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(54) COMBUSTION CHAMBER FOR A GAS TURBINE ENGINE

(57) A combustion chamber for a gas turbine engine includes a casing (2) and a heat shield (3), having ceramic tiles (4) arranged in rows and removably fastened to the casing (2) by respective supporting devices (5). The casing (2) has grooves (7) receiving the supporting devices (5) of a respective row of tiles (4). Each supporting device (5) has a first portion (10) in the form of a plate engaging a respective groove (7) and a second portion (12) in the form of a hooked head coupled to a coupling structure (8) of a respective tile (4). The first portions (10) of the supporting devices (5) of each tile (4) are separated from each other by a respective separation region at a central portion of the respective tile (4). First cooling holes (27) and second cooling holes (23) direct first cooling jets (28) and second cooling jets (25) against the first portions (10) and the second portions (12) of respective supporting device (5). Each supporting device (5) has a through opening at a connection of the first portion (10) and the second portion (12) and spacers (15) on a face (12c) of the respective second portion (12) and wherein a channel (16) aligned with the through opening (17) is defined between the face (12c), the spacers (15) and the tile (4).

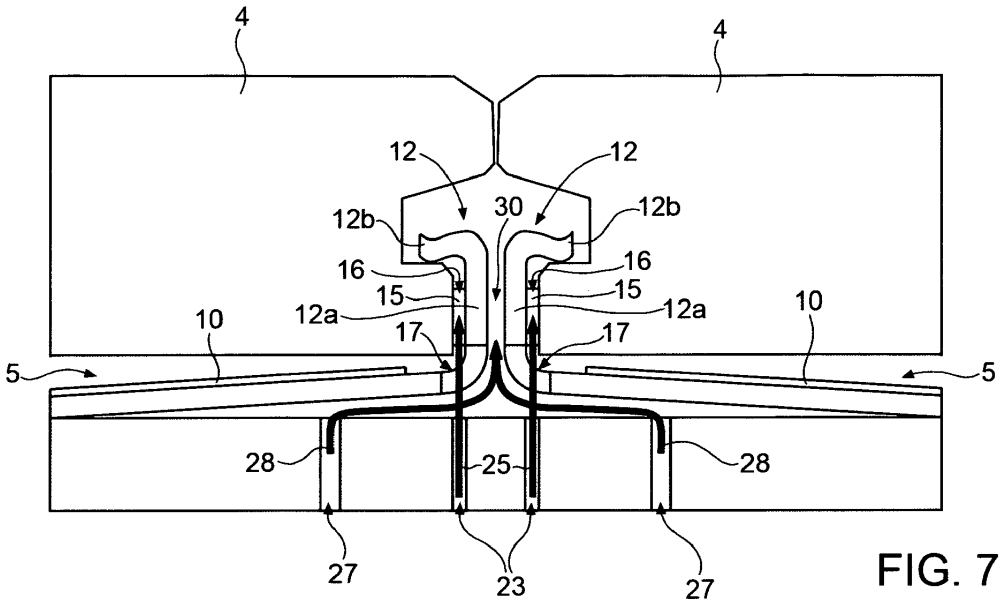

FIG. 7

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Description

TECHNICAL FIELD

[0001] The present invention relates to a gas turbine engine with selected outlet temperature measurements and to a method of operating a gas turbine engine.

BACKGROUND

[0002] As known, the combustion chamber of a gas turbine engines need be internally protected by a thermoinsulating shield of ceramic material, due to the high temperatures reached during the operation. The thermoinsulating shield generally consists of a plurality of tiles of ceramic material arranged in contiguous rows on the inner surface of the casing of the combustion chamber, so as to define a substantially continuous surface. In annular combustion chambers, for example, the tiles are arranged to form circles around the (horizontal) rotor axis. In combustion chambers of the silo type, the rows may still form circles, yet around vertical axes, or vertical columns.

[0003] Normally, the tiles are fastened to the casing by supporting devices which couple to seats on the sides of the tiles themselves. More precisely, a supporting device comprises a plate, configured to engage a corresponding groove in the casing of the combustion chamber, and a hooked head, protruding outside the groove and configured to be coupled to an edge of the tile. The hooked head has a first portion extending orthogonally from the plate and a second portion parallel to the plate. The edges of the tiles are normally provided with seats configured to receive the second portion of the hooked head. The supporting devices are elastic and, are loaded to ensure stable mounting, once the tiles are placed in their seats.

[0004] The supporting devices may be subject to sever thermal stress, because of thermal conduction with the ceramic material ingestion of hot gas that may penetrate between adjacent tiles of the same row or of contiguous rows. In fact, gaps between adjacent tiles are not sealed and hot gas may reach the supporting devices.

[0005] In particular, high temperature and mechanical stress due to vibrations may induce creeping and cause the elastic material forming the supporting devices to exceed the fatigue threshold.

SUMMARY OF THE INVENTION

[0006] It is thus an object of the present invention to provide combustion chamber that allow to overcome or at least attenuate the above described limitations.

