(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 405 200 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.01.2012 Bulletin 2012/02

(51) Int Cl.:
F23R 3/00 *(2006.01)*

(21) Application number: **10168429.8**

(22) Date of filing: **05.07.2010**

(84) Designated Contracting States:
AL 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
Designated Extension States:
BA ME RS

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

(72) Inventor: **Sanderson, Victoria**
Newark, NG24 4SR (GB)

(54) **A combustion apparatus and gas turbine engine**

(57) The present invention discloses a combustion apparatus 100, which comprises a combustion chamber 12, in which combustion of a fuel/oxidant mix takes place, a pre-chamber 14 located upstream of the combustion chamber 12, wherein the combustion chamber 12 and the pre-chamber 14 comprise a common first wall 20 and a common second wall 30 spaced to each other building a cavity 40, and wherein the first wall 20 exhibits at least one first opening 21 for introducing a coolant into the cavity 40. With a combustion apparatus 100 according to the present invention an enhancement of the cooling of the pre-chamber 14 and the combustion chamber 12 and of the combustion flame itself can be realized.

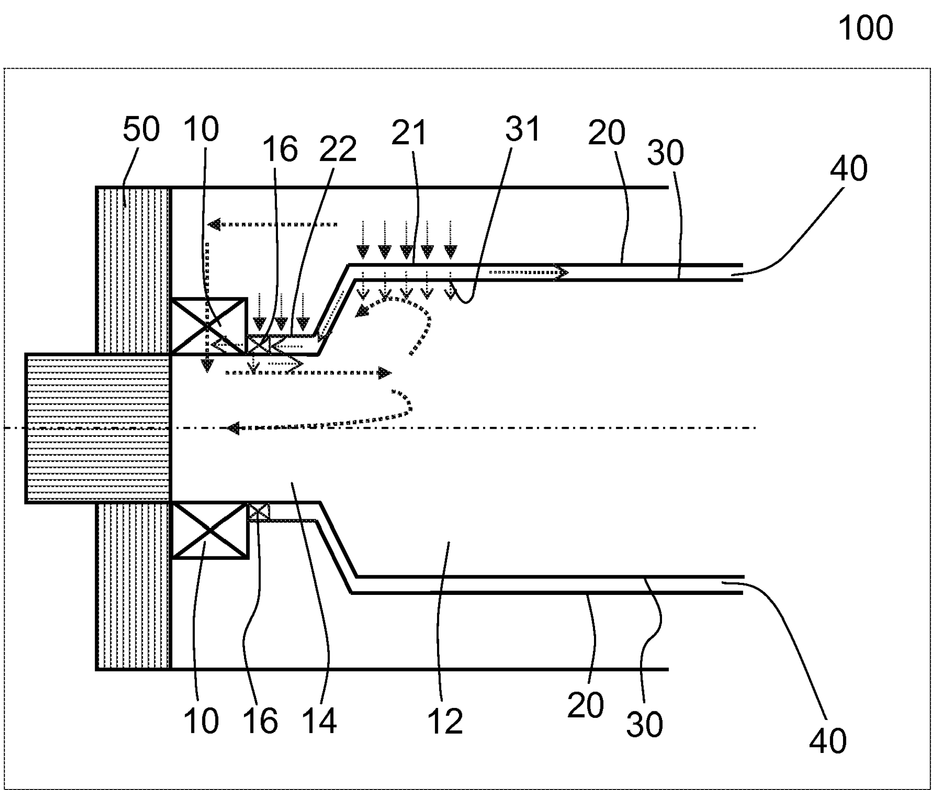

Fig. 2

EP 2 405 200 A1

Description

[0001] The present invention relates to a combustion apparatus. More particularly the present invention relates to a cooling system of a combustion apparatus. Furthermore, the present invention relates to a gas turbine engine using a combustion apparatus.

[0002] The development of gas turbines will continue the demand for higher operating temperatures. In known cooling systems a current parallel cooling approach leads to higher flame temperatures due to the lack of available air to the primary zone. Higher flame temperatures have a direct adverse impact on the NOx emissions.

