



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.03.2010 Bulletin 2010/10

(51) Int Cl.:
F04D 29/02 (2006.01) **F04D 29/32 (2006.01)**
F01D 5/00 (2006.01) **F01D 5/28 (2006.01)**

(21) Application number: **09166070.4**

(22) Date of filing: **22.07.2009**

(84) Designated Contracting States:
**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 SE SI SK SM TR**

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(30) Priority: **31.07.2008 US 222067**

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(54) **Compressor blade leading edge shim and related method**

(57) A method of improving an erosion resistance at the leading edge (16) of a compressor blade (12) includes: a) cleaning a leading edge portion (16) of the compressor blade airfoil; and b) attaching one or more erosion or corrosion-resistant shims (24) to the leading edge portion (16).

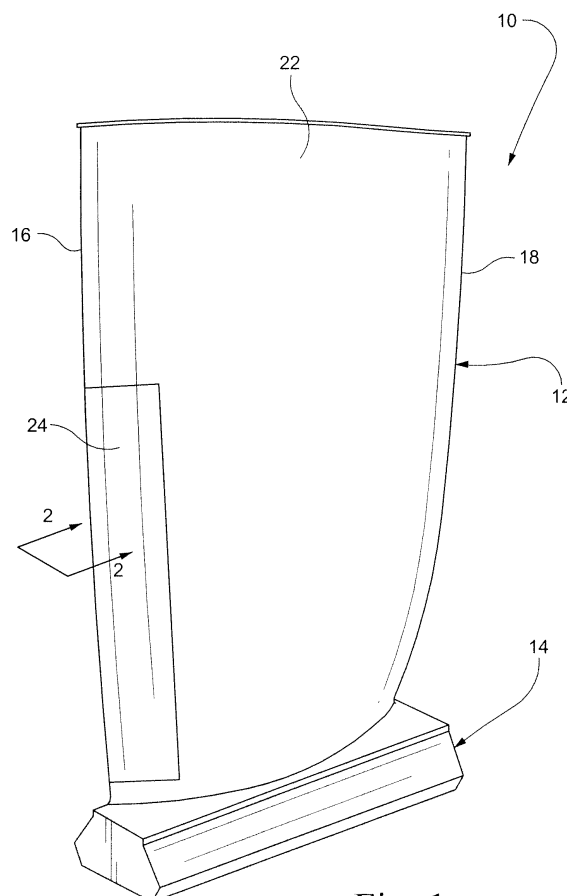


Fig. 1

Description

BACKGROUND OF THE INVENTION

[0001] This invention relates generally to turbine technology and, more specifically, to an article and a method for mitigating damage caused by compressor blade leading edge erosion and/or corrosion.

[0002] Compressor blade leading edge erosion/corrosion is a common problem in turbine engines. Turbine blades, and particularly the leading edges of the turbine compressor blades or airfoils, are particularly susceptible to erosion and/or corrosion resulting from exposure to harsh environments. Repair and/or replacement of damaged turbine blades requires costly downtime that may not coincide with normal service intervals.

[0003] It would be advantageous, therefore, to develop techniques or processes to mitigate the incidence or damage caused by erosion and/or corrosion of blade leading edges.

BRIEF DESCRIPTION OF THE INVENTION

[0004] In accordance with one exemplary but nonlimiting embodiment, the invention relates to a compressor blade comprising an airfoil portion and a mounting portion; the airfoil portion having leading and trailing edges, the leading edge having an erosion or corrosion-resistant shim attached thereto.

[0005] In another aspect, the invention relates to a method of improving erosion or corrosion resistance at the leading edge of a compressor blade airfoil comprising: a) cleaning a leading edge portion of the compressor blade airfoil; and b) attaching one or more erosion or corrosion-resistant shims to the leading edge portion.

[0006] The invention will now be described in more detail in connection with the drawings identified below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

FIGURE 1 is a perspective view of a compressor blade in accordance with an exemplary embodiment of the invention; and

FIGURE 2 is a section taken along the line 2-2 in Figure 1, but with the shim exaggerated in scale.

DETAILED DESCRIPTION OF THE INVENTION

[0008] With reference to Figure 1, a vane or blade 10, e.g., a turbine compressor blade, includes an airfoil portion 12 and a dovetail mounting portion 14. The airfoil portion 12 has a leading edge 16, a trailing edge 18, a pressure side 20 and a suction side 22.

[0009] It is the leading edge 16 that is most susceptible to erosion and/or corrosion due to incoming air flow (con-

taining, for example, dry particles, salt fog, etc.) at the compressor inlet.

