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(54) **Component with sensor and sensor installation method**

(57) The invention relates to a component (2) that is configured to be exposed to a working fluid. The component (2) comprises a coupon (8) fitted in or located on

the component (2) and a measurement sensor (14) embedded in and/or located on the coupon (8).

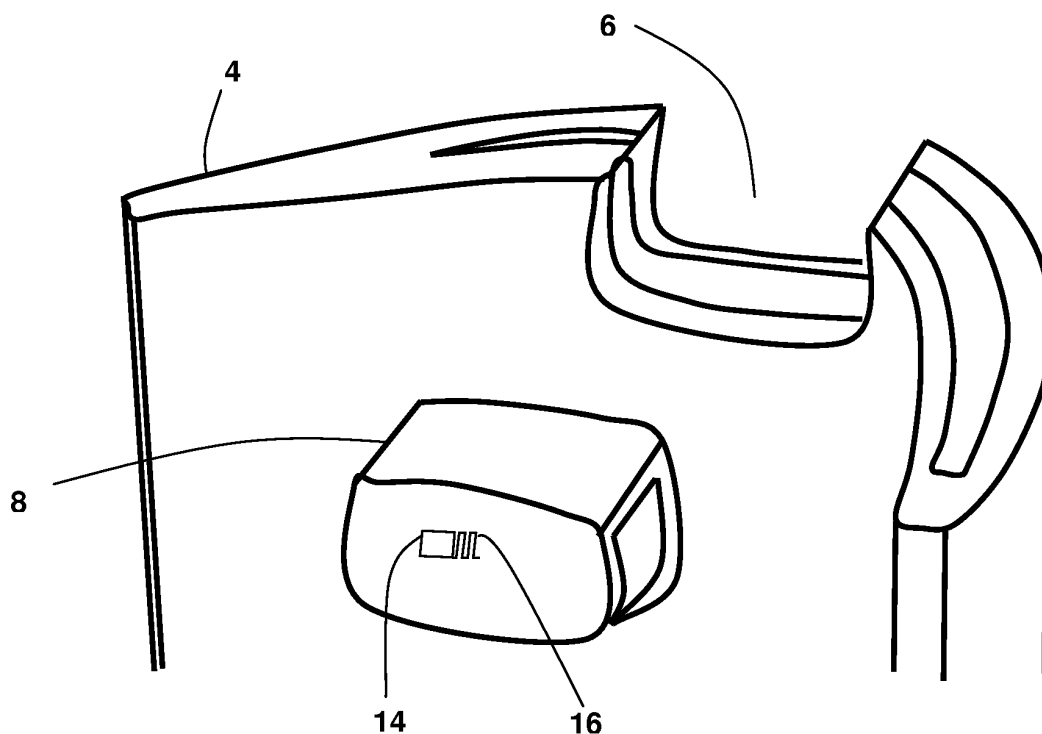


FIG. 2

Description

TECHNICAL FIELD

[0001] The present disclosure relates generally to monitoring parameters of component located in a working fluid and particularly to the installation of measurement devices in a gas turbine steam turbine, HRSG, or boilers.

BACKGROUND INFORMATION

[0002] In order to obtain information regarding the internal status and condition of a gas turbine engine, there is a need to measure or at least estimate conditions. While it may be possible to estimate conditions using numerical methods it is preferably to obtain data by direct measurement.

[0003] A direct measurement solution is discussed in US patent application 2006/0056959 A1. The solution involves providing a component for use in a combustion turbine having a substrate with a micro-electromechanical system (MEMS) device affixed to the substrate. At least one deposited connector is in electrical communication with the MEMS device and is used to route a data signal from the MEMS device to a termination location. The MEMS device is deposited in a number of trenches in a thermal barrier coating of the component.

[0004] The requirement for trenches and routing of connections to distal locations of the component increases the difficulty in retrofitting such solution to existing components.

SUMMARY

[0005] Provided is a component and a simplified method for retrofitting a component with a sensor.

[0006] It attempts to address this problem by means of the subject matters of the independent claims. Advantageous embodiments are given in the dependent claims.

[0007] The disclosure is generally based on fixing a coupon embedded with a sensor to a working fluid exposed component. As coupons are known to be used to repairing components the solution provides a simple means of retrofitting components with sensors, in particular during component repair.

[0008] In an aspect a Component, that is configured to be exposed to the working fluid of a turbine such as a turbine blade, comprises a coupon that is fitted, such as by welding, in or located on the component and a measurement sensor embedded in and/or located on the coupon. The sensor may be configured to measure one or more of a selection of temperature, pressure and strain. In a further aspect the sensor is a self-powered, wireless sensor which may include an antenna.