[0003] It is known to apply a double skin arrangement for a combustion chamber of a combustion apparatus. I.e. the combustion chamber exhibits a first wall and a second wall spaced to each other building a cavity. The first wall, which is the outer skin of the combustion chamber exhibits holes so that a coolant can enter the cavity between the first and the second wall of the combustion chamber. The second wall of the combustion chamber, which is the inner layer, also exhibits openings, in particular perforations or a series of small holes, so that the coolant can enter from the cavity into the combustion chamber cooling the inner layer of the combustion chamber. The perforations or small holes in the inner layer are smaller than those on the outer skin and provide for cooling and acoustic dampling.

[0004] An object of the present invention is to improve the cooling of a combustion apparatus. A further object of the present invention is to reduce the NOx emissions of a combustion apparatus. These objects are achieved by a combustion apparatus according to claim 1 of the present invention and by a gas turbine engine according to claim 13 of the present invention. Advantageous embodiments are disclosed in the dependent claims of the present invention.

[0005] More particularly according to the present invention there is provided a combustion apparatus which comprises a combustion chamber in which combustion of a fuel/oxidant mix takes place, a pre-chamber which is located upstream of the combustion chamber, wherein the combustion chamber and the pre-chamber comprise a common first wall and a common second wall spaced to each other building a cavity, and wherein the first wall exhibits at least one first opening for introducing a coolant into the cavity.

[0006] In the present invention the term upstream means the direction from the combustion chamber towards the pre-chamber. The first wall is the outer wall, which faces the outer casing of the combustion apparatus. A second wall is the inner wall, which faces the center of the combustion apparatus and which therefore faces the combustion flame. The first opening can be realized by holes in the first wall. Thereby the cavity is a continuous cavity which extends from the area of the pre-chamber to the area of the combustion chamber. Throughout the invention the term common can also have the meaning of one of the following terms: combined, joint or corporate.

[0007] Due to the common first wall and common second wall of the pre-chamber and the combustion chamber coolant introduced through the first opening into the cavity can also be supplied to the pre-chamber. Therefore, the pre-chamber of the combustion apparatus is also cooled.

[0008] In the above described combustion apparatus the at least one first opening can be located in the area of the combustion chamber. Therefore, all coolant, in particular air, can come from the first opening. Alternatively the first wall can exhibit at least one second opening which is adapted for introducing the coolant into the cavity, as well, wherein the at least one second opening is located in the area of the pre-chamber.

[0009] The second opening in the first wall can be realized by a softwall or by at least one dilution hole or by a perforation of the first wall. Due to the provision of the at least one second opening in the first wall in the area of the pre-chamber an additional cooling of the pre-chamber can be provided. The holes in the first wall have a larger diameter and are spaced at a greater distance than the holes in the second wall.

[0010] In the above described combustion apparatuses the second wall can exhibit at least one third opening adapted for outputting the coolant from the cavity to the combustion chamber and/or the pre-chamber.

[0011] By a corresponding arrangement of at least one third opening in the second wall an optimized cooling of the second wall can be realized by the realization of a cooling film next to the second wall. If more than one third opening is provided in the second wall then these openings can be located in the area of the pre-chamber and/or the area of the combustion chamber.

[0012] In the above described combustion apparatuses a first device can be provided for mixing a fuel with an oxidant, wherein the first device is located upstream of the pre-chamber.

[0013] In the above described combustion apparatus the first device can be arranged in such a way that the coolant can be introduced from the cavity into the first device, wherein the first device is adapted for receiving the coolant from the cavity.

[0014] By introducing the coolant into the first device the coolant is supplied to the pre-chamber and to the combustion chamber by the first device. Therefore, an effective cooling of the pre-chamber and the combustion chamber can be achieved. More particularly, en effective cooling of the inner face of the second wall along the pre-chamber and the combustion chamber is achieved.

[0015] In the two last described combustion apparatuses a second device can be provided between the first device and the cavity, wherein the second device is adapted for outputting the coolant to the first device and/or the pre-chamber.

[0016] Moreover, the second device can also be located in the cavity, the second device being adapted for outputting the coolant to the first device and/or the pre-chamber.

[0017] By introducing the coolant through the second device into the first device an optimized provision of the coolant to the first device can be realized. This coolant then is supplied to the pre-chamber and to the combustion chamber by the first device cooling the pre-chamber and the combustion chamber. It is also possible that the second device outputs the coolant directly into the pre-chamber. Thereby, an optimized cooling of the pre-chamber can be realized. More particularly, en effective cooling of the inner face of the second wall along the pre-chamber and the combustion chamber is achieved. It is furthermore possible that the output of the coolant through the second device is so chosen that it matches the flow induced from the first device. This avoids any potential shear layers which may result in flash backs.