[0007] According to the present invention, there is provided a combustion chamber for a gas turbine engine comprising:

a casing; and

a heat shield comprising a plurality of ceramic tiles arranged in rows and removably fastened to the casing by respective supporting devices;

wherein the casing has grooves configured to receive the supporting devices of a respective row of tiles at respective locations;

wherein each tile has opposite coupling sides with respective coupling structures;

wherein each supporting device has a respective first portion in the form of a plate configured to engage a respective groove and a respective second portion in the form of a hooked head configured to couple to the coupling structure on one of the coupling sides of a respective tile;

wherein each tile is fastened to the casing by at least one pair of supporting devices, which engage the same groove and are coupled to opposite coupling sides of the tile;

wherein the first portions of the supporting devices of each tile are separated from each other by a respective separation region at a central portion of the respective tile;

wherein, for each supporting device, the casing has at least one first cooling hole at least one first cooling hole in the respective groove, the at least one first cooling hole being configured to direct a first cooling jet of cooling air against the second portion of the supporting device and the at least one first cooling hole being configured to direct a first cooling jet of cooling air against the first portion of the supporting device;

wherein each supporting device has a through opening at a connection of the first portion and the second portion and spacers on a face of the respective second portion, wherein the spacers are interposed between the face and the respective tile and wherein a channel aligned with the through opening is defined between the face, the spacers and the tile.

[0008] The configuration of the supporting device allows introduction of the first cooling jets directly into the channel so that the hooked head may be reached by impingement flow. The first cooling holes and the second cooling holes provide protection of the supporting devices, specifically directed to the plates (first portions) and to the hooking heads (second portions), which are mostly exposed to hot gas. An impingement scheme is used, thus taking advantage from the associated efficiency. The risk of creeping and of exceeding the fatigue threshold of the material forming the supporting devices is avoided or at least substantially mitigated. Due to the provision of the spacers, moreover, the channel may be defined in practice in the supporting device and the respective tile only delimits one side. No special shape of the coupling sides of the tiles is required and, in particular, there is no need to create recesses in the tiles to allow passage of air.

[0009] According to an aspect of the invention, the combustion chamber comprises a plurality of second

cooling holes configured to direct respective second cooling jets against the second portion of the supporting device.

[0010] According to an aspect of the invention, the combustion chamber comprises a plurality of first cooling holes configured to direct respective first cooling jets against respective portions of the first portion of the supporting device.

[0011] According to an aspect of the invention, the first cooling holes associated with supporting devices of adjacent tiles of the same row of tiles are configured to deliver the respective first cooling jets so that the respective first cooling jets flow along the first portions of the respective supporting devices and interact with each other at a gap between the respective supporting devices, thereby sealing the gap.

[0012] Cooling air supplied by the first cooling holes flows along the plates toward the spaces between adjacent tiles. Opposite flows interact in such space and help seal gaps, further reducing the risk of hot gas ingestion.

[0013] According to an aspect of the invention, the second cooling holes are aligned with the through openings and the channels of the respective supporting devices, whereby the second cooling jets are directed into the through openings and the channels of the respective supporting devices.

[0014] According to an aspect of the invention, the second portion of each supporting device is T-shaped and has a stem projecting perpendicularly from the respective first portion and a hook, extending transversely to the stem and wherein the second cooling jets are directed against the hooks of the respective supporting devices through the respective channels.

[0015] According to an aspect of the invention, wherein, in each supporting device, the spacers are L-shaped and have respective first legs, parallel to the stem and defining the channel, and respective second legs, parallel to the hook and extending in opposite directions from the respective first legs.

[0016] According to an aspect of the invention, in each supporting device, the respective channel is split into two opposite branches each defined between the hook and the second leg of a respective one of the spacers, the branches discharging on opposite sides of the hook.

[0017] According to an aspect of the invention, wherein the coupling structures comprise continuous ribs extending along respective coupling sides of the tiles.

[0018] According to an aspect of the invention, the ribs have respective flat faces resting against the second portions of the respective supporting devices.

[0019] According to an aspect of the invention, the casing has a plurality of sealing holes in the grooves at the separation regions and the sealing holes are configured to direct respective sealing jets of cooling air through the separation regions to impinge on the central portions of respective tiles, thereby sealing a space between the respective tile and the casing.

[0020] The sealing action provided by the sealing holes avoids ingestion of hot gas in the space between the tiles and the casing of the combustion chamber, thus allowing additional protection against high temperature. The sealing holes are also configured to cause cooling of the central portions of the tiles by impingement of the respective sealing jets. In addition to sealing action, therefore, also in this case an impingement cooling scheme is exploited, which is particularly effective.

[0021] According to an aspect of the invention, the sealing holes associated with each tile are organized in rows extending longitudinally in the respective grooves.

[0022] According to an aspect of the invention, the casing has a plurality of parallel rows of sealing holes at each separation region.

[0023] The arrangement of the sealing holes may be flexibly selected in accordance with design preferences to obtain the desired effect, also in consideration of the specific position in the combustion chamber. For example, the number, size and location of the sealing holes may vary from a groove to another in order to optimize protection of the supporting elements and consumption of cooling air.

[0024] According to an aspect of the invention, the sealing holes are configured to direct the respective sealing jets perpendicularly to the tiles.

[0025] The sealing holes are also configured to cause cooling of the central portions of the tiles by impingement of the respective sealing jets. In addition to sealing action, therefore, an impingement cooling scheme is exploited, which is particularly effective.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The present invention will now be described with reference to the accompanying drawings, which illustrate some non-limitative embodiments thereof, in which:

- figure 1 is a side view, cut along a vertical axial plane, of a combustion chamber for a gas turbine engine in accordance with an embodiment of the present invention;
- figure 2 is a rear view of the combustion chamber of figure 1, cut along the plane A-A of figure 1, with parts removed for clarity;
- figure 3 is a perspective view of an enlarged detail of the combustion chamber of figure 1, partly exploded and with parts removed for clarity;
- figure 4 is a top plan view of a portion of the combustion chamber of figure 1;
- figure 5 is a front perspective view of a supporting device for thermoinsulating tiles of the combustion chamber of figure 1;
- figure 6 shows a first enlarged detail of the combustion chamber of figure 1, cut along the plane B-B of figure 4;
- figure 7 shows a second enlarged detail of the combustion chamber of figure 1, cut along the plane B-

B of figure 4;

- figure 8 is a simplified top plan view with parts removed for clarity of a detail of a combustion chamber in accordance with a different embodiment of the present invention; and
- figure 9 is a simplified top plan view with parts removed for clarity of a detail of a combustion chamber in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0027] Figures 1-3 illustrate a combustion chamber 1 of a gas turbine engine, not shown in its entirety, in accordance with a non-limiting embodiment of the present invention. In the embodiment herein described, in particular, the combustion chamber is of the annular type. It is however understood that the invention may be exploited also in combustion chambers of different type, such as silo combustion chambers.