[0009] In a further aspect a coating, such as a thermal barrier coating covers an outer layer of the sensor and at least part of an outer surface of the coupon.

[0010] In a further aspect the component includes a measurement channel with a first opening through a surface of the component and a second opening fluidly connected to the sensor.

[0011] An aspect includes a method of fitting and joining a sensor to a turbine blade, comprising the steps of forming a cavity in the turbine blade, forming a coupon fittable within the cavity, embedding a sensor in or on the coupon and fitting and joining the coupon, with the sensor, in the cavity.

[0012] In a further aspect the method includes the step of coating the coupon with a thermal barrier coating after the step of fitting and joining of the coupon.

[0013] It is a further object of the invention to overcome or at least ameliorate the disadvantages and shortcomings of the prior art or provide a useful alternative.

[0014] Other aspects and advantages of the present disclosure will become apparent from the following description, taken in connection with the accompanying drawings which by way of example illustrate exemplary embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] By way of example, an embodiment of the present disclosure is described more fully hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a side cut view of a component with a cavity not fitted coupon that has an embedded sensor according to an exemplary embodiment of the disclosure;

Figure 2 is a perspective of another exemplary embodiment wherein the component is a turbine blade; and

Figure 3 is a perspective of another exemplary embodiment wherein the sensor is fitted to the component and the component includes a measurement channel in fluid contact with the embedded sensor.

DETAILED DESCRIPTION

[0016] Exemplary embodiments of the present disclosure are now described with references to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purposes of explanation, numerous specific details are set forth to provide a thorough understanding of the disclosure. However, the present disclosure may be practiced without these specific details, and is not limited to the exemplary embodiment disclosed herein.

[0017] In an exemplar embodiment shown in Fig 1 a component, has a cavity 6 in which a coupon 8 having an embedded sensor 14 may be fixed. In an exemplary embodiment a surface of the sensor 14 and at least part of a surface of the coupon 8 is covered with a coating

12, such as a thermal barrier coating, to protect the sensor 14 and the coupon 8. The coating 12 may also extend over the component 2.

[0018] The sensor may be any type of MEMs sensor including self-powered wireless sensors configured to measure temperature, pressure and/or strain.

[0019] The coupon 8 may be fixed within the cavity 6 using any known method of fixing coupons to components as part of component repair methods. The fixing/joining may therefore include, brazing and/or welding, including laser welding.

[0020] In an exemplary embodiment shown in Fig. 2 coupon 8 may be part of a turbine blade 4. In addition, the embedded sensor 14 may further include an antenna 16, also embedded in the coupon 8, to embedded wireless communication with the sensor 14.

[0021] The coupon itself may take any shape including curved straight, flat or any other shape. In addition it may be formed by any known method or technology including selective laser melting.

[0022] In an exemplary embodiment shown in Fig. 3 the component 2 is a turbine blade 4 that includes a measurement channel 18 fluidly connected to a fitted coupon 8 and sensor 14. In this embodiment direct measurement of a property of the working fluid, such as pressure, is enabled. The measurement channel 18 with a first end opening to the working fluid and a second end in fluid contact with the sensor 14 may be formed prior to the installation of the coupon 8, for example during manufacture of the blade using a techniques including but not limited to Selective Laser Melting, casting, and drilling.

[0023] In an exemplary embodiment where the coupon 8 with embedded sensor 14 is retrofitted to a component as part of a component repair, the cavity 6 for fitting and joining the coupon 8 is first formed in the component 2. Methods for forming the cavity include machining, electro-chemical processes such as milling, die sinking, or direct build-up by additive manufacturing of the coupon with cavity...

[0024] In an exemplary method, a cavity 6 is formed in a component 2, a coupon 10, fittable within the cavity 6 is formed, a sensor 14 is embedded in or on the coupon 8 and the coupon 8 is fixed into the cavity. The order which the cavity 6 and coupon 8 are formed is not significant.

[0025] In a further exemplary method, at least part of a surface of the coupon 8 and a surface of the sensor 14 is covered by a coating 12.

[0026] Although the disclosure has been herein shown and described in what is conceived to be the most practical exemplary embodiment, it will be appreciated by those skilled in the art that the present disclosure can be embodied in other specific forms. The presently disclosed embodiments are therefore considered in all respects to be illustrative and not restricted. The scope of the disclosure is indicated by the appended claims rather than the foregoing description and all changes that come within the meaning and range and equivalences thereof

are intended to be embraced therein.

