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(71) Applicant: **Alstom Technology Ltd**

5400 Baden (CH)

(72) Inventors:

- **Huber, Andreas**
CH-5400, Baden (CH)
- **Noiray, Nicolas**
CH-5430, Wettingen (CH)
- **Schürmans, Bruno**
CH-1814 La Tour De Peitz (CH)
- **Bothien, Mirko**
CH-8037, Zürich (CH)

(54) Damper Arrangement

(57) The damper arrangement (10) comprises a first damping volume (11) with a first entrance portion (12) connectable to a chamber (13) wherein pressure oscillations to be damped may be generated. The damping

arrangement (10) also has a second damping volume (15) with a second entrance portion (16). The second entrance portion (16) is housed within the first entrance portion (12).

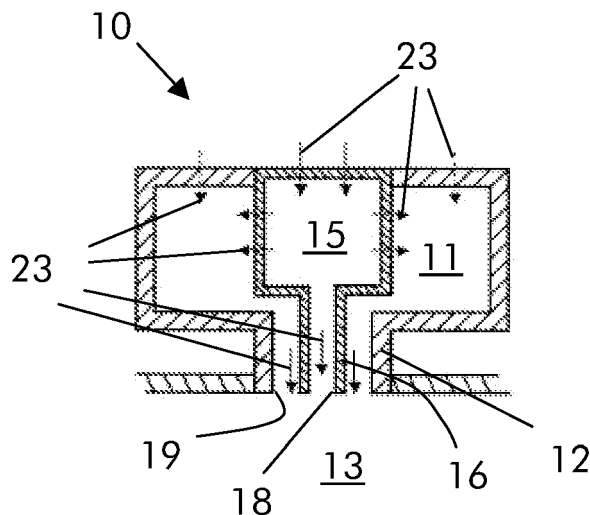


Fig. 2

Description

TECHNICAL FIELD

[0001] The present invention relates to a damper arrangement.

[0002] In particular, the damper arrangement is used to damp pressure oscillations that are generated during operation of a gas turbine provided with a lean premixed, low emission combustion system.

BACKGROUND OF THE INVENTION

[0003] Gas turbines are known to comprise one or more combustion chambers, wherein a fuel is injected, mixed to an air flow and combusted, to generate high pressure flue gases that are expanded in a turbine.

[0004] During operation, pressure oscillations may be generated that could cause mechanical damages to the combustion chamber and limit the operating regime.

[0005] For this reason, usually combustion chambers are provided with damping devices, such as quarter wave tubes, Helmholtz dampers or acoustic screens, to damp these pressure oscillations.

[0006] With reference to figure 1, traditional Helmholtz dampers 1 include a damping volume 2 (i.e. a resonator volume) and an entrance portion or neck 3 to be connected to a combustion chamber 5, wherein combustion occurs and pressure oscillations to be damped may be generated (reference 4 indicates the wall of the combustion chamber 5).

[0007] The resonance frequency (i.e. the damped frequency) of the Helmholtz damper depends on the geometrical features of the damping volume 2 and entrance portion 3 (neck) and must correspond to the frequency of the pressure oscillations generated in the combustion chamber 5.

[0008] Nevertheless, at the low frequency range the damping frequency bandwidth of the Helmholtz dampers 1 is very narrow, such that in case one single Helmholtz damper is used, it could not be able to cover the whole frequency bandwidth of the pressure oscillations that are generated in the combustion chamber 5.

[0009] It is clear that in this case some of the pressure oscillations would not be damped, with a detrimental effect on the gas turbine structure and operation.

[0010] In order to damp pressure oscillations in a bandwidth sufficiently large, typically a number of Helmholtz dampers 1 are connected to the combustion chamber 5.

[0011] Nevertheless, also in this case problems may arise.

[0012] In fact, in order to efficiently damp pressure oscillations having a fixed frequency, a Helmholtz damper must be located at the position of the combustion chamber where that pressure oscillations have maximum amplitude.