[0028] The combustion chamber 1 comprises an annular casing 2 extending around an axis R and is provided with a heat shield 3 that covers internally the casing 2. The heat shield 3 comprises a plurality of thermoinsulating tiles 4 of a ceramic material, fastened to the casein arranged in adjacent rows, along circumferences, around the axis R of the combustion chamber 1.

[0029] With reference to figures 3 and 4, the tiles 4 are fastened to the casing 2 by respective supporting devices 5. The supporting devices 5 engage circumferential grooves 7, which are formed on an inner face of the casing 2 around the axis R and are configured to receive the supporting devices 5 of a respective row of tiles 4 at respective locations. More in detail, the tiles 4 have a quadrangular shape and have, respective ribs 8 extending along opposite coupling sides for coupling with the supporting devices 5. The ribs 8 define coupling structures of the tiles 4 and have flat and continuous faces resting against the respective supporting devices 5. Each tile 4 is fastened by two pairs of respective supporting devices 5. Each pair of supporting devices 5 engage a respective one of two adjacent grooves 7 and the supporting devices 5 of each pair are coupled to opposite coupling sides of the tile 4.

[0030] Once the supporting devices 5 for a coupling side of a tile 4 have been slidingly inserted in adjacent grooves 7 and secured to the casing 2 by screws 9, the tile 4 is placed in its seat and the supporting devices 5 for the other coupling side of the tile 4 are fitted. Preferably, the supporting devices 5 for the other coupling side of the tile 4 are not secured to the casing to accommodate thermal expansion.

[0031] One of the supporting devices 5 is illustrated with more detail in figure 5. The supporting device 5 has a first portion in the form of a plate 10 configured to engage a respective groove 7 and a second portion in the form of a hooked head 12 configured to couple to the rib 8 on one of the coupling sides of a respective tile 4. The hooked head 12 of the supporting device 5 is T-shaped and has a stem 12a projecting perpendicularly from the respective plate 10 and a hook 12b, extending transversely to the stem 12a. Spacers 15 are provided on a face 12c of the hooked head 12 oriented toward the respective tile 4. In use, the spacers 15 are interposed between the face 12c of the hooked head 12 and the respective tile 4 and a channel 16 is defined between the face 12c of the hooked head 12, the spacers 15 and the tile 4. The channel 16 is also aligned with a through opening 17 formed at a connection 14 of the plate 10 and the hooked head 12. The spacers 15 are L-shaped and have respective first legs 15a, parallel to the stem 12a and defining the channel 16, and respective second legs 15b, parallel to the hook 12b and extending in opposite directions from the respective first legs 15a. Thus, the channel 16 is split into two opposite branches 16a, each defined between the hook 12b and the second leg 15b of a respective one of the spacers 15. The branches are open and discharge on opposite sides of the hook 12b.

[0032] With reference again to figure 3 and 4, the plates 10 of each pair of supporting devices 5, which are coupled to the same tile 4 and engage the same groove 7, are separated from each other by a respective separation region 19 at a central portion of the respective tile 4.

[0033] The casing 2 has a plurality of sealing holes 20 in the grooves 7 at the separation regions 19. The sealing holes 20 are configured to create and direct respective sealing jets 21 of cooling air through the separation regions 19 perpendicularly to the tiles 4. The sealing jets 21 are mixed in a cross or transverse flow thereby sealing the separation region 19 and, in general, a space between the respective tile 4 and the casing 2. More precisely, the sealing holes 20 are configured to direct the respective sealing jets 21 perpendicularly to the tiles 4. The sealing holes 20 associated with each tile 4 are organized in rows extending longitudinally in the respective grooves 7. The casing 2 may have one or more parallel rows of sealing holes 20 at each separation region (two in the embodiment of figure 4).

[0034] For each supporting device, the casing 2 has at least one head cooling hole 23, configured to direct a head cooling jet 25 of cooling air against the hooking head 12 and at least one plate cooling hole 27 configured to direct a plate cooling jet 28 of cooling air against the plate 10 of the supporting device.

[0035] The head cooling holes 23 are aligned with the through openings 17 and the channels 16 of the respective supporting devices 5. Thus, the head cooling jets 25 delivered by the head cooling holes 23 are directed against the hooks of 12b the respective supporting devices 5 through the respective through openings 17 and channels 16.

[0036] The plate cooling holes 27 are configured to deliver the respective plate cooling jets 28 so that the respective plate cooling jets 28 impinge on the plates 10 of the respective supporting devices 5 and flow along the

plates 10 toward the respective hooked heads 12, thus also providing a convective cooling effect. Moreover, plate cooling jets 28 delivered by the plate cooling holes 27 associated with supporting devices of adjacent tiles 4 of the same row of tiles 4 interact with each other at a gap 30 between the respective supporting devices 5. The gap 30 is therefore sealed by the interacting plate cooling jets 28.