REFERENCE NUMBERS

5 **[0027]**

2 Component

4 Turbine blade

10 6 Cavity

8 Coupon

15 12 Coating

14 Sensor

16 Antenna

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18 Measurement channel

Claims

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1. A component (2) configured to be exposed to a working fluid, the component (2) comprising:

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a coupon (8) fitted in or located on the component (2); and
a measurement sensor (14) embedded in and/or located on the coupon (8).

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2. The component (2) of claim 1 wherein the component (2) is a turbine blade (4).

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3. The component (2) of claim 1 or 2 wherein the measurement sensor (14) is configured to measure one or more of a selection of temperature, pressure and strain.

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4. The component (2) of claim 1 or 2 wherein a coating (12) covers an outer layer of the sensor (14) and at least part of an outer surface of the coupon (10).

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5. The component (2) of claim 1 or 2 wherein the sensor (14) is a self-powered, wireless sensor (14).

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6. The component (2) of claim 1 or 2 further including a measurement channel (18) with a first opening through a surface of the component (2) and a second opening fluidly connected to the sensor (14).

7. The component (2) of any one of claims 1 to 6 wherein the sensor (14) includes an antenna (16) for wireless communication from the sensor (14).

8. A method of fitting and joining a sensor (14) to a

turbine blade (4), comprising the steps of:

forming a cavity (6) in the turbine blade (4);
forming a coupon (8) fittable within the cavity (6);
embedding the sensor (14) in or on the coupon (8, 10); and
fitting and joining the coupon (8, in the cavity (6). 5

9. The method of claim 8 further including the step of
coating (12) the coupon (8) with a thermal barrier
coating (12) after the step of fitting and joining the
coupon (8). 10

10. The method of claim 8 wherein fitting and joining the
coupon (8) in the cavity (6) includes laser welding
the coupon (8) to the component (2). 15

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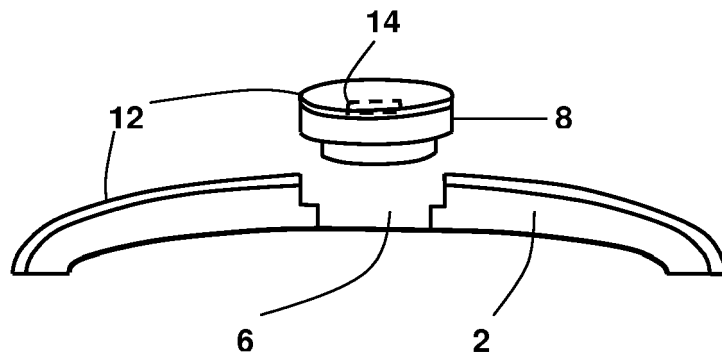


