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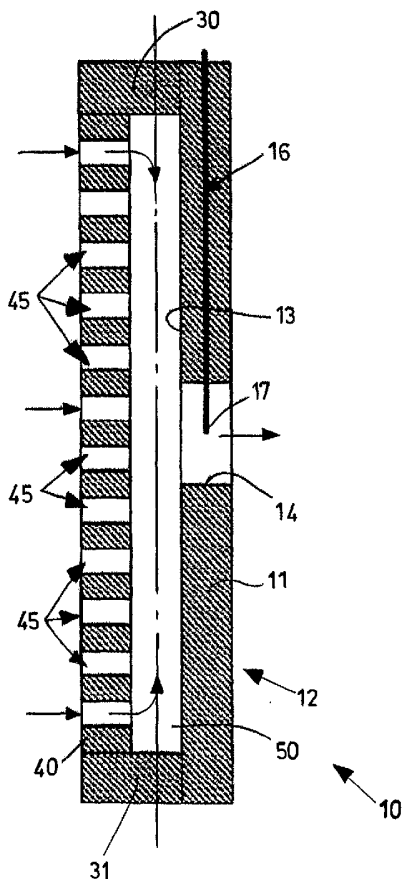
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[Continued on next page]

(54) Title: ASSEMBLY SYSTEM OF A THERMOCOUPLE FOR A GAS TURBINE



(57) Abstract: Assembly system (10) for a thermocouple (16) for a gas turbine equipped with a supporting element (12) in which the thermocouple (16) is housed, the supporting element (12) has a series of holes (45) for the inlet of the discharge gases of the gas turbine and a cavity (50) in which they are mixed before flowing through an opening (14) of the supporting element (12).



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

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ASSEMBLY SYSTEM OF A THERMOCOUPLE FOR A GAS TURBINE

The present invention relates to an assembly system of a thermocouple for a gas turbine, in particular a gas turbine of the "heavy duty" type.

The technical sector relates to so-called "heavy duty" gas turbines, which are almost always controlled on the basis of the temperature of the discharge gases downstream of the expander present therein.

A series of temperature sensors is normally housed downstream of the expander, which allows a series of signals to be obtained, that are proportional to the temperature which each of the temperature sensors detects in the surrounding area.

From the various temperature values, it is possible, by means of appropriate processing, to obtain an average temperature whose value, when further processed, provides the so-called "ignition" temperature of the gas turbine.

From an operative and functional point of view, it is therefore extremely important to have a temperature

detection system in heavy duty turbines, which provides a reliable and repeatable measurement of the average temperature at the expander of the turbine itself as this greatly influences the performances and useful life of
5 the machine.

As mentioned above, the average temperature is currently obtained by means of a series of temperature sensors, whose number varies according to the type of machine.

10 Furthermore, the series of temperature sensors is uniformly distributed on the expander along a circumference of a section of the expander itself.

One of the disadvantages which arise in the case of transients is that this type of solution is not capable
15 of guaranteeing a reliable measurement of the average temperature of the discharge gases of the turbine.

This occurs when the temperature profile is not very uniform inside the section of the expander and also when it varies with time, as the average temperature value obtained from the series of temperature sensors may not be
20 representative of the real average temperature of the turbine with a consequent risk for the efficient functioning of the turbine itself.

An objective of the present invention is to provide
25 an assembly system of a thermocouple for a gas turbine

which is simple and provides a reliable and repeatable measurement of the temperature of the discharge gases of the turbine itself.

A further objective is to provide an assembly system
5 of a thermocouple for a gas turbine which allows a reliable measurement of the temperature of the discharge gases of the gas turbine, whatever the temperature profile may be in the discharge section.

Yet another objective is to provide an assembly sys-
10 tem of a thermocouple for a gas turbine which also allows a reliable measurement of the temperature of the discharge gases of the gas turbine, even with variations in the temperature profile in the discharge section.

These objectives according to the present invention
15 are achieved by providing an assembly system of a thermocouple for a gas turbine as specified in claim 1.

Further characteristics of the invention are indicated in the subsequent claims.

The characteristics and advantages of an assembly
20 system of a thermocouple for a gas turbine according to the present invention will appear more evident from the following illustrative and non-limiting description, referring to the enclosed schematic drawings, in which:

figure 1 is a raised side view of a preferred em-
25 bodiment of an assembly system of a thermocouple for a

gas turbine according to the present invention.