[0037] As illustrated in figures 4 and 7, one head cooling hole 23 and one plate cooling holes 27 are provided for each supporting device 5. Other configurations are possible, however, as illustrated e.g. in figures 8 and 9.

[0038] In the embodiment of figure 8, the casing 2 has one head cooling hole 23 as already described and a plurality of plate cooling holes 27, all aligned in a single row.

[0039] In the embodiment of figure 9, the casing 2 has a plurality of head cooling holes 23 (four), arranged in a matrix and directing the respective head cooling jets 25 against the hook 12b of the respective supporting device 5, and a plurality of plate cooling holes 27, arranged in parallel rows.

[0040] In general, the number, size and location of the sealing holes 20, of the head cooling holes 23 and of the plate cooling holes 27 may be selected in accordance with design preferences and may be different as required in distinct grooves 7.

[0041] It is finally apparent that changes and variations may be made to the combustion chamber described and illustrated without departing from the scope of protection of the accompanying claims.

Claims

1. A combustion chamber for a gas turbine engine comprising:

a casing (2); and
a heat shield (3) comprising a plurality of ceramic tiles (4) arranged in rows and removably fastened to the casing (2) by respective supporting devices (5);
wherein the casing (2) has grooves (7) configured to receive the supporting devices (5) of a respective row of tiles (4) at respective locations;
wherein each tile (4) has opposite coupling sides with respective coupling structures (8);
wherein each supporting device (5) has a respective first portion (10) in the form of a plate configured to engage a respective groove (7) and a respective second portion (12) in the form of a hooked head configured to couple to the coupling structure (8) on one of the coupling sides of a respective tile (4);
wherein each tile (4) is fastened to the casing (2) by at least one pair of supporting devices (5), which engage the same groove (7) and are coupled to opposite coupling sides of the tile (4);
wherein, for each supporting device (5), the casing (2) has at least one first cooling hole (27) at least one second cooling hole (23) in the respective groove (7), the at least one first cooling hole (27) being configured to direct a first cooling jet (28) of cooling air against the first portion (10) of the supporting device (5) and the at least one second cooling hole (23) being configured to direct a second cooling jet (25) of cooling air against the second portion (12) of the supporting device (5);
wherein each supporting device (5) has a through opening at a connection of the first portion (10) and the second portion (12) and spacers (15) on a face (12c) of the respective second portion (12), wherein the spacers (15) are interposed between the face (12c) and the respective tile (4) and wherein a channel (16) aligned with the through opening (17) is defined between the face (12c), the spacers (15) and the tile (4).

2. The combustion chamber according to claim 1, comprising a plurality of second cooling holes (23) configured to direct respective second cooling jets (25) against the second portion (12) of the supporting device (5) .

3. The combustion chamber according to claim 1 or 2, comprising a plurality of first cooling holes (27) configured to direct respective first cooling jets (28) against respective portions of the first portion (10) of the supporting device (5).

4. The combustion chamber according to claim 3, wherein the first cooling holes (27) associated with supporting devices (5) of adjacent tiles (4) of the same row of tiles (4) are configured to deliver the respective first cooling jets (28) so that the respective first cooling jets (28) impinge on and flow along the first portions (10) of the respective supporting devices (5) and interact with each other at a gap (30) between the respective supporting devices (5), thereby sealing the gap (30).

5. The combustion chamber according to any one of the preceding claims, wherein the second cooling holes (23) are aligned with the through openings (17) and the channels (16) of the respective supporting devices (5), whereby the second cooling jets (25) are directed into the through openings (17) and the channels (16) of the respective supporting devices (5).

6. The combustion chamber according to claim 5, wherein the second portion (12) of each supporting device (5) is T-shaped and has a stem (12a) projecting perpendicularly from the respective first portion

(10) and a hook (12b), extending transversely to the stem (12a) and wherein the second cooling jets (25) are directed against the hooks of (12b) the respective supporting devices (5) through the respective channels (16).

7. The combustion chamber according to claim 6, wherein, in each supporting device (5), the spacers (15) are L-shaped and have respective first legs (15a), parallel to the stem (12a) and defining the channel (16) between each other, and respective second legs (12b), parallel to the hook (12b) and extending in opposite directions from the respective first legs (15a).

8. The combustion chamber according to claim 7, wherein, in each supporting device (5), the respective channel (16) is split into two opposite branches (16a) each defined between the hook (12b) and the second leg (15b) of a respective one of the spacers (15), the branches (16a) discharging on opposite sides of the hook (12b).

9. The combustion chamber according to any one of the preceding claims, wherein the coupling structures (8) comprise continuous ribs extending along respective coupling sides of the tiles (4).

10. The combustion chamber according to claim 9, wherein the ribs have respective flat faces (12c) resting against the second portions (12) of the respective supporting devices (5) .

11. The combustion chamber according to any one of the preceding claims, wherein the first portions (10) of the supporting devices (5) of each tile (4) are separated from each other by a respective separation region at a central portion of the respective tile (4); and wherein the casing (2) has a plurality of sealing holes (20) in the grooves (7) at the separation regions and the sealing holes (20) are configured to direct respective sealing jets (21) of cooling air through the separation regions to impinge on the central portions of respective tiles (4), thereby sealing a space between the respective tile (4) and the casing (2).

12. The combustion chamber according to claim 11, wherein the sealing holes (20) associated with each tile (4) are organized in rows extending longitudinally in the respective grooves (7).

13. The combustion chamber according to claim 12, wherein the casing (2) has a plurality of parallel rows of sealing holes (20) at each separation region.