[0018] In the above described combustion apparatus the second device can output the coolant radially or axially into the pre-chamber or can output the coolant axially into the first device.

[0019] Thereby, the term radially means the direction towards a center axis of the combustion apparatus and the term axially means a direction parallel to the center axis of the combustion apparatus. The second device therefore can be adapted to create a film that directs the flow along the pre-chamber wall. This coolant film is also realized by coolant outputted by third openings in the second wall.

[0020] In the two last above described combustion apparatuses the second device can comprise a swirler, in particular a radial swirler or an axial swirler.

[0021] In the three last described combustion apparatuses the first device and the second device can be formed integrally, i.e. in one piece.

[0022] By integrally forming the first device and the second device the combined device can be realized in a compact form. Moreover, the production of an integrally formed first and second device eases the production and the matching of the flows from the first device and the second device can be easily achieved.

[0023] In the six last described combustion apparatuses the first device can comprise a swirler. If the coolant, in particular air, is been exiting into the main swirler then an axial type swirler can be used, if the coolant, in particular air, is been exiting into the prechamber a radial type swirler can be used.

[0024] The swirler creates a swirling mix of the fuel and the oxidant, which travels along the pre-chamber to the combustion chamber. The swirler can be a radial swirler, i.e. the oxidant and/or the fuel/oxidant mix is outputted in a radial direction into the pre-chamber. But the present invention is not limited to a first device comprising a radial swirler. The first device can also comprise an axial swirler outputting the oxidant and/or the fuel/oxidant mix in an axial direction into the pre-chamber.

[0025] In the above described combustion apparatuses the coolant can be an oxidant, in particular air.

[0026] Furthermore, the present invention discloses a gas turbine engine, which comprises at least one of the above described combustion apparatuses.

[0027] The present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic cross-sectional side view of a combustion apparatus according to the prior art,

Figure 2 is a schematic cross-sectional side view of a combustion apparatus according to the present invention.

[0028] Figure 1 of the present invention shows a schematic cross-sectional side view of a combustion apparatus according to the prior art. The combustion apparatus shown in Figure 1 comprises a combustion chamber 12, a pre-chamber 14 located upstream of the combustion chamber 12, a first device 10 for mixing a fuel with an oxidant, wherein the first device 10 is located upstream of the pre-chamber 14. Moreover, the combustion apparatus according to the prior art also comprises a back plate 50 and an outer casing. The combustion chamber 12 exhibits a first wall 20 and a second wall 30, wherein the first wall 20 is spaced to the second wall 30. Therefore, the first wall 20 and the second wall 30 build a cavity 40. The first wall 20 exhibits a first opening for introducing a coolant into the cavity 40. Furthermore, the second wall 30 exhibits at least one opening 21 for outputting the coolant from the cavity 40 into the combustion chamber 12. Thereby, a cooling of the combustion chamber 12 is achieved.

[0029] An oxidant, such as e.g. air, is supplied by a not shown compressor to the first device 10. The flow direction of the oxidant is indicated by dotted arrows shown in the upper part of Figure 1. The first device 10 is adapted for mixing a fuel, which can be supplied by fuel galleries through the back plate 50, with the oxidant supplied by the not shown compressor. The first device 10 outputs the oxidant or the fuel/oxidant mix into the pre-chamber 14. In the case shown in Figure 1 the combustion apparatus exhibits a cylindrical geometry so that the first device 10 outputs the oxidant or the fuel/oxidant mix towards the center axis of the combustion apparatus and the first device 10 respectively.

[0030] According to the radial output of the oxidant or the fuel/oxidant mix from the first device 10 a central recirculation is generated in the pre-chamber 14. The flow structure having a central recirculation extends from the pre-chamber 14 into the combustion chamber 12. The flow structure having the central recirculation is indicated by the dotted arrows extending from the pre-chamber 14 into the combustion chamber 12. The recirculation is an aerodynamic feature of highly swirling flow. The recirculating flow is generally hot combustion products and it is this which heats the prechamber and incoming fluids.

The not combusted oxidant and/or fuel/oxidant mix interacts with the wall of the pre-chamber 14 and therefore heats the pre-chamber 14.