[0013] It is clear that when a combustion chamber has the pressure oscillations with different frequencies hav-

ing maximum amplitude at the same location or at locations close to one another, different Helmholtz dampers having different features should be installed at that location.

[0014] Nevertheless, in combustion chambers of gas turbines the locations where Helmholtz dampers can be connected are limited and, thus, it is usually not possible to connect different Helmholtz dampers at the same location (for example angularly shifted from one another).

[0015] DE102005062284 discloses a combustion chamber with a damper arrangement including several Helmholtz dampers connected in series.

[0016] This arrangement allows different frequencies to be addressed, but it is very demanding in terms of space.

SUMMARY OF THE INVENTION

[0017] The technical aim of the present invention therefore includes providing a damper arrangement addressing the aforementioned problems of the known art.

[0018] Within the scope of this technical aim, an aspect of the invention is to provide a damper arrangement, which is able to damp pressure oscillations having different frequencies at the same location.

[0019] Another aspect of the invention is to provide a damper arrangement, which is quite compact and, in other words, requires a limited space, in particular when compared to traditional Helmholtz dampers connected in series.

[0020] The technical aim, together with these and further aspects, are attained according to the invention by providing a damper arrangement in accordance with the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Further characteristics and advantages of the invention will be more apparent from the description of a preferred but non-exclusive embodiment of the damper arrangement illustrated by way of non-limiting example in the accompanying drawings, in which:

Figure 1 is a schematic view of a Helmholtz damper according to the prior art;

Figures 2 and 3 show two different embodiments of damper arrangements;

Figure 4 shows an entrance portion or neck of a Helmholtz damper;

Figure 5 shows means to enhance viscous dissipation included in the embodiment of figure 4;

Figure 6 shows a further entrance portion or neck of a Helmholtz damper;

Figure 7 shows a cross section of the entrance portion or neck of figure 6;

Figure 8 shows a further different cross section of an entrance portion or neck; and

Figures 9 and 10 show further different embodiments

of

the entrance portion or neck.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0022] The damper arrangement 10 comprises a first damping volume 11 with a first entrance portion or neck 12 connectable to a chamber 13 wherein pressure oscillations to be damped may be generated.

[0023] Thus, for example, the chamber 13 may be the combustion chamber of a gas turbine.

[0024] The arrangement 10 has a second damping volume 15 with a second entrance portion or neck 16.

[0025] The second entrance portion 16 is housed within the first entrance portion 12.

[0026] In particular, the first and the second entrance portions 12, 16 are defined by a first and a second tubular part that are preferably coaxial with each other.

[0027] In addition, the mouth 18 of the tubular part defining the second entrance portion 16 is flush with the mouth 19 of the tubular part defining the first entrance portion 12 (i.e. they are aligned and in particular the mouth 18 does not protrude from the mouth 19).

[0028] As shown in the figures, the second damping volume 15 is included (i.e. housed) within the first damping volume 11. Nevertheless in different embodiments it could also be external or partially external to it; for example the wall defining the first damping volume 11 could have a hole through which the second volume 15, or also the first entrance portion 16, passes.

[0029] In particular, the first volume 11 and the first entrance portion 12 define a Helmholtz damper and the second volume 15 and the second entrance portion 16 also define a Helmholtz damper (embodiment shown in figure 2).

[0030] Alternatively, the first volume 11 and the first entrance portion 12 define a Helmholtz damper and the second volume 15 and the second entrance portion 16 define a quarter wave tube (embodiment shown in figure 3).

[0031] Also further embodiments are possible and, for example, the first volume 11 and the first entrance portion 12 may define a quarter wave tube and the second volume 15 and the second entrance portion 16 may also define a quarter wave tube (embodiment not shown).

[0032] Advantageously the first entrance portion 12 and/or the second entrance portion 16 may be provided with means 20 to enhance viscous dissipation (in order to increase damping efficiency).