14. The combustion chamber according to any one of claims 11 to 13, wherein the sealing holes (20) are configured to direct the respective sealing jets (21) perpendicularly to the tiles (4).

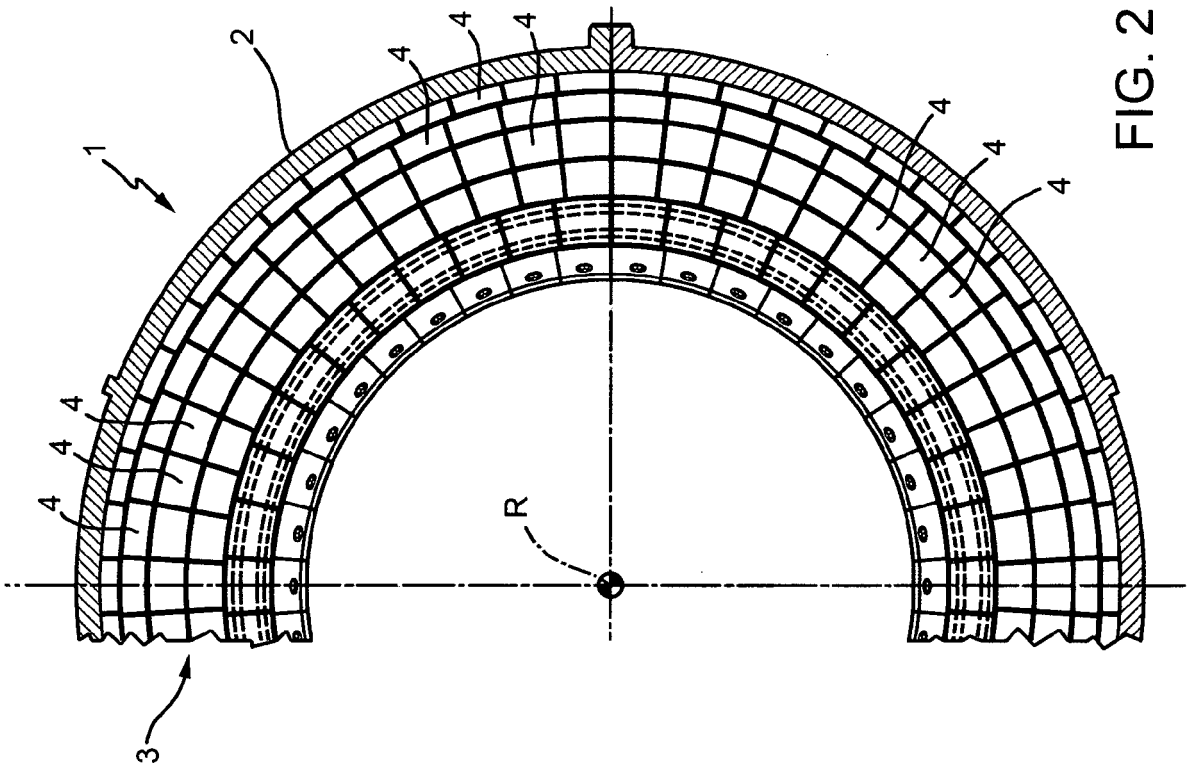

FIG. 2

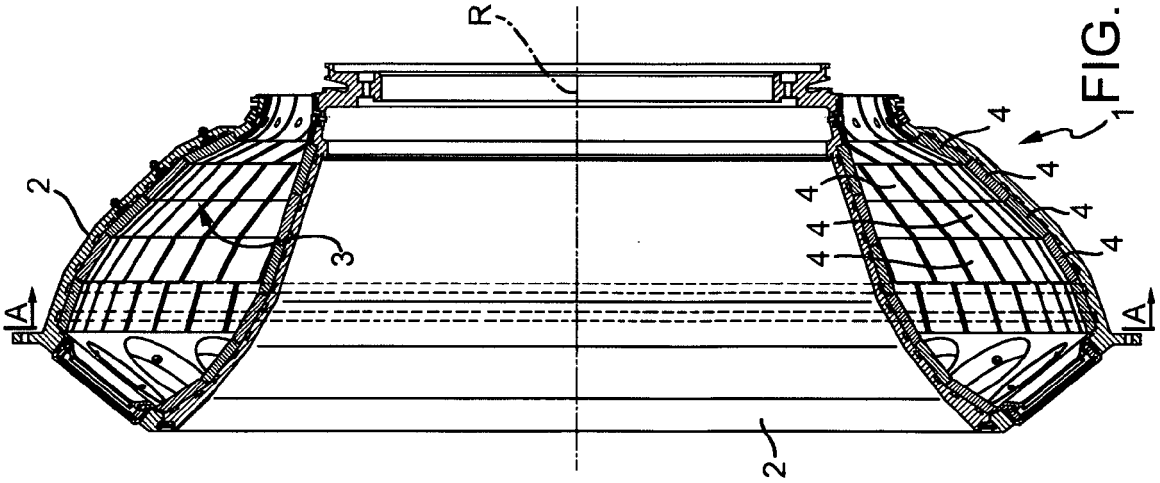

FIG. 1

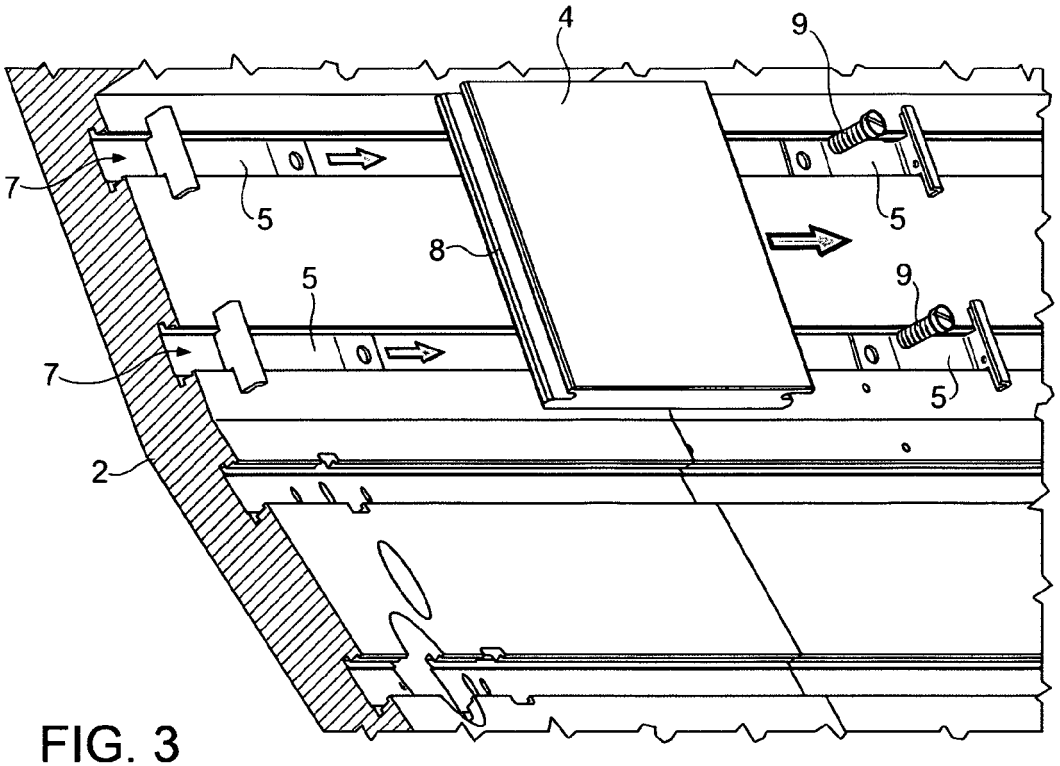
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FIG. 3

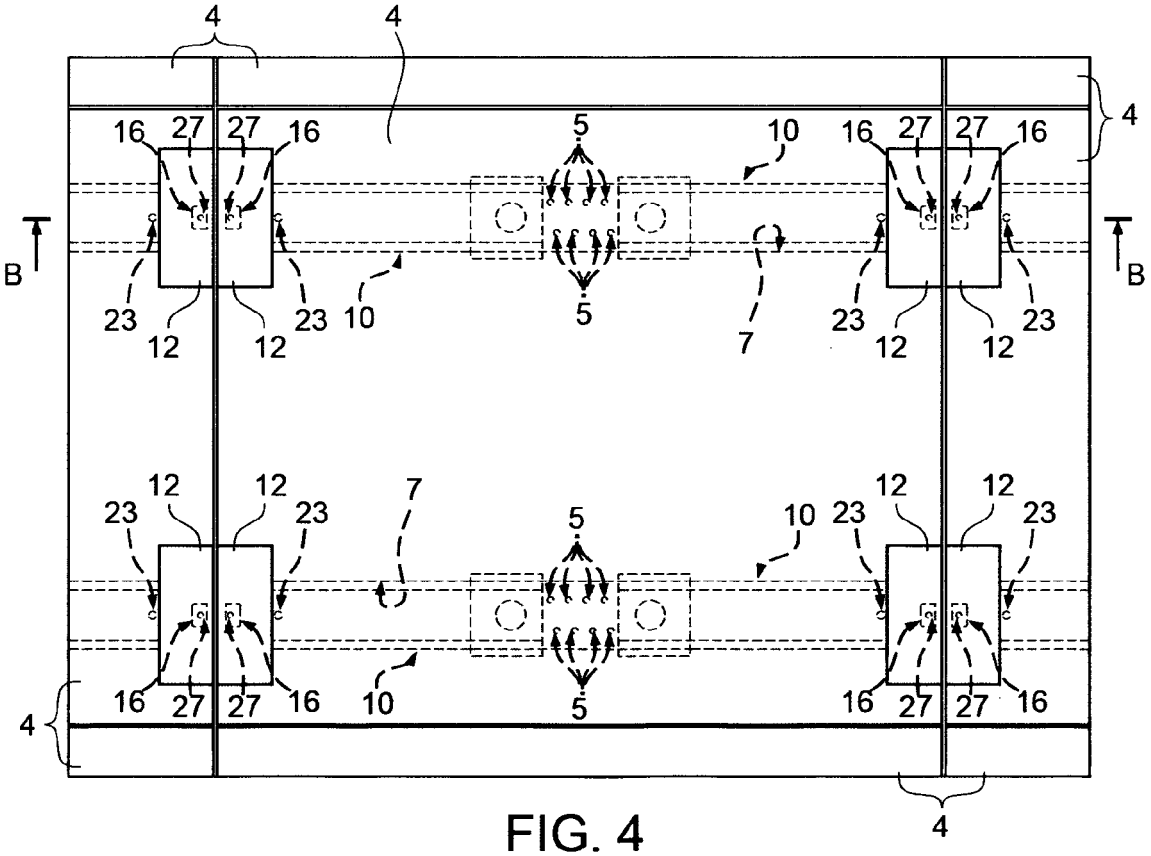