[0031] Figure 2 of the present invention shows a schematic cross-sectional side view of a combustion apparatus 100 according to the present invention. The combustion apparatus 100 shown in Figure 2 comprises a combustion chamber 12 in which combustion of a fuel/oxidant mix takes place, and a pre-chamber 14 located upstream of the combustion chamber 12. The combustion chamber 12 and the pre-chamber 14 comprise a common first wall 20 and a common second wall 30, wherein the first wall 20 and the second wall 30 are spaced to each other, so that they build a cavity 40. The cavity 40 therefore extends from the combustion chamber 12 to the pre-chamber 14. Moreover, the first wall 20 of the combustion apparatus 100 exhibits at least one first opening 21 which is adapted for introducing a coolant into the cavity 40.

[0032] The common first wall 20 of the combustion chamber 12 and the pre-chamber 14 is the outer skin or the outer wall of the combustion chamber 12 and the pre-chamber 14. The common second wall 30 of the combustion chamber 12 and the pre-chamber 14 is the inner skin of the combustion chamber 12 and the pre-chamber 14 facing the center of the combustion apparatus 100 and therefore facing the center of the combustion chamber 12 and the pre-chamber 14.

[0033] The at least one first opening 21 in the first wall 20 can e.g. be realized by a softwall, a dilution hole or simply by a perforation of the first wall. The position of the first opening 21 in the first wall 20 is completely variable. E.g. the first opening 21 in the first wall 20 can be located in the area of the combustion chamber 12, as shown in Figure 2. Nevertheless, the present invention is not limited to this arrangement. The first opening 21 of the first wall 20 can also be located in the area of the pre-chamber 14.

[0034] Coolant introduced into the cavity 40 through the first opening 21 in the first wall 20 spreads in the cavity 40 as indicated by the dotted arrows inside the cavity 40. Therefore, in addition to a cooling of the combustion chamber 12 also a cooling of a pre-chamber 14 is realized.

[0035] In Figure 2 it is shown that the at least one first opening 21 in the first wall 20 is located in the area of the combustion chamber 12. But this is not a limitation of the present invention. The at least one first opening 21 can of course also be a plurality of first openings 21, which can be arranged in the first wall 20. This arrangement of the plurality of first openings 21 in the first wall 20 can be adapted by the person skilled in the art as required.

[0036] In the combustion apparatus 100 shown in Figure 2 the first wall 20 additionally exhibits at least one second opening 22. The at least one second opening 22 is also adapted for introducing the coolant into the cavity 40. In Figure 2 of the present invention it is shown that the at least one second opening 22 is located in the area of the pre-chamber 40. Nevertheless, the present invention is not limited to this arrangement. The at least one second opening 22 in the first wall 20 can also be located in another area of the double skin arrangement of the combustion chamber 12 and the pre-chamber 14. In Figure 2 it is shown that coolant introduced through the second opening 22 is directly coupled into the cavity 40 in the area of the pre-chamber 14. Therefore, a more effective cooling of the pre-chamber 14 is realized.

[0037] In Figure 2 of the present invention it is indicated by the dotted arrows in the area of the pre-chamber 14 directing into the direction of the center axis of the combustion apparatus 100 that the at least one second opening 22 is realized by three second openings 22 in the first wall 20. Nevertheless, the present invention is not limited to this arrangement. Any arbitrary number of second openings 22 in the first wall 20, which applies useful for the person skilled in the art to reach an optimized cooling of the pre-chamber 14 and the combustion chamber 12 is possible.

[0038] The at least one second opening 22 in the first wall 20 can be realized e.g. by a softwall or by at least one dilution hole or simply by a perforation of the common first wall 20 of the combustion chamber 12 and the pre-chamber 14.

[0039] In Figure 2 it is shown that the common second wall 30 of the combustion chamber 12 and the pre-chamber 14 exhibits at least one third opening 31. This at least one third opening 31 is adapted for outputting the coolant from the cavity 40 to the combustion chamber 12 and/or the pre-chamber 14.