[0033] In particular, figure 4 shows an entrance portion 16; it is clear that even if this particular example is described and shown, also different embodiments are possible and the means 20 may be provided at the entrance portion 12 in addition to or instead of the entrance portion 16. Moreover also the entrance portion of a quarter wave tube (in case it is provided) may be provided with the

means 20.

[0034] Figure 5 shows a first embodiment of the means 20 to enhance viscous dissipation being a perforated plate. Alternatively, the means 20 may also be a vortex generator.

[0035] Figures 6 and 7 show a further embodiment in which the means 20 are arranged to increase the inner surface of the entrance portion 16; in this case the means 20 may define a cross section such as a star shaped cross section (eventually by introducing into the entrance portion 16 a holed cylinder having internal walls with the required shape, as shown in the enclosed figures 6 and 7).

[0036] Figure 8 shows a further example in which the means 20 comprise additional plates housed in the entrance portion 16.

[0037] Alternatively, means 21 to reduce the flow resistance may also be provided at the entrance portion 16 and/or 12, both in case the damper arrangement comprises Helmholtz dampers and/or quarter wave tubes.

[0038] These means 21 could comprise rounded inlet and/or outlet of the entrance portions (figures 9 and 10).

[0039] This can lead to higher oscillation amplitudes in the entrance portion and thus an increase of damping effect.

[0040] In order to cool the components of the damper arrangement, cooling holes may be provided, to allow cooling air 23 to enter the first and/or second volume 11 and/or 15.

[0041] The operation of the damper arrangement of the invention is apparent from that described and illustrated and is substantially the following.

[0042] When during gas turbine operation pressure oscillations are generated, they cause gas to move in and out the entrance portions 12 and 16; this makes the pressure oscillations damp.

[0043] Since the entrance portions 12, 16 have the same or substantially the same location, also pressure oscillations having different frequencies with peaks at the same or close locations can be addressed.

[0044] Naturally, the features described may be independently provided from one another.

[0045] In practice, the materials used and the dimensions can be chosen at will according to requirements and to the state of the art.

REFERENCE NUMBERS

[0046]

- | | |
|---|--------------------------|
| 1 | Helmholtz damper |
| 2 | damping volume |
| 3 | entrance portion or neck |
| 4 | wall |

5 combustion chamber
 10 damp arrangement
 11 first volume
 12 first entrance or neck
 13 chamber
 15 second volume
 16 second entrance or neck
 18 mouth of 16
 19 mouth of 12
 20 means to enhance viscous dissipation
 21 means to reduce the flow resistance
 23 cooling air

characterised in that the first entrance portion (12) and/or the second entrance portion (16) are provided with means (20) to enhance viscous dissipation.

- 5 7. Damper arrangement (10) as claimed in claim 1, **characterised in that** the first entrance portion (12) and/or the second entrance portion (16) are provided with means (21) to reduce the flow resistance.
- 10 8. Damper arrangement (10) as claimed in claim 1, **characterised in that** the first volume (11) and the first entrance portion (12) define a Helmholtz damper.
- 15 9. Damper arrangement (10) as claimed in claim 8, **characterised in that** the second volume (15) and the second entrance portion (16) define a Helmholtz damper.
- 20 10. Damper arrangement (10) as claimed in claim 8, **characterised in that** the second volume (15) and the second entrance portion (16) define a quarter wave tube.

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Claims

1. Damper arrangement (10) comprising a first damping volume (11) with a first entrance portion (12) connectable to a chamber (13) wherein pressure oscillations to be damped may generate, **characterised by** comprising a second damping volume (15) with a second entrance portion (16), wherein the second entrance portion (16) is housed within the first entrance portion (12). 30 35
2. Damper arrangement (10) as claimed in claim 1, **characterised in that** the first and the second entrance portion (12, 16) are defined respectively by a first and a second tubular part. 40
3. Damper arrangement (10) as claimed in claim 2, **characterised in that** the tubular part defining the first entrance portion (12) and the tubular part defining the second entrance portion (16) are coaxial with each other. 45
4. Damper arrangement (10) as claimed in claim 2, **characterised in that** the mouth (18) of the tubular part defining the second entrance portion (16) is flush with the mouth (19) of the tubular part defining the first entrance portion (12). 50
5. Damper arrangement (10) as claimed in claim 1, **characterised in that** the second damping volume (15) is included in the first damping volume (11). 55
6. Damper arrangement (10) as claimed in claim 1,

