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(54) Turbine blade with locking pin

(57) The present invention relates to a turbine blade (100), comprising an aerofoil (111), a platform (112) and a root portion (101) configured to be slidably received in mounting slots of a rotor disc (102). The blade (100) further comprises a locking member (106) disposed on the root portion (101) and engaged with the rotor disc (102)

to make axial fixation of the blade to the rotor disc. The present invention provides a blade with simple and cost effective axial locking system to axially fix the blade relative to the rotor disc, and also a fail-safe solution during assembly process.

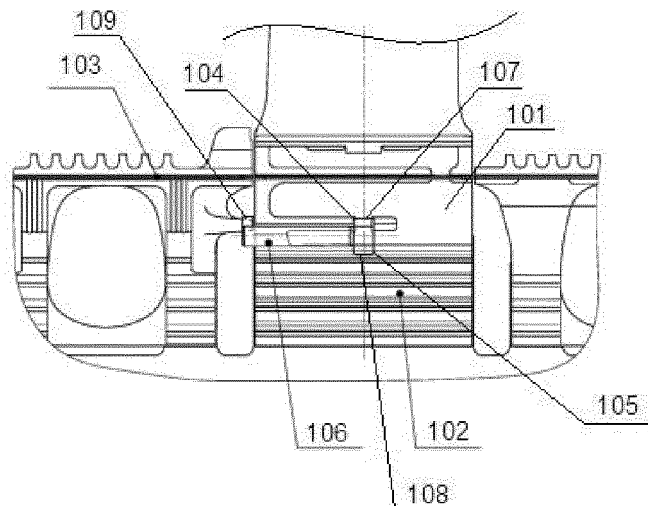


Fig.2

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Description

Technical Field

[0001] The present invention relates to a turbine, in particular, to a blade of turbine, more particularly, to a blade with a locking member to make axial fixation of the blade relative to the rotor disc.

Background of the Invention

[0002] A gas turbine has a rotor assembly which generally includes blades attached to a rotor disc. Each blade comprises a root, a platform and an airfoil. The root of each blade is usually of a so-called "fir tree" configuration to enable it to be firmly attached to the periphery of the disc and still have room for thermal expansion. The "fir tree" attachment of a blade to the rotor disc is effective in restraining the radial and circumferential movements of the blades, relative to the rotor disc, against radial centrifugal forces. However, during high speed, high temperature operation of the gas turbine engine, the axial flow of air or gas through the rotor assembly exerts a constant axial force on the blades so as to bias the blade roots axially relative to the "fir tree" slots in the periphery of the rotor disc. In order to restrain the blades against the axial force, it has been common practice to employ various retention systems.

[0003] A conventional solution is applying a tab washer to fix the blade root relative to the slots in the rotor disc. However, the tab washer needs to be bent at assembly, which increases the complexity for the assembly process and may cause errors.

[0004] US4,349,318 discloses a blade retaining assembly including a continuous wire-type retainer, a generally cylindrical retaining plate and a split retainer ring. Annular grooves or recesses are machined out of the rotor disc and the roots of the blades for accommodating the individual retaining elements.

[0005] EP0,761,930A1 discloses a retention plate carried in radially inner and outer slots preventing axial movement of the blade roots in their slots. A locking member is interposed between an adjacent pair of retention plates to prevent their circumferential movement relative to the disc. The locking member in turn interacts with the disc to anchor itself to the disc.

[0006] It can be seen from above mentioned reference that the current axial retention systems either need further work during the assembly process or have a complex structure, which cause expensive cost of the product and higher likelihood of failures.

Summary of the Invention

[0007] It is an object of the present invention to provide a turbine blade with a simple locking member for axial fixation of the blade relative to the rotor disc.

[0008] It is another object of the present invention to

provide a fail-safe solution during assembly process of the locking member.

[0009] The objects are achieved by a blade of turbine, comprising an aerofoil, a platform and a root portion configured to be slidingly received in mounting slots of a rotor disc. The blade further comprises a locking member disposed on the root portion and engaged with the rotor disc to make axial fixation of the blade to the rotor disc. According to one possible embodiment of the present invention, the locking member is a locking pin disposed between the root portion and the rotor disc, the locking pin comprising a first protrusion to engage with a first groove in the root portion and a second protrusion to engage with a second groove in the rotor disc.

[0010] According to one possible embodiment of the present invention, the first and second protrusions are arranged at one end of the locking pin to be received by the first and second groove respectively.