[0040] This at least one third opening 31 in the common second wall 30 of the combustion chamber 12 and the pre-chamber 14 can also be a plurality of third openings 31. In Figure 2 of the present invention it is shown that the at least one third opening 31 in the second wall 30 is positioned in the area of the combustion chamber 12. Nevertheless, the present invention is not limited to this arrangement. The at least one third opening 31 can also be located in other areas of the second wall 30, which apply usefull for the person skilled in the art for an optimized cooling of the combustion chamber 12 and/or the pre-chamber 14.

[0041] Coolant which is outputted by the at least one third opening 31 into the combustion chamber 12 and/or the pre-chamber 14 can build a cooling film next to the common second wall 30 of the combustion chamber 12 and the pre-chamber 14. Therefore, an optimized cooling of the combustion chamber 12 and the pre-chamber 14 can be realized.

[0042] The at least one third opening 31 can be realized e.g. by a softwall or by at least one dilution hall or simply by a perforation of the second wall 30.

[0043] In Figure 2 of the present invention it is shown that the combustion apparatus 100 comprises a first device 10, which is adapted for mixing a fuel with an oxidant. The first device 10 is located upstream of the pre-chamber 14. Oxidant, which is supplied by a not shown compressor is supplied to the first device 10. The flow direction of the oxidant is indicated by dotted arrows in the upper left part of Figure 2. In Figure 2 it is shown that the oxidant is outputted by the first device into a radial direction towards the center axis of the first device 10 and the combustion apparatus 100, respectively. It is possible that fuel is injected into the pre-chamber 14 by injection holes where the injected fuel is mixed with the oxidant supplied by the first device 10. Nevertheless, the present invention is not limited to this arrangement. It is also possible that fuel is inserted into the first device 10 by e. g. fuel galleries or fuel injection holes so that mixing of the oxidant and the inserted fuel is already conducted in the first device 10. This fuel/oxidant mix is then outputted by the first device into the pre-chamber 14.

[0044] Even though it is shown in Figure 2 of the present invention that a second device 16 is located between the first device 10 and the cavity 40 the present invention is not limited to this arrangement. It is also possible that the second device 16 is omitted. In case of omitting the second device 16 coolant introduced into the cavity 40 is directed towards the first device 10. The first device 10 is adapted for receiving the coolant from the cavity 40. This coolant then is outputted to the pre-chamber 14 where it is spread also into the direction of the combustion chamber 12. Therefore, an optimized cooling of the pre-chamber 14 and the combustion chamber 12 and also of the combustion flame itself can be realized.

[0045] In Figure 2 of the present invention it is shown that in the combustion apparatus 100 a second device 16 is located between the first device 10 and the cavity 40. The second device 16 is adapted for outputting the coolant introduced into the cavity 40 to the first device 10 and/or the pre-chamber 14.

[0046] In case of an outputting of the cooling from the second device 16 to the first device 10 an optimized supply of the coolant to the first device 10 and therefore to the pre-chamber 14 and the combustion chamber 12 is realized. In the case of outputting of the coolant by the second device 16 into the pre-chamber 14 also an optimized cooling of the pre-chamber 14 and therefore also of the combustion chamber 12 can be realized.

[0047] By a suitable outputting of the coolant by the second device 16 into the pre-chamber 14 a matching can be achieved with the flow structure induced by the first device 10. Therefore, any potential shear layers, which may result in flash backs of the combustion flame can be avoided.

[0048] In the case that the second device 16 outputs the coolant into the pre-chamber 14 the second device 16 can output the coolant radially or axially. That is, the second device 16 can output the coolant parallel to the center axis of the combustion apparatus 100 or radially towards the center axis of the combustion apparatus 100.

[0049] The second device 16 can comprise a swirler. This swirler may either be a radial swirler or an axial swirler. Moreover, the first device 10 can also comprise a swirler, which also may either be a radial swirler or an axial swirler. In case of an axial swirler, which is comprised by a first device 10, the axial swirler 10 has to be introduced into the pre-chamber 14. Moreover, it is possible that the first device 10 and the second device 16 are integrally formed.

[0050] With the combustion apparatus 100 according to the present invention an improvement of the cooling of the pre-chamber 14 and the combustion chamber 12 and also of the combustion flame itself is realized. Thereby, the emissions (NOx) are lowered. The provision of a cavity 40 realized by a common first wall 20 and a common second wall 30 of the pre-chamber 14 and the combustion chamber 12 optimizes the cooling of the pre-chamber 14 and the combustion chamber 12 and the combustion flame itself.