[0010] In accordance with a non-limiting exemplary embodiment of this invention, one or more shims 24 may be applied to the leading edge 16 of the airfoil portion. With further reference to Figure 2, the shim 24 substantially encloses the leading edge 16, extending into both the pressure and suction sides 20, 22 of the airfoil. Note that in Figure 2, the shim is shown in greatly exaggerated scale simply to facilitate an understanding of the invention. One shim may extend along part or substantially the entire length of the leading edge, or alternatively, plural shim segments may be employed to reduce shear strain at the airfoil/shim interface.

[0011] In a preferred configuration, the shim 24 has a thickness in a range of from 1 to 30 mils. The shim or shims may be composed of corrosion-resistant compositions including Cr-rich materials such as Ni-25Cr sheet; Al-rich or Ti-rich materials. Alternatively, hard, erosion resistant materials such as TiN, Ti/TiN, TiN/CrN, NiCrWC, etc. may be employed. The shim or shims could also be constructed of an erosion-resistant polymeric material such as polypropylene, or a corrosion-resistant tape, e.g., 3M Protective Polyurethane Tape, having a thickness of about 1-10 mils. It will be appreciated that the shim or shims may also be constructed of a suitable metal coated with an erosion or corrosion resistant material, i.e., using a powder form of the compositions mentioned above.

[0012] The shim or shims 24 in metal form may be attached to the leading edge 16 by any of several known techniques such as, for example, welding, brazing, soldering and/or by an adhesive film. One suitable adhesive film is available under the name 3M Structural Adhesive Tape. Additional adhesive material shown at 26, 28, may be applied along the edges 30, 32 of the metal shim in order to smooth out shim edges where they interface with the airfoil.

[0013] In any event, thermal expansion characteristics of the airfoil and shim should be matched to the extent possible to reduce the amount of cyclic straining, noting that in the front end of the machine temperature swings are relatively mild, i.e., from about 70°F to about 400°F. In this regard, low temperature adhesive for attaching the metal shims, or for use as the shims themselves, are advantageous in that no cutting is required, thus preserving the properties of the base metal.

[0014] Prior to the attachment of one or more shims 24, surface preparation at the leading edge 16 is required through milling, shot-peening, grit blasting, vibratory finishing or combinations of the above. For attachment of a shim by means of a high pressure adhesive tape such as the 3M structural adhesive tape mentioned above, additional preparation is required. For example, the facing surfaces of the shim and the airfoil leading edge may be rinsed, alkaline-degreased, etched, dried, primed and cured. After the shim is applied by means of the adhesive tape, the blade may be placed in an autoclave, for ex-

ample, for curing the adhesive.

[0015] When utilizing a low temperature adhesive such as the 3M Protective Polyurethane Tape as the shim, the facing surfaces simply need to be rinsed and degreased prior to application of the tape.

[0016] It is contemplated that the shims described herein would be added to blades at the time of manufacture. On the other hand, they could be retrofitted to existing blades so long as the blades are in acceptable condition.

[0017] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

Claims

1. A compressor blade (10) comprising an airfoil portion (12) and a mounting portion (14); the airfoil portion having leading and trailing edges (16, 18), the leading edge having an erosion-resistant (24) shim attached thereto. 25
2. The compressor blade of claim 1, wherein said shim (24) is comprised of a material selected from a group comprising TiN, Ti/TiN, TiN/CrN, NiCrWC. 30
3. The compressor blade of claim 1, wherein the shim (24) is composed at least in part of a composition selected from a group comprising Cr, Al or Ti-rich materials. 35
4. The compressor blade of claim 1, wherein the shim (24) is comprised of a metal coated with an erosion or corrosion resistant material. 40
5. The compressor blade of claim 1, wherein said shim (24) is attached by welding, brazing, soldering or adhesive. 45
6. The compressor blade of claim 1, wherein said shim (24) comprises plural shim segments. 50
7. The compressor blade of claim 1, wherein said shim (24) is between about 1 and about 25 mils thick. 55
8. The compressor blade of claim 1, wherein said shim (24) is made of a polymeric material.
9. The compressor blade of claim 8, wherein said polymeric material comprises polypropylene or a polyurethane tape.
10. A method of improving an erosion/corrosion resist-

ance at the leading edge portion (16) of a compressor blade airfoil (12) comprising:

- a) preparing the leading edge portion (16) of the compressor blade airfoil (12); and
- b) attaching one or more shims (24) to said leading edge portion (16).