FIG. 1

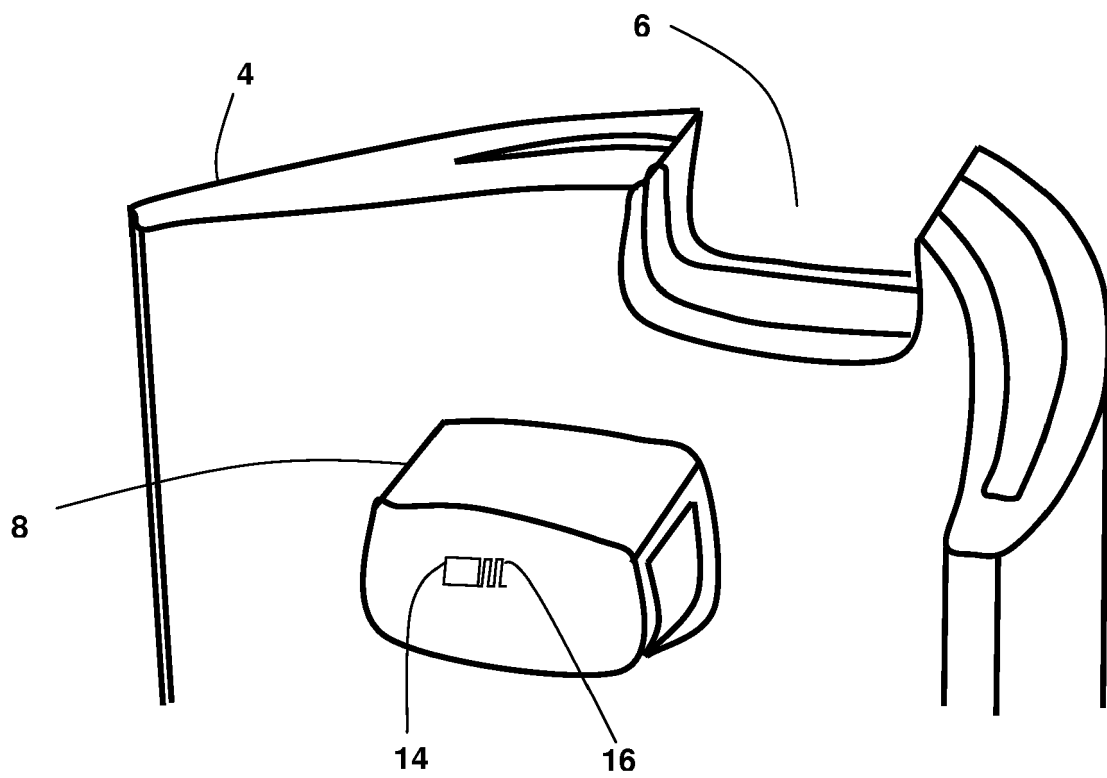


FIG. 2

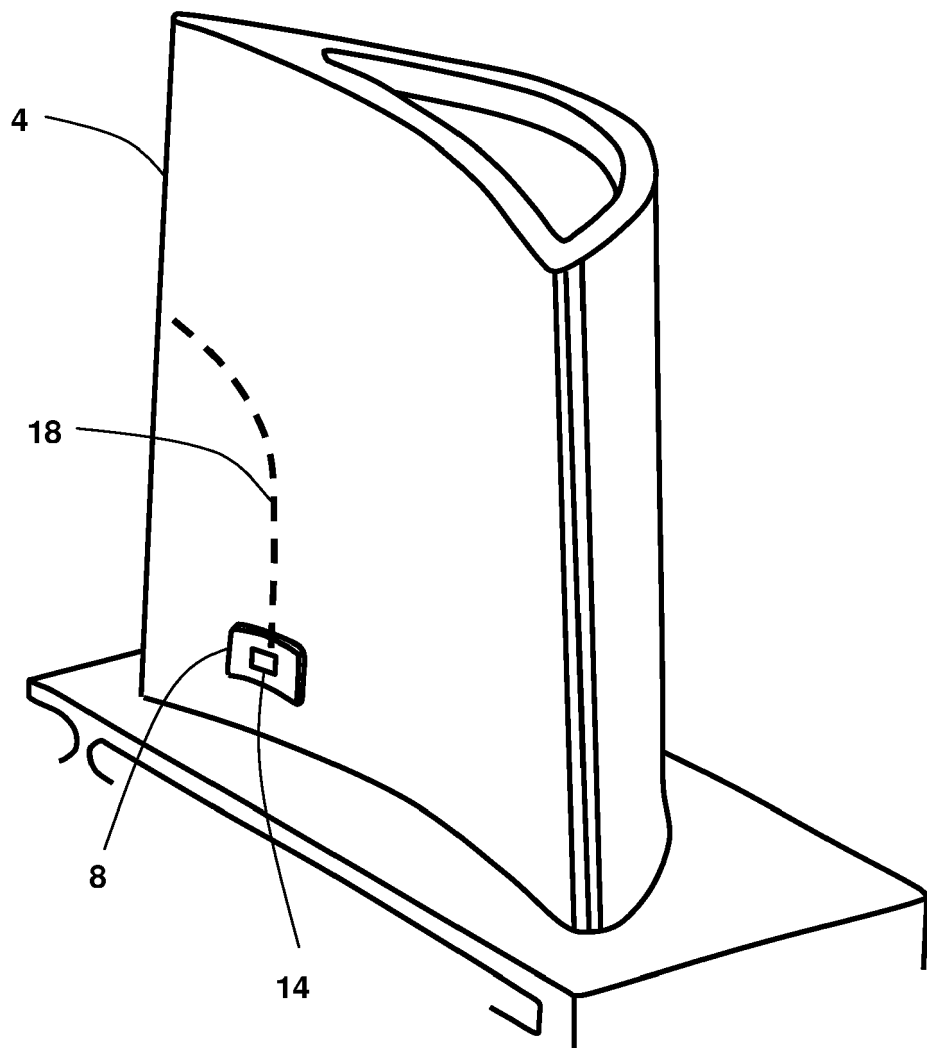


FIG. 3



EUROPEAN SEARCH REPORT

 Application Number
 EP 14 17 0188

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Y	US 2011/100964 A1 (BURBAUM BERND [DE] ET AL) 5 May 2011 (2011-05-05) * paragraph [0004] *	10	TECHNICAL FIELDS SEARCHED (IPC) F01D B23P
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 August 2014	Examiner Georgi, Jan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 17 0188

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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27-08-2014

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