[0051] It has to be noted, with "common" wall for a pre-chamber and a main combustion chamber, a wall is meant that continues along both chamber sections, the pre-chamber and the main combustion chamber. For example the common wall may be a single sheet of metal pressed into the wanted form such that a pre-chamber and a main combustion chamber is built. The first common wall and the second common wall may have separators between each other but otherwise should not be joined such that the cavity between the two walls would be blocked. Over the whole length of the walls, the cavity should have a width to let pass cooling fluid without major interruptions. Specifically no larger areas of the two walls should touch or should be bonded to each other to form a blockage for the cooling fluid.

[0052] Thus the two common walls with the cavity in between form a double skin pre-chamber leading into a double skin combustion chamber.

Claims

1. A combustion apparatus (100) comprising:

   a combustion chamber (12) in which combustion of a fuel/oxidant mix takes place;
   a pre-chamber (14) located upstream of the combustion chamber (12);
   wherein the combustion chamber (12) and the pre-chamber (14) comprise a common first wall (20) and a common second wall (30) spaced to each other building a cavity (40), and wherein the first wall (20) exhibits at least one first opening (21) for introducing a coolant into the cavity (40).

2. The combustion apparatus (100) according to claim 1, wherein the at least one first opening (21) is located in the area of the combustion chamber (12), and wherein the first wall (20) exhibits at least one second opening (22) for introducing the coolant into the cavity (40), wherein the at least one second opening (22) is located in the area of the pre-chamber (14).

3. The combustion apparatus (100) according to claim 1 or 2, wherein the second wall (30) exhibits at least one third opening (31) for outputting the coolant from the cavity (40) to the combustion chamber (12) and/or the pre-chamber (14).

4. The combustion apparatus (100) according to one of the claims 1 to 3, further comprising a first device (10) for mixing a fuel with an oxidant, the first device (10) located upstream of the pre-chamber (14).

5. The combustion apparatus (100) according to claim 4, wherein the first device (10) is arranged in such a way that the coolant can be introduced from the cavity (40) into the first device (10), wherein the first device (10) is adapted for receiving the coolant from the cavity (40).

6. The combustion apparatus (100) according claim 4 or 5, further comprising a second device (16) located between the first device (10) and the cavity (40), the second device (16) being adapted for outputting the coolant to the first device (10) and/or the pre-chamber (14).

7. The combustion apparatus (100) according to one of the claims 4 to 6, further comprising a second device (16) located in the cavity (40), the second device (16) being adapted for outputting the coolant to the first device (10) and/or the pre-chamber (14).

8. The combustion apparatus (100) according to claim 6 or 7, wherein the second device (16) outputs the coolant radially or axially into the pre-chamber (14) or outputs the coolant axially into the first device (10).

9. The combustion apparatus (100) according to one of the claims 6 to 8, wherein the second device (16) comprises a swirler, in particular a radial swirler or an axial swirler.

10. The combustion apparatus (100) according to any one of the claims 6 to 9, wherein the first device (10) and the second device (16) are integrally formed.

11. The combustion apparatus (100) according to any of the claims 4 to 10, wherein the first device (10) comprises a swirler.

12. The combustion apparatus according to any of the claims 1 to 11, wherein the coolant is an oxidant, in particular air.