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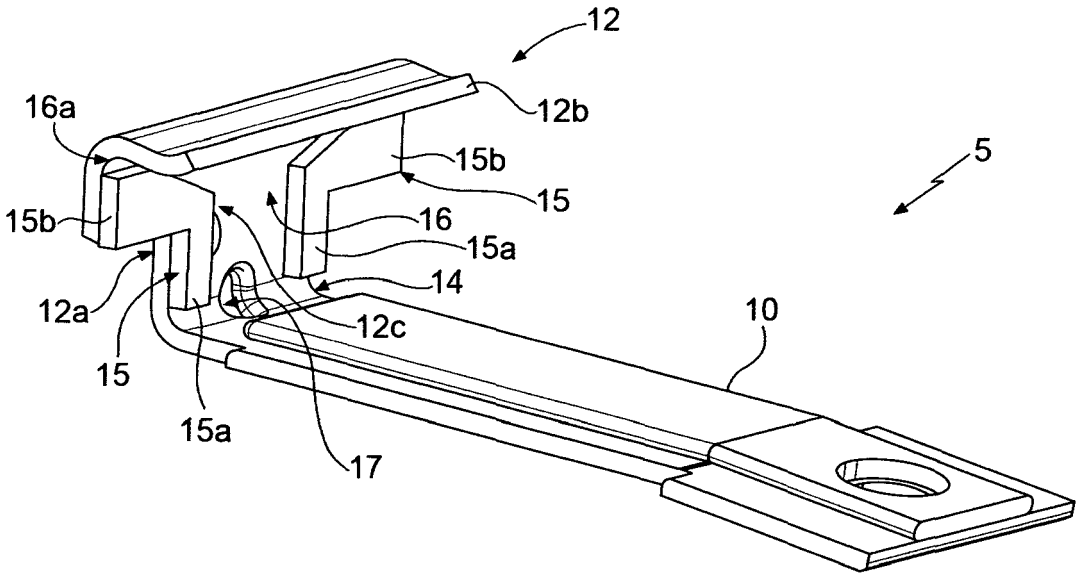
FIG. 4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15b
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15b
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15a
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12a
12c
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15a
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FIG. 5