With reference to the figure, this illustrates an assembly system 10 of a thermocouple 16 for a gas turbine comprising a supporting element 12, which is substantially an internally hollow cylinder in which the thermocouple 16 is inserted.

The supporting element also has an opening 14 from which an end 17 of the thermocouple 16 protrudes.

A part of the discharge gases of the gas turbine flows through the opening 14.

Said opening 14 is positioned centrally on a surface 13 of a first portion 11 of the supporting element 12.

The supporting element 12 comprises a series of holes (45) and a cavity (50) for the mixing of these so as to make their temperature uniform in order to obtain more reliable temperature measurements.

The supporting element 12 also comprises a second portion 40 in which the series of pass-through holes 45 are situated, through which a part of the discharge gases whose temperature is to be measured, flows.

The first portion 11 and the second portion 40 substantially form the body, essentially a hollow cylinder, of the supporting element 12 of the assembly system for the thermocouple 16.

The first portion 11 and the second portion 40 are

also both connected to a first base portion 30 and a second base portion 31.

The first base portion 30 and the second base portion 31 define a first end and a second end respectively
5 of the supporting element 12.

The thermocouple is preferably inserted in the first base portion until it completely passes the first portion 11, and protrudes into the opening 14.

A series of pass-through holes 45 are situated on
10 the second portion 40, for the mixing of the combusted gases, whose temperature is to be measured.

The series of holes 45 is preferably opposite the opening 14 with respect to the axis of the supporting element 12.

15 The first portion 11 and the second portion 40 also define a cavity 50 communicating with the series of holes 45 and with the opening 14 of the supporting element 12.

Said cavity 50 has the function of mixing the discharge gases which pass through the series of holes 45,
20 subsequently sending them, mixed with each other, through the opening 14.

Mixing occurs as the passage through the cavity 50 causes a change in direction of the discharge gases with the formation of turbulences suitable for mixing them.

25 In this way, the discharge gases which pass through

the opening 14 have a homogeneous and uniform temperature even with variations in the temperature profile of the discharge gases outside the assembly system 10.

This allows much more reliable temperature measurements to be effected, thus lengthening the useful life and reliability of the gas turbine in which said assembly system 10 is applied.

Furthermore, with the use of said assembly system 10, it is possible to obtain extremely satisfactory results, in the case of transients in the temperature profile of the discharge gases.

According to a preferred embodiment of the present invention, the first portion 11, the second portion 40 and the first and second base portion 30 and 31 can also be advantageously produced in different pieces.

It can thus be seen that an assembly system of a thermocouple for a gas turbine according to the present invention achieves the objectives specified above.

Numerous modifications and variants can be applied to the assembly system of a thermocouple for a gas turbine of the present invention, thus conceived, all included within the inventive concept.

Furthermore, in practice the materials used as also the dimensions and components can vary according to technical demands.

CLAIMS

1. An assembly system (10) of a thermocouple (16) for a gas turbine comprising a supporting element (12) in which said thermocouple (16) is housed, characterized in that
5 said supporting element (12) includes a series of holes (45) for the inlet of the discharge gases of the gas turbine and a cavity (50) in which they are mixed before flowing through an opening (14) of the supporting element (12).
- 10 2. The assembly system (10) according to claim 1, characterized in that said opening (14) of the supporting element (12) is positioned centrally with respect to a base surface (13) of a first portion (11) of the supporting element (12) itself.
- 15 3. The assembly system (10) according to claim 1, characterized in that said series of holes (45) is situated in a second portion (40) of the supporting element (12), and is opposite the opening (14) with respect to the axis of the supporting element (12).
- 20 4. The assembly system (10) according to claim 1, characterized in that said series of pass-through holes (45), said cavity (50) and said opening (14) are intercommunicating.
5. The assembly system (10) according to claim 1, characterized in that the thermocouple (16) has an end (17)
- 25

which protrudes from the opening (14) of the supporting element (12).

6. The assembly system (10) according to claim 1, characterized in that said supporting element (12) is substantially an internally hollow cylinder.

7. The assembly system (10) according to claims 2 and 4, characterized in that said supporting element (12) comprises a first base portion (30) and a second base portion (31) both connected to the first portion (11) and the second portion (40) of the supporting element (12).