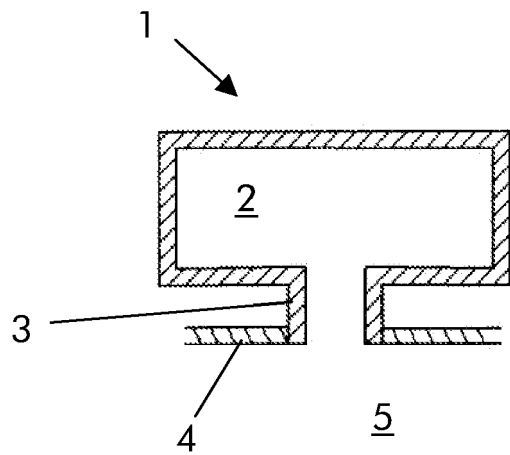


Fig. 1
PRIOR ART

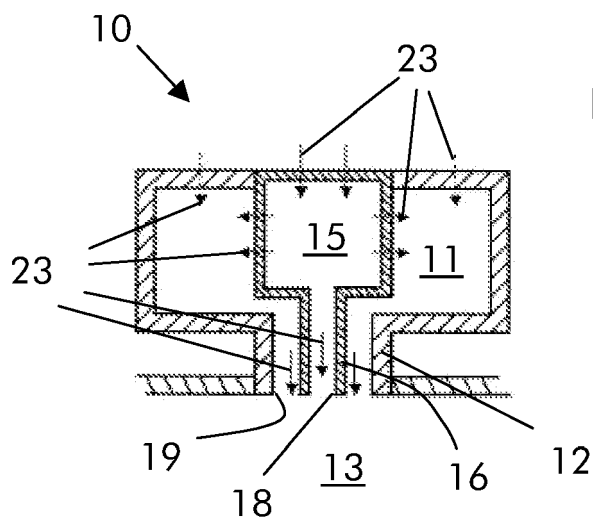


Fig. 2

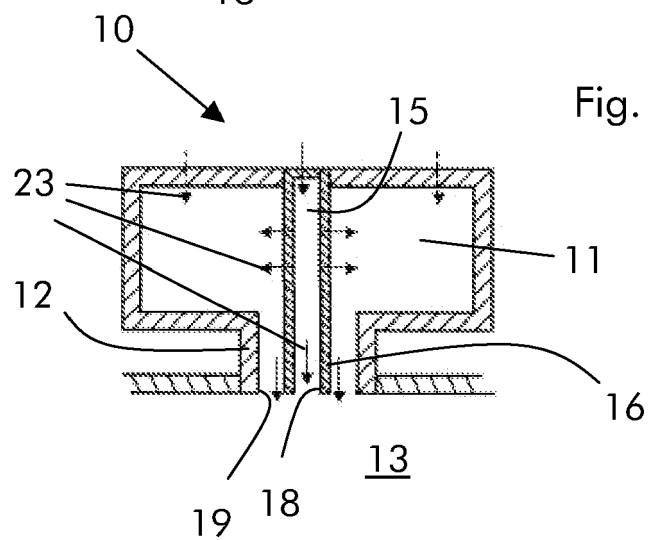
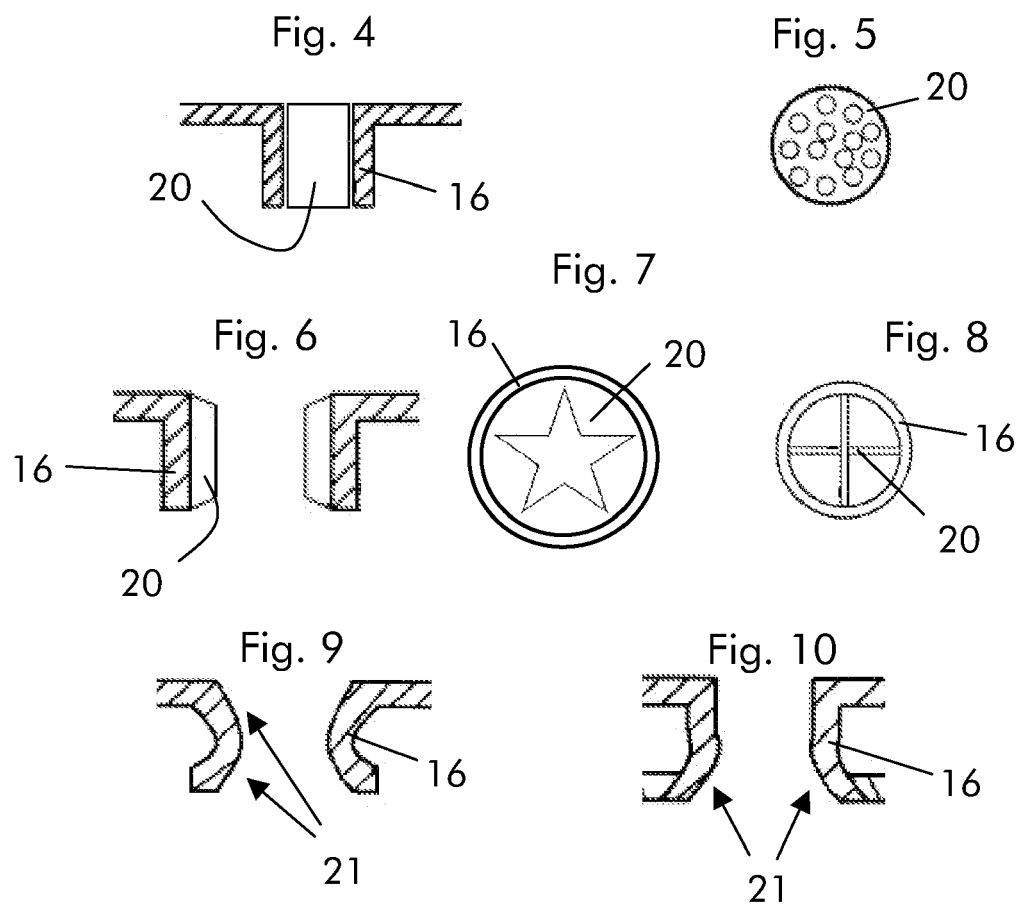


Fig. 3





EUROPEAN SEARCH REPORT

Application Number
EP 10 16 6095

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	JP 9 021364 A (TOYOTA AUTO BODY CO LTD) 21 January 1997 (1997-01-21)	1-5,8-10	INV. F23M99/00
Y	* figures 1-5 *	6,7	

X	EP 0 974 788 A1 (ASEA BROWN BOVERI [CH]) 26 January 2000 (2000-01-26)	1-3,8-10	
Y	* paragraph [0026] - paragraph [0031]; figure 3 *	6,7	

Y	JP 6 081737 A (YAMAHA MOTOR CO LTD) 22 March 1994 (1994-03-22)	6	
	* figures 2-5 *		

Y	JP 5 215027 A (SUZUKI MOTOR CO) 24 August 1993 (1993-08-24)	7	
	* figures 2,3 *		

			TECHNICAL FIELDS SEARCHED (IPC)
			F23M F23R F02K F01N F02M
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		1 February 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			

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EPO FORM 1503 03.82 (P04C01)

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

EP 10 16 6095

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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01-02-2011

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JP 5215027	A	24-08-1993	NONE	

REFERENCES CITED IN THE DESCRIPTION

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