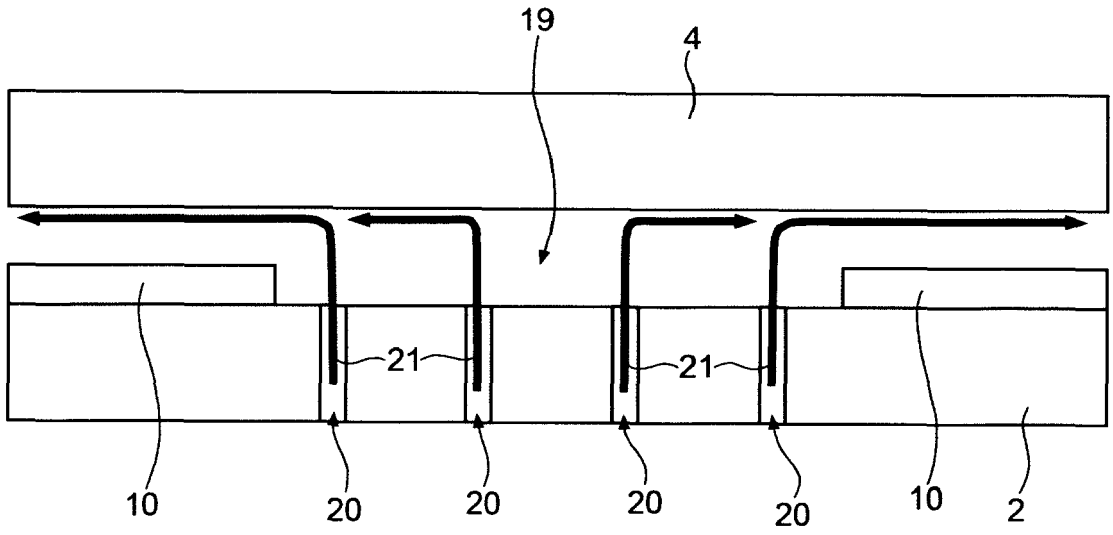
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FIG. 6