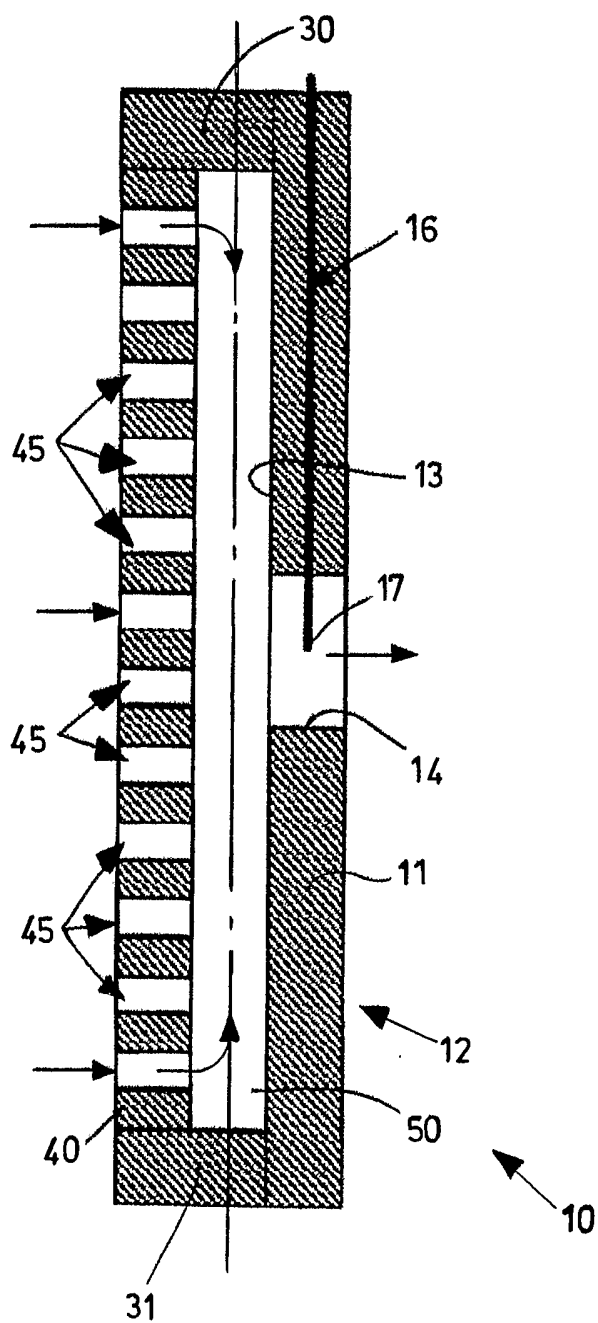
8. The assembly system (10) according to claim 1, characterized in that the supporting element (12), the element (30) and the portion (40) of the assembly system (10) are produced in one piece.

9. An assembly system (10) as previously described and illustrated and for the purposes specified above.

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Fig.1

INTERNATIONAL SEARCH REPORT

PCT/EP2004/014467

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01K3/06 F01D17/08 G01K13/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01K F01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 011, no. 087 (P-557), 17 March 1987 (1987-03-17) -& JP 61 241633 A (MATSUSHITA ELECTRIC IND CO LTD), 27 October 1986 (1986-10-27) abstract; figure	1-8
X	US 5 253 190 A (SRINIVASAN ET AL) 12 October 1993 (1993-10-12) figure 2	1,4,6-8
X	GB 784 597 A (JOHN HENRY CANTLIN; ERIC ERNEST ANDERSON) 9 October 1957 (1957-10-09) figure 1b	1,4,6-8
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

10 March 2005

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21/03/2005

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INTERNATIONAL SEARCH REPORT

PCT/EP2004/014467

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 623 367 A (ROBERT P. BENEDICT) 30 November 1971 (1971-11-30) figures -----	1-4,6
X	US 4 605 315 A (KOKOSZKA ET AL) 12 August 1986 (1986-08-12) figures 2,3,5 -----	1
X	US 4 047 379 A (BROOKES ET AL) 13 September 1977 (1977-09-13) figures -----	1

INTERNATIONAL SEARCH REPORT

PCT/EP2004/014467

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 9
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 9

Independent claim 9 relies on references to the description and the drawings. This cannot be considered as absolutely necessary, and is therefore in clear infringement of Rule 6.2 (a) of the Regulations under the Patent Cooperation Treaty

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

PCT/EP2004/014467

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