[0011] According to one possible embodiment of the present invention, the locking pin comprises a third protrusion at the other end thereof to abut on a component arranged next to the blade in the axial direction of the rotor.

[0012] According to one possible embodiment of the present invention, the component comprises a heat shield with an anti-rotation member to engage with the third protrusion of the locking pin.

[0013] According to one possible embodiment of the present invention, the anti-rotation member is sized and positioned so that the anti-rotation member is engaged with the third protrusion of the locking pin as the first and second protrusions of the locking pin are engaged with the first and second grooves respectively.

[0014] According to one possible embodiment of the present invention, the locking member or the locking pin is disposed at the both sides of the root portion.

[0015] With the technical solution of the present invention, it provides a blade with simple and cost effective axial locking system to make axial fixation of the blade relative to the rotor disc, and also a fail-safe solution during assembly process.

Brief Description of the Drawings

[0016] The present invention is now to be explained more closely by means of different embodiments and with reference to the drawings.

Fig. 1 shows a schematic perspective view of a blade assembly of turbine with a locking pin according to embodiments of the present invention;

Fig. 2 shows a front view of the blade assembly in Fig. 1; and

Fig. 3 shows a cross-section side view of the blade assembly.

Detailed Description of Different Embodiments of the Invention

[0017] Fig.1 shows a schematic view of a blade assembly of turbine according to embodiments of the present invention. The blade 100 comprises an aerofoil 111, a platform 112 and a root portion 101. The "fir tree" type root portion is configured to be received in the mounting slots of a rotor disc 102. To show a complete root portion 101, the rotor disc 102 is not shown in Fig. 1, but can be seen from Fig. 3, which shows a cross section view of the assembly of the root portion 101 and the rotor disc 102.

[0018] According to an embodiment of the present invention, the blade 100 further comprises a locking member disposed on the root portion 101 and engaged with the rotor disc 102, so as to make axial fixation of the blade relative to the rotor disc 102.

[0019] In a preferable embodiment of the present invention, the locking member is embodied as a locking pin 106 as shown in Fig. 1. The locking pin 106 is disposed between the rotor portion 101 and the rotor disc 102, which can be seen from the cross-section view of Fig. 3. With reference to Fig. 1 and Fig. 2, a first protrusion 107 and a second protrusion 108 are respectively disposed on the locking pin 106 in the radial direction. A first groove 104 is arranged on the root portion 101 to receive the first protrusion 107; a second groove 105 is arranged on the rotor disc 102 to receive the second protrusion 108.

[0020] In a preferable embodiment of the present invention, the first protrusion 107 and the second protrusion 108 are arranged at one end of the locking pin 106 in the radial direction. The first groove 104 and the second groove 105 are respectively formed on the root portion 101 and the rotor disc 102 at the corresponding position to receive the first protrusion 107 and the second protrusion 108. However, it should be noticed by those skilled in the art that the two protrusions are not necessarily arranged at the same end of the locking pin 106. For example, the protrusions 107, 108 may also be staggered along the axial direction of the locking pin 106, as long as they are received in the corresponding grooves respectively.

[0021] In a preferable embodiment of the present invention, a third protrusion 109 is arranged at the other end of the locking pin 106 opposite to the one end where the protrusions 107, 108 is disposed. As shown in Fig. 1, a heat shield 103 is arranged next to the root portion 101 of the blade in the axial direction. The heat shield 103 comprises an anti-rotation member 110. The anti-rotation member 110 is sized and positioned so that it is engaged with the third protrusion 109 of the locking pin 106 as the first and second protrusions 107 and 108 of the locking pin 106 are engaged with the first and second grooves 104 and 105 respectively.

[0022] During the assembling process, after the installation of the blade 100 and the rotor disc 102, the locking

pin 106 will be inserted between the root portion 101 and the rotor disc 102. After inserted, the locking pin 106 needs to be rotated by a certain degrees so that the first and second protrusions 107 and 108 can be locked into the corresponding grooves 104 and 105, respectively. However, as the protrusions 107, 108 and grooves 104, 105 may not be visible after insertion of the locking pin 106, it is difficult to evaluate whether the pin is installed in position. This issue can be solved by arrangement of the anti-rotation member 110 and its engagement with the third protrusion 109 of the pin 106 as mentioned above, in which case the anti-rotation member 110 may also function as position element for the locking pin 106. In particular, after the locking pin is installed, the heat shield 103 will be assembled in axial direction next to the root portion 101. However, if the locking pin 106 is not in position, the anti-rotation member 110 will be stuck on the third protrusion 109. Then, the heat shield 103 cannot be assembled in position. Only when the locking pin 106 is rotated into lock position, the heat shield 103 can be installed correctly with the anti-rotation member 110 being engaged with the third protrusion 109. Thus, a fail-safe feature for assembling the locking pin is achieved.

