72) Inventors:
- **Buchholz, Björn**
  45470 Mülheim an der Ruhr (DE)
- **Gossilin, Ralph**
  46047 Oberhausen (DE)
- **Mattheis, Thorsten**
  45473 Mülheim (DE)
- **Müsgen, Ralf**
  45147 Essen (DE)

(54) **Guide vane and turbine comprising such guide vane**

(57) The present invention relates to a guide vane (1) comprising an inner platform (2), an outer platform (3) and an airfoil (4) extending between the inner platform (2) and the outer platform (3), wherein at least one groove (5) for receiving a sealing means (6) is formed at a side of the inner platform (2) and/or of the outer platform (3), said groove (5) having a predetermined groove width (a), characterized in that opposing side walls (7, 8) of said at least one groove (5) each are formed with at least one curved projection (9, 10), wherein the projections (9, 10) define a gap (11) within said groove (5), whose gap width (b) is smaller than said predetermined groove width (a). Moreover, the present invention relates to a turbine comprising such guide vanes.

FIG 2



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Description

[0001] The present invention relates to a guide vane comprising an inner platform, an outer platform and an airfoil extending between the inner platform and the outer platform, wherein at least one groove is formed at a side of the inner platform and/or of the outer platform facing away from said airfoil for receiving a sealing means, said groove having a predetermined groove width. Moreover, the present invention relates to a turbine having an inner case, an outer case, an annular cavity defined between said inner case and said outer case, and a plurality of guide vanes, which are arranged in said annular cavity, wherein at least one sealing means is provided, which is inserted in the grooves of the guide vanes.

[0002] Guide vanes of the above-mentioned kind are known in prior art. They comprise an inner platform, an outer platform and an airfoil provided in between. In order to seal the platforms of such guide vanes in their intended assembled condition with respect to an inner case or to an outer case of a turbine, it is known to insert at least one sealing means fixed to the inner case or to the outer case into grooves provided at the inner platforms and/or of the outer platforms of the guide vanes. The form of the at least one sealing means and the one of the grooves are adapted to each other, such that the sealing means is firmly held within the corresponding grooves.

[0003] During the operation of a turbine, the inner case, the outer case and the guide vanes are exposed to large forces. These forces create stresses in the guide vanes in particular leading to displacements of the airfoils, because the airfoils have a much lower stiffness than the platforms. In addition, the seals between the cases an the platforms of the guide vanes counteract a natural deformation of the platforms. As a result, the airfoils are subjected to crack formation, in particular in the transient area between the inner platform and the airfoil.

[0004] Starting from this prior art it is an object of the present invention to provide a guide vane and a turbine of the above-mentioned kind having constructions counteracting such a crack formation.

[0005] In order to solve this object the present invention provides a guide vane of the above-mentioned kind, which is characterized in that opposing side walls of said at least one groove each are formed with at least one curved projection, wherein the projections define a gap within said groove, whose gap width is smaller than said predetermined groove width. Thanks to such curved projections a sealing means is received within the groove with clearance, which allows a certain relative movement between the sealing means and the corresponding platform. Such a relative movement reduces deformations of the airfoil because stresses will at least partly be transformed to displacements of the platform. Accordingly a crack formation can be prevented.

[0006] According to one aspect of the present invention, the groove is formed at a side of the inner platform and/or of the outer platform, which faces away from said airfoil. In this way, the guide vane is easy to produce and to assemble.

[0007] Preferably, the projections are arranged opposite to one another. Thus, a sealing means inserted into the groove can perform a defined tilting movement.

[0008] According to one aspect of the present invention each projection extends substantially along the entire length of the groove.

[0009] According to an alternative aspect of the present invention, a plurality of projections is formed on each side wall of said at least one groove, wherein the projections formed on each side wall are spaced apart from each other along the length of the groove.

[0010] Preferably, the projections have a sinusoidal cross section. Such a contour of the cross section has shown a very good performance.

[0011] In order to solve the above-mentioned object the present invention further provides a turbine having an inner case, an outer case, an annular cavity defined between said inner case and said outer case, and a plurality of guide vanes according to the present invention, which are arranged in said annular cavity, wherein at least one sealing means is provided, which is inserted in the grooves of the guide vanes.

[0012] The sealing means is preferably formed in one piece with the inner case or with the outer case. Thus, a simple construction is achieved.

[0013] Advantageously, the at least one sealing means is made of metal. The sealing means may also be provided with a wear-resisting coating, such as aluminum bronze or the like.