11. The method of claim 10, wherein step (a) is carried out by milling, shot-peening, grit blasting, vibratory finishing or combinations thereof.
12. The method of claim 10, wherein said shim (24) is comprised of a material selected from a group comprising TiN, Ti/TiN, TiN/CrN, NiCrWC and a polymeric material.
13. The method of claim 10, wherein the shim (24) is composed at least in part of a composition selected from a Cr, Al or Ti-rich material.
14. The method of claim 10, wherein the shim (24) is comprised of a metal coated with an erosion or corrosion resistant material.
15. The method of claim 10, wherein said shim (24) is attached by welding, brazing, soldering or adhesive.

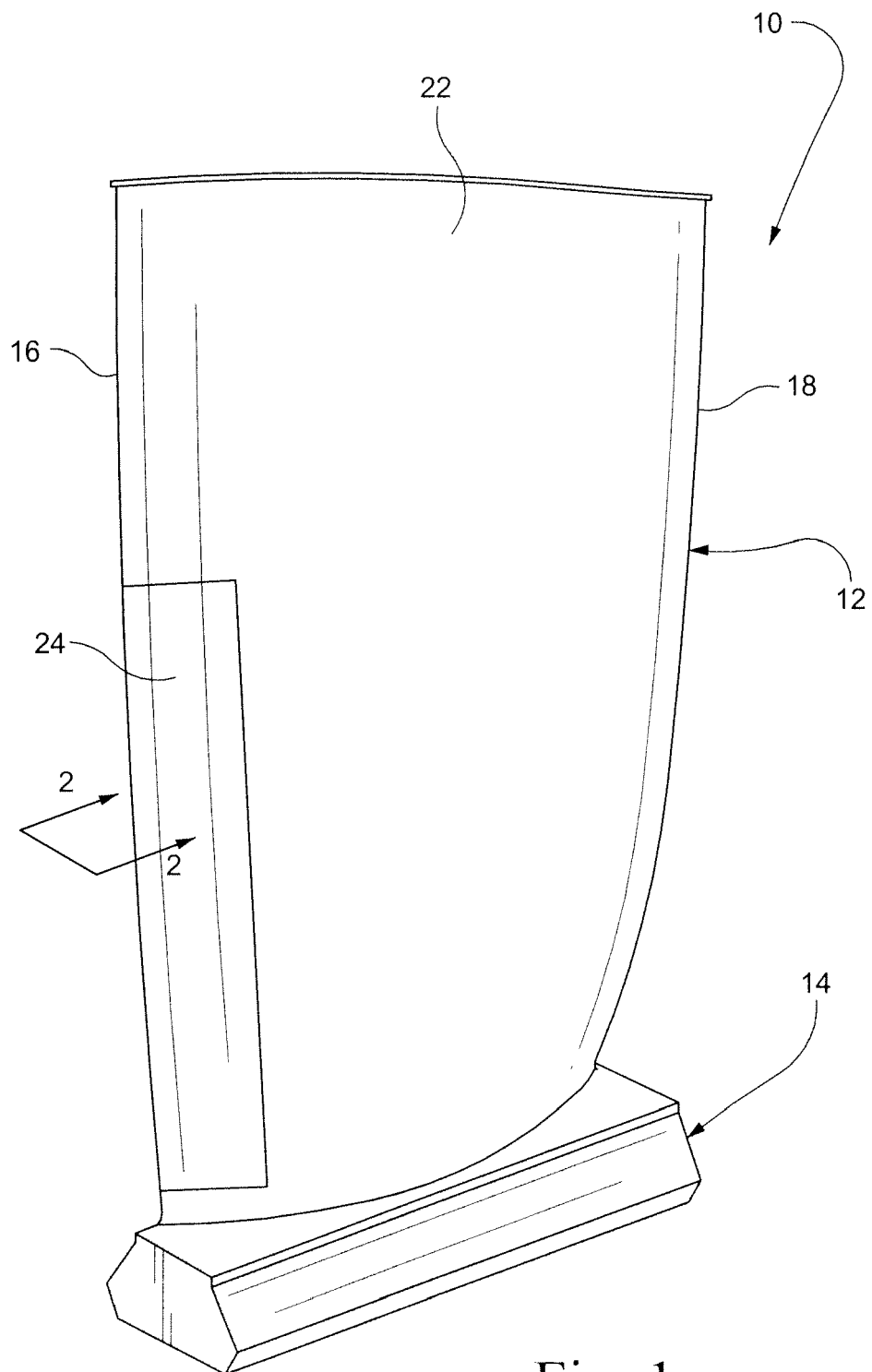


Fig. 1