13. A gas turbine engine comprising a combustion apparatus according to any one of the preceding claims.

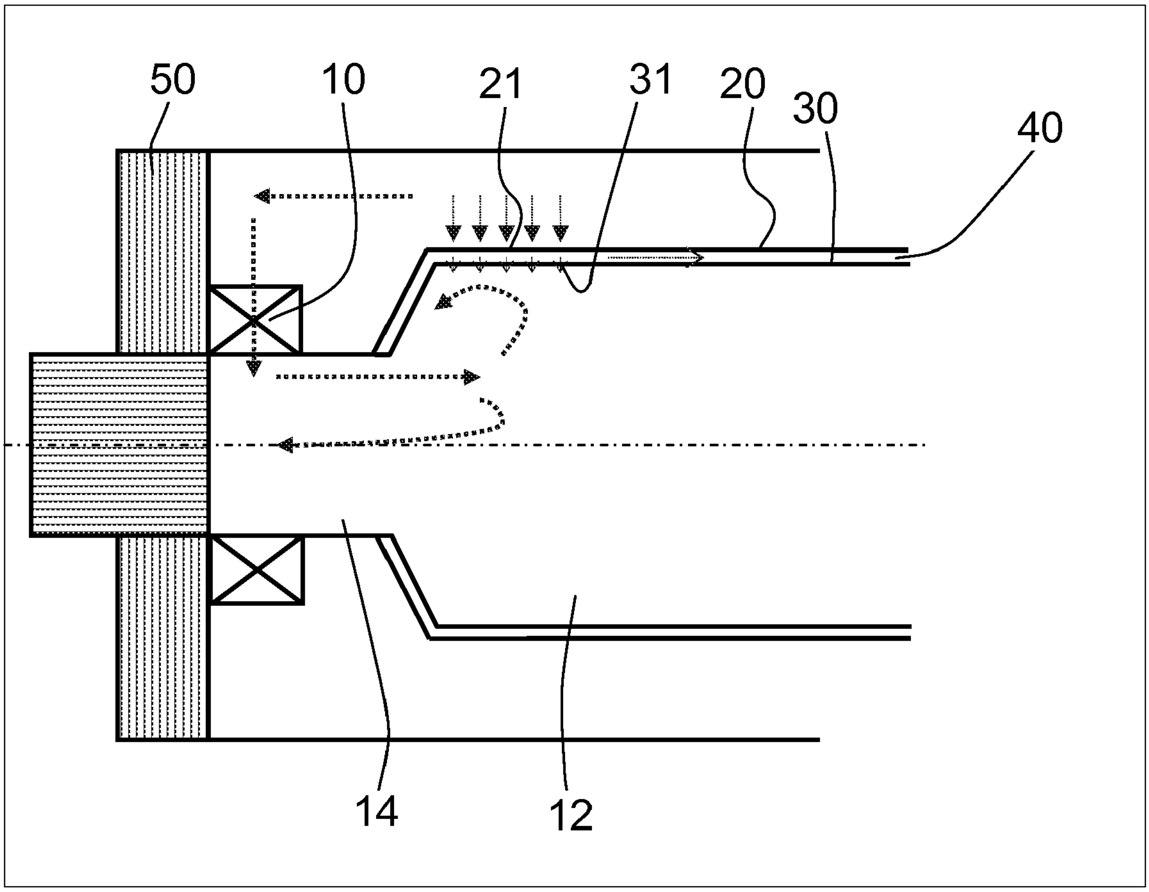

Fig. 1

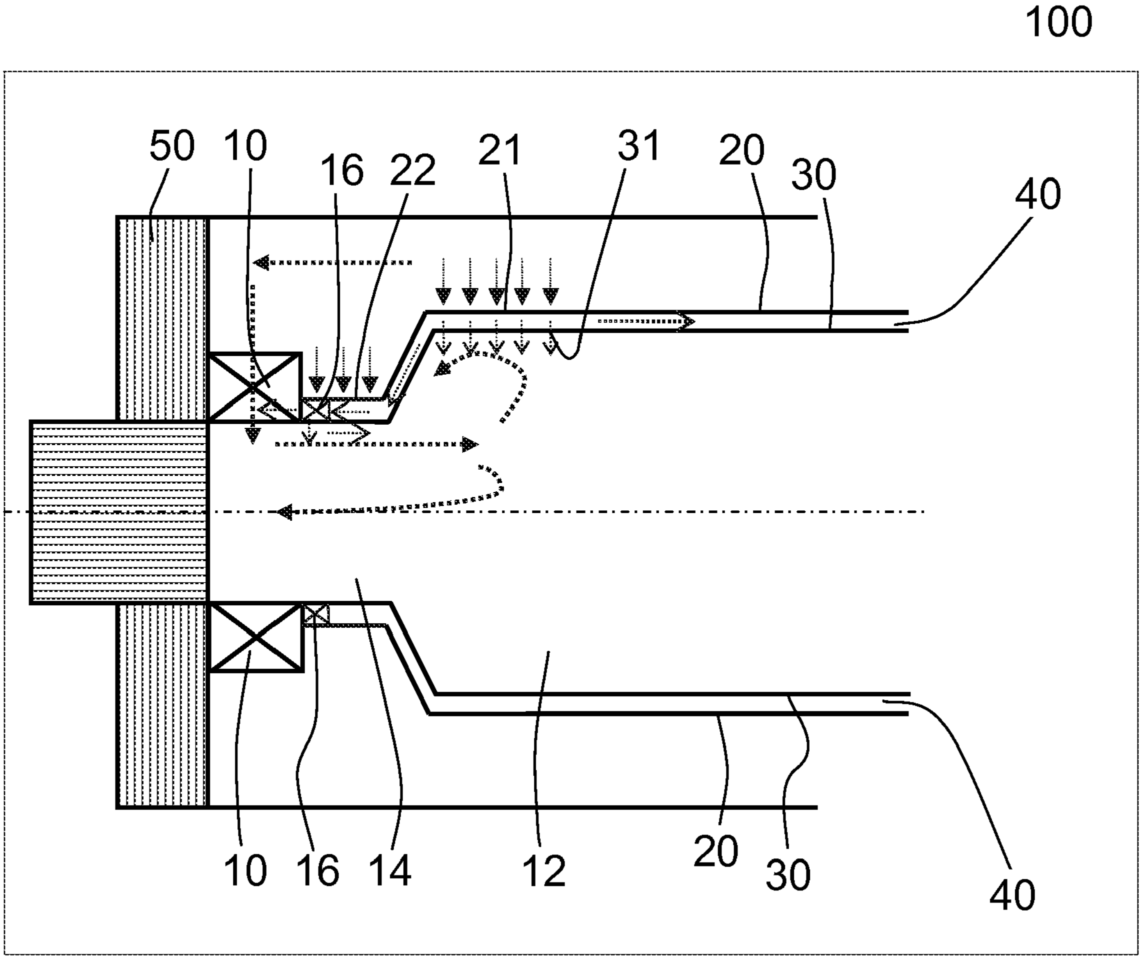

Fig. 2

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 10 16 8429

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 896 193 A2 (EUROP GAS TURBINES LTD [GB]) 10 February 1999 (1999-02-10) * paragraph [0017] - paragraph [0021]; figure 1 *	1,4-13	INV. F23R3/00
X	WO 2008/028621 A1 (MAN TURBO AG [DE]; BRINKMANN RAINER [DE]; HUITENGA HOLGER [DE]; NORSTE) 13 March 2008 (2008-03-13) * page 3, line 30 - page 6; figure 1 *	1-5, 11-13	
X	US 2009/120094 A1 (NORSTER ERIC ROY [GB]) 14 May 2009 (2009-05-14) * paragraph [0016] - paragraph [0022]; figure 2 *	1,3-5, 11-13	
X	EP 0 725 253 A2 (MITSUBISHI HEAVY IND LTD [JP]) 7 August 1996 (1996-08-07) * column 4, line 45 - column 5, line 35; figure 1 *	1	
A	WO 01/59369 A1 (ULSTEIN TURBINE AS [NO]; ROEKKE NILS A [NO]) 16 August 2001 (2001-08-16) * page 7, line 15 - page 8, line 9; figures 1,4 *	3,6,12	TECHNICAL FIELDS SEARCHED (IPC) F23R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	28 March 2011	Munteh, Louis

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

3

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 16 8429

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-03-2011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0896193 A2	10-02-1999	DE 69818376 D1	30-10-2003
		DE 69818376 T2	22-04-2004
		GB 2328011 A	10-02-1999
		US 6134877 A	24-10-2000
WO 2008028621 A1	13-03-2008	CA 2662720 A1	13-03-2008
		CN 101573560 A	04-11-2009
		DE 102006042124 A1	27-03-2008
		EP 2059724 A1	20-05-2009
		JP 2010502928 T	28-01-2010
		US 2010126174 A1	27-05-2010
US 2009120094 A1	14-05-2009	CN 101918764 A	15-12-2010
		EP 2220437 A2	25-08-2010
		WO 2009063321 A2	22-05-2009
EP 0725253 A2	07-08-1996	DE 69631991 D1	06-05-2004
		DE 69631991 T2	27-01-2005
		JP 8270950 A	18-10-1996
		US 5865030 A	02-02-1999
WO 0159369 A1	16-08-2001	AU 3622101 A	20-08-2001
		EP 1255952 A1	13-11-2002
		JP 2003522929 T	29-07-2003
		NO 20000715 A	15-08-2001
		US 2003074885 A1	24-04-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82