[0014] Preferably, the at least one sealing means has a square-cross section. Accordingly, the sealing means is easy to manufacture.

[0015] Further features and advantages of the present invention will become apparent by the following description of an embodiment of the present invention with reference to the accompanying drawing. In the drawing

Figure 1 is a perspective view of a guide vane according to an embodiment of the present invention and

Figure 2 is an enlarged view of detail II in figure 1 in the assembled condition of the guide vane.

[0016] Figure 1 shows a guide vane 1 according to an embodiment of the present invention. The guide vane 1 comprises an inner platform 2, an outer platform 3 and an airfoil 4 extending between the inner platform 2 and the outer platform 3. The inner platform 2 is formed with a longish groove 5 for receiving a sealing means 6 as shown in figure 2. The groove 5 is situated at a side of the inner platform 2 facing away from the airfoil 4. The groove 5 has a predetermined groove width a, wherein the opposing side walls 7 and 8 of the groove 5 each are formed with a curved projection 9 and 10 defining a gap 11 within the groove 5, whose gap width b is smaller than

the predetermined groove width a. The projections 9 and 10 are arranged opposite to one another and have a sinusoidal cross section. The projections 9 and 10 presently extend substantially along the entire length of the groove 5. Alternatively it is also possible to form a plurality of projections on each side wall 7 and 8 of the groove 5, wherein the projections formed on each side wall are spaced apart from each other along the length of the groove 5. Likewise, the outer platform 3 is provided with a groove 12, which is formed correspondingly.

[0017] In its assembled state the guide vane 1 is arranged in an annular cavity formed between an inner case 13 and an outer case (not shown) of a turbine. As shown in figure 2, the inner case 13 is provided with a ring-shaped sealing means 6, which is formed in one piece with the inner case 13. The sealing means 6 has a square cross-section and outwardly projects from the inner case 13. The sealing means 6 is inserted into the groove 5 of the guide vane 1 in order to seal the clearance between the guide vane 1 and the inner case 13, so that gases running through the annular cavity of the turbine cannot pass. The sealing means 6 butts against the projections 9 and 10 of the groove 5 to provide the necessary sealing contact.

[0018] In case of a relative movement between the guide vane 1 and the inner case 13, the sealing means 6 can perform a tilting movement within the groove 12 as shown by the dotted line. Accordingly a certain relative movement between the inner platform 2 of the guide vane 1 and the inner case 13 is permitted. This relative movement leads to reduced stresses of the airfoil 4. Accordingly, the formation of cracks at the airfoil 4 can be prevented.

[0019] It should be noticed, that a corresponding seal can be provided between the outer case and the outer Platforms 3 of the guide vanes 1.

Claims

1. Guide vane (1) comprising an inner platform (2), an outer platform (3) and an airfoil (4) extending between the inner platform (2) and the outer platform (3),
   wherein at least one groove (5) for receiving a sealing means (6) is formed at a side of the inner platform (2) and/or of the outer platform (3), said groove (5) having a predetermined groove width (a),
   characterized in that opposing side walls (7, 8) of said at least one groove (5) each are formed with at least one curved projection (9, 10),
   wherein the projections (9, 10) define a gap (11) within said groove (5), whose gap width (b) is smaller than said predetermined groove width (a).

2. Guide vane (1) according to claim 1,
   characterized in that the groove (5) is formed at a side of the inner platform (2) and/or of the outer platform (3), which faces away from said airfoil (4).

3. Guide vane (1) according to claim 1 or 2,
   characterized in that the projections (9, 10) are arranged opposite to one another.

4. Guide vane (1) according to one of the foregoing claims,
   characterized in that each projection (9, 10) extends substantially along the entire length of the groove (5).

5. Guide vane (1) according to one of the claims 1 to 3,
   characterized in that a plurality of projections (9, 10) is formed on each side wall (7, 8) of said at least one groove (5),
   wherein the projections (9, 10) formed on each side wall (7, 7) are spaced apart from each other along the length of the groove (5).

6. Guide vane (1) according to one of the foregoing claims,
   characterized in that the projections (9, 10) have a sinusoidal cross section.

7. Turbine having an inner case (13), an outer case, an annular cavity defined between said inner case (13) and said outer case, and a plurality of guide vanes (1) according to one of the foregoing claims,
   which are arranged in said annular cavity, wherein at least one sealing means (6) is provided,
   which is inserted in the grooves (5) of the guide vanes (1).

8. Turbine according to claim 7,
   characterized in that the at least one sealing means (6) is formed in one piece with the inner case (13) or with the outer case.

9. Turbine according to claim 7 or 8,
   characterized in that the at least one sealing means (6) is made of metal.

10. Turbine according to one of the claims 7 to 9,
    characterized in that the at least one sealing means (6) has a square cross-section.

FIG 1

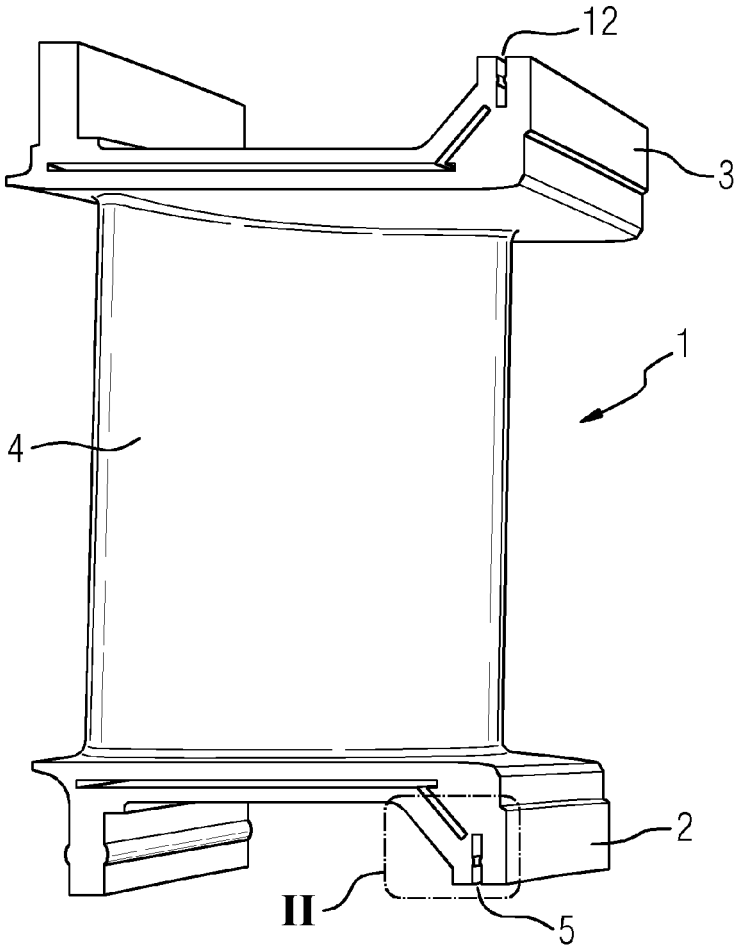
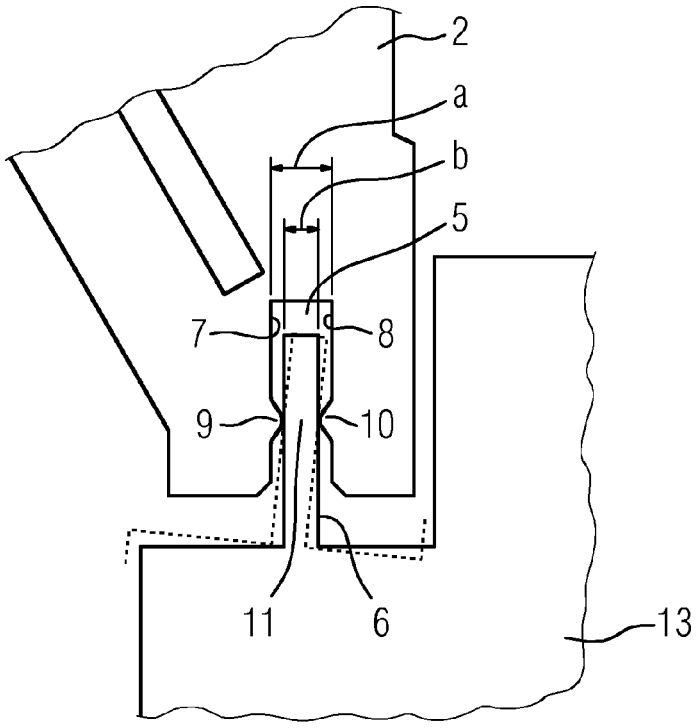


FIG 2



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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 7047

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 January 2015	Teusch, Reinhold

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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