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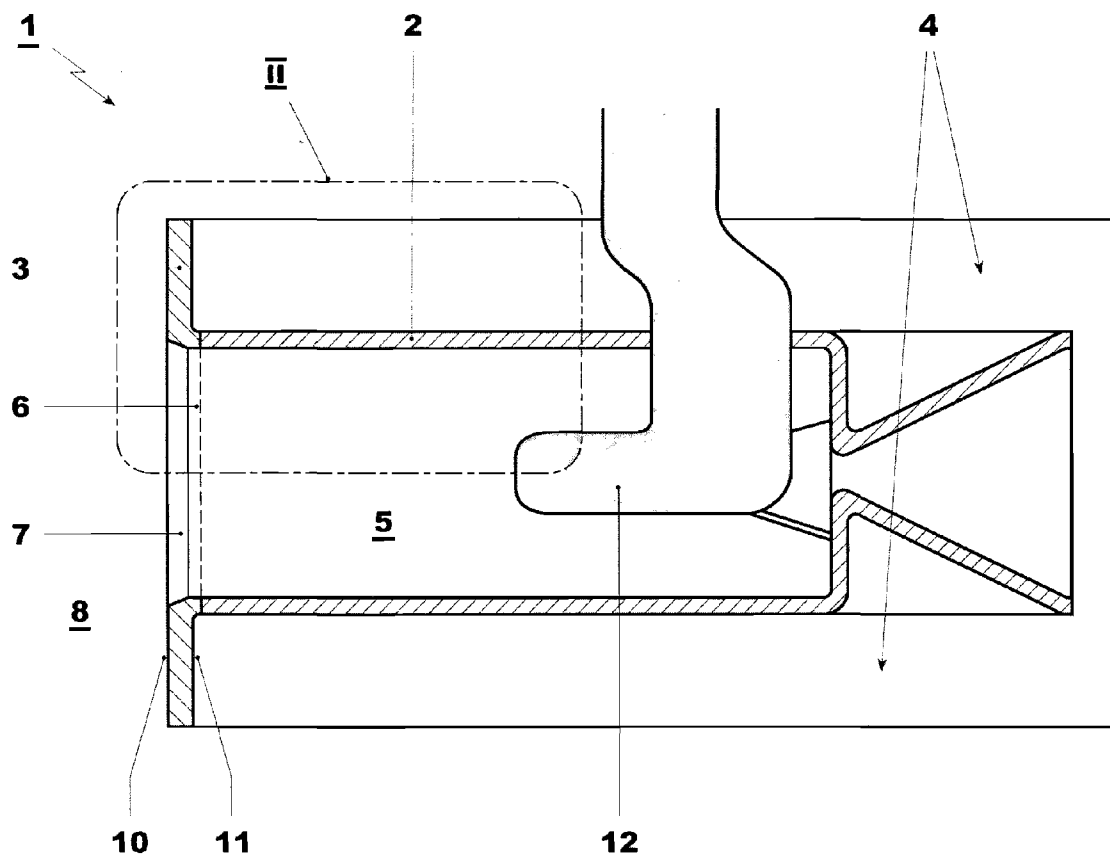
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Riemer et al.(10) **Pub. No.: US 2009/0042154 A1**(43) **Pub. Date: Feb. 12, 2009**(54) **BURNER FOR A COMBUSTOR OF A TURBOGROUP**(30) **Foreign Application Priority Data**

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Gipf-Oberfrick (CH)**Publication Classification**(51) **Int. Cl.**
F23C 7/00 (2006.01)(52) **U.S. Cl.** **431/187**(57) **ABSTRACT**

A burner for a combustor of a turbogroup is provided. The burner includes a burner body, an outlet flange, and a plenum which is exposed, or can be exposed, to admission of cooling medium. In order to improve the cooling of the outlet flange, a flow passage and a supply passage are formed. The flow passage and the supply passage are arranged so that the cooling medium from the plenum enters the flow passage, is transferred from the flow passage into the supply passage, and is discharged from the supply passage through holes into a burner interior.

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