[0023] It should be noticed by those skilled in the art that the anti-rotation member may also be arranged on other components than the heat shield as far as the fail-safe feature for assembling the locking pin is achieved.

[0024] Additionally, as shown in Fig. 3, the locking pins 106 can be disposed at the both sides of each root portion 101.

[0025] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description, but is only limited by the scope of the appended claims.

List of Reference Numerals

100	blade
101	root portion
102	rotor disc
103	heat shield
104	first groove
105	second groove
106	locking pin
107	first protrusion
108	second protrusion
109	third protrusion

(continued)

110	anti-rotation member	
111	aerofoil	
112	platform	5

Claims

1. A blade of turbine, comprising an aerofoil, a platform and a root portion configured to be slidingly received in mounting slots of a rotor disc, **characterized in that** the blade further comprising a locking member disposed on the root portion and engaged with the rotor disc to make axial fixation of the blade to the rotor disc. 10
15
2. The blade of claim 1, **characterized in that** the locking member is a locking pin disposed between the root portion and the rotor disc, the locking pin comprising a first protrusion to engage with a first groove in the root portion and a second protrusion to engage with a second groove in the rotor disc. 20
3. The blade of claim 1 or 2, **characterized in that** the first and second protrusion are arranged at one end of the locking pin to be received by the first and second groove respectively. 25
4. The blade of any of claims 1 to 3, **characterized in that** the locking pin comprises a third protrusion at the other end thereof to abut on a component arranged next to the blade in the axial direction of the rotor. 30
35
5. The blade of any of claims 1 to 4, **characterized in that** the component comprises a heat shield with an anti-rotation member to engage with the third protrusion of the locking pin. 40
6. The blade of any of claims 1 to 5, **characterized in that** the anti-rotation member is sized and positioned so that the anti-rotation member is engaged with the third protrusion of the locking pin as the first and second protrusions of the locking pin are engaged with the first and second grooves respectively. 45
7. The blade of any of claims 1 to 6, **characterized in that** the locking member is disposed at the both sides of the root portion. 50
8. The blade of any of claims 1 to 6, **characterized in that** the locking pin is disposed at the both sides of the root portion. 55