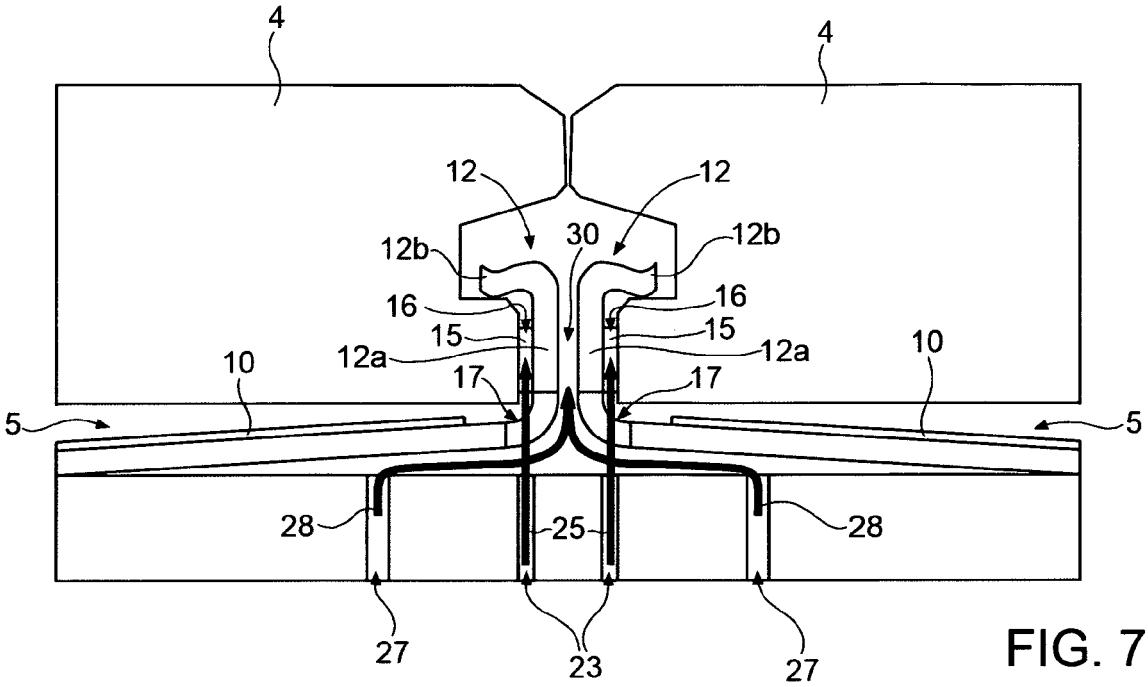

FIG. 7

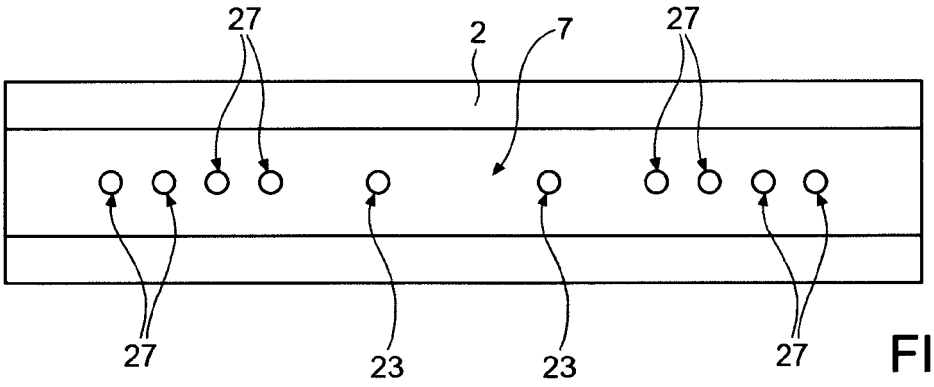

FIG. 8

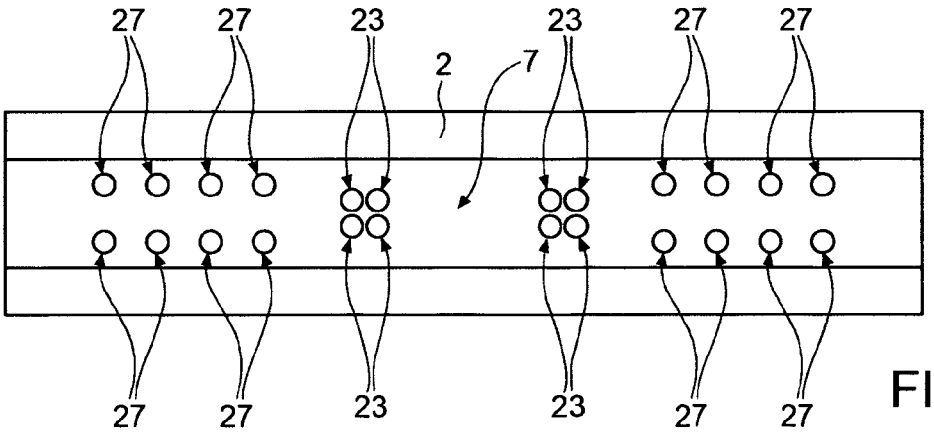

FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 21 42 5076

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 3 845 810 A1 (ANSALDO ENERGIA SPA [IT]) 7 July 2021 (2021-07-07)	1,5-10	INV. F23R3/00
Y	* paragraphs [0030] - [0037]; figures 3-7 *	2-4, 11-14	F23M5/04 F23R3/60
Y	US 2006/176671 A1 (HEILOS ANDREAS [DE]) 10 August 2006 (2006-08-10)	2-4	
A	* paragraphs [0042] - [0045]; figure 6 *	1	
Y	US 2015/241061 A1 (KLUGE ANDRE [DE] ET AL) 27 August 2015 (2015-08-27)	11-14	
A	* paragraphs [0046] - [0048]; figures 1-3 *	1	
Y	DE 10 2015 206033 A1 (SIEMENS AG [DE]) 6 October 2016 (2016-10-06)	14	
A	* paragraphs [0037] - [0039]; figures 7,8 *	1,11	

TECHNICAL FIELDS SEARCHED (IPC)

F23R
F23M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 May 2022	Mougey, Maurice

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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30-05-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3845810 A1	07-07-2021	CN 113124419 A	16-07-2021
		EP 3845810 A1	07-07-2021
US 2006176671 A1	10-08-2006	CN 1818527 A	16-08-2006
		EP 1701095 A1	13-09-2006
		ES 2378375 T3	11-04-2012
		JP 5105745 B2	26-12-2012
		JP 2006220409 A	24-08-2006
		US 2006176671 A1	10-08-2006
US 2015241061 A1	27-08-2015	CN 104662367 A	27-05-2015
		EP 2711634 A1	26-03-2014
		EP 2883003 A2	17-06-2015
		KR 20150058231 A	28-05-2015
		RU 2015114777 A	10-11-2016
		US 2015241061 A1	27-08-2015
		WO 2014044656 A2	27-03-2014
DE 102015206033 A1	06-10-2016	NONE	

EPO FORM P0459

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