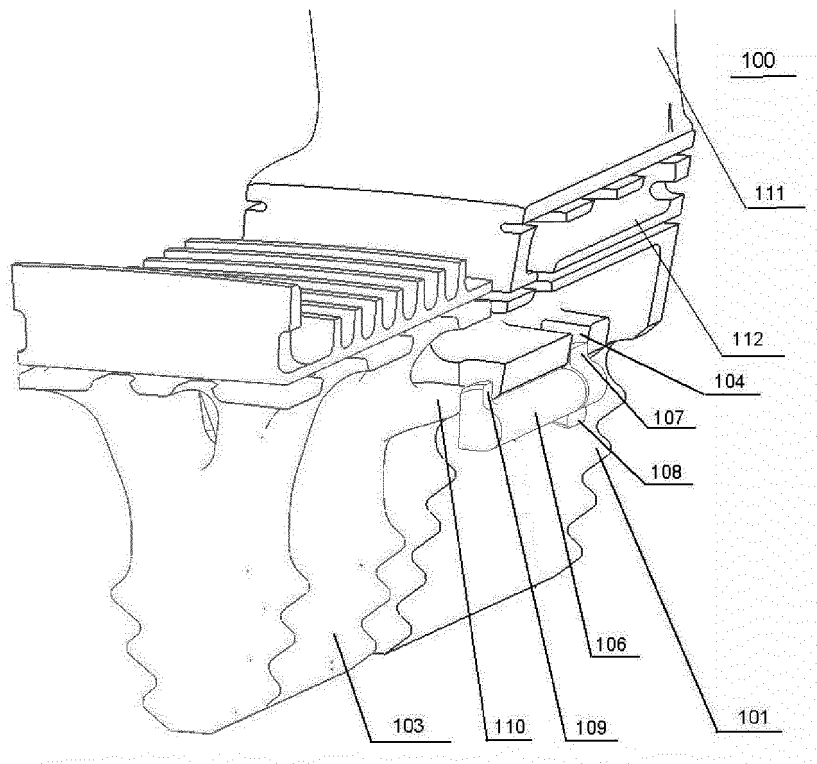


Fig.1

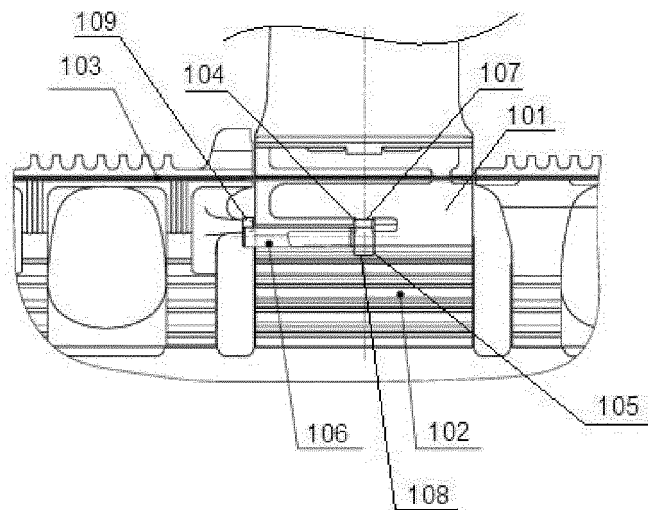


Fig.2

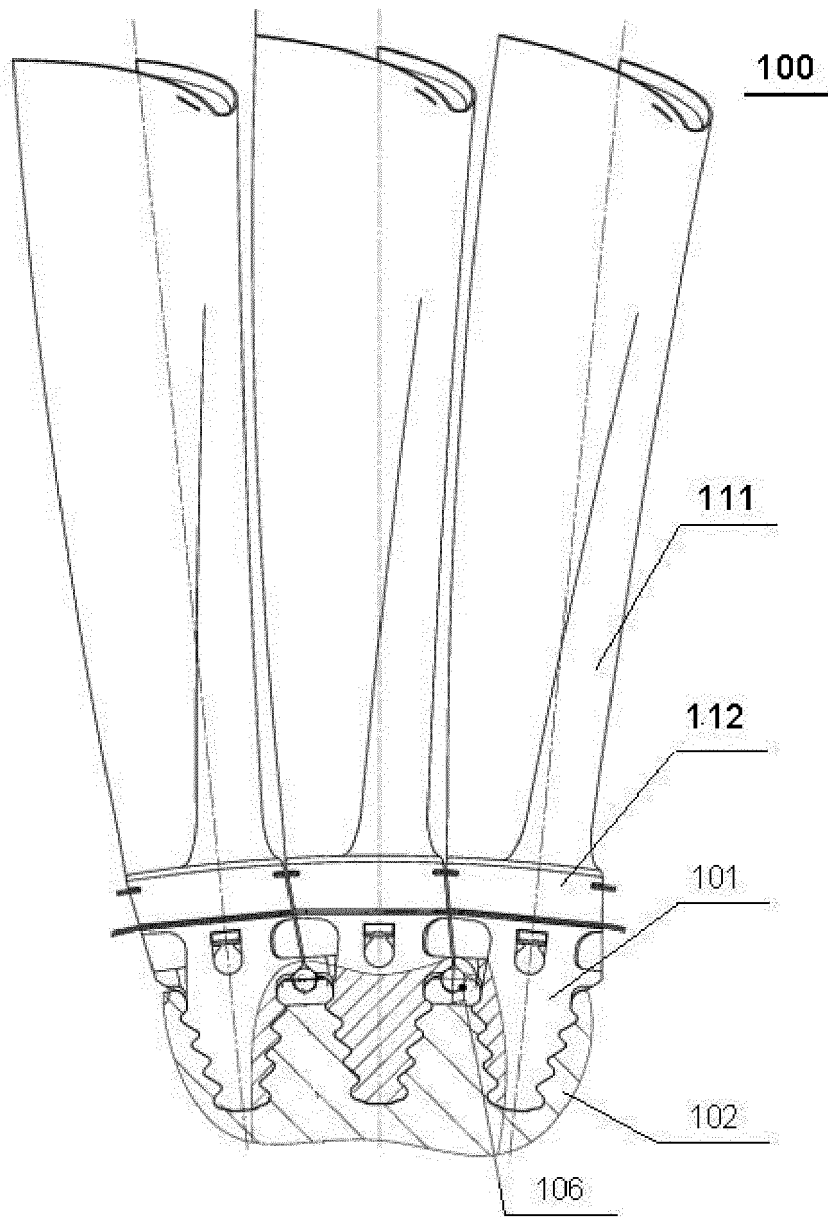


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 13 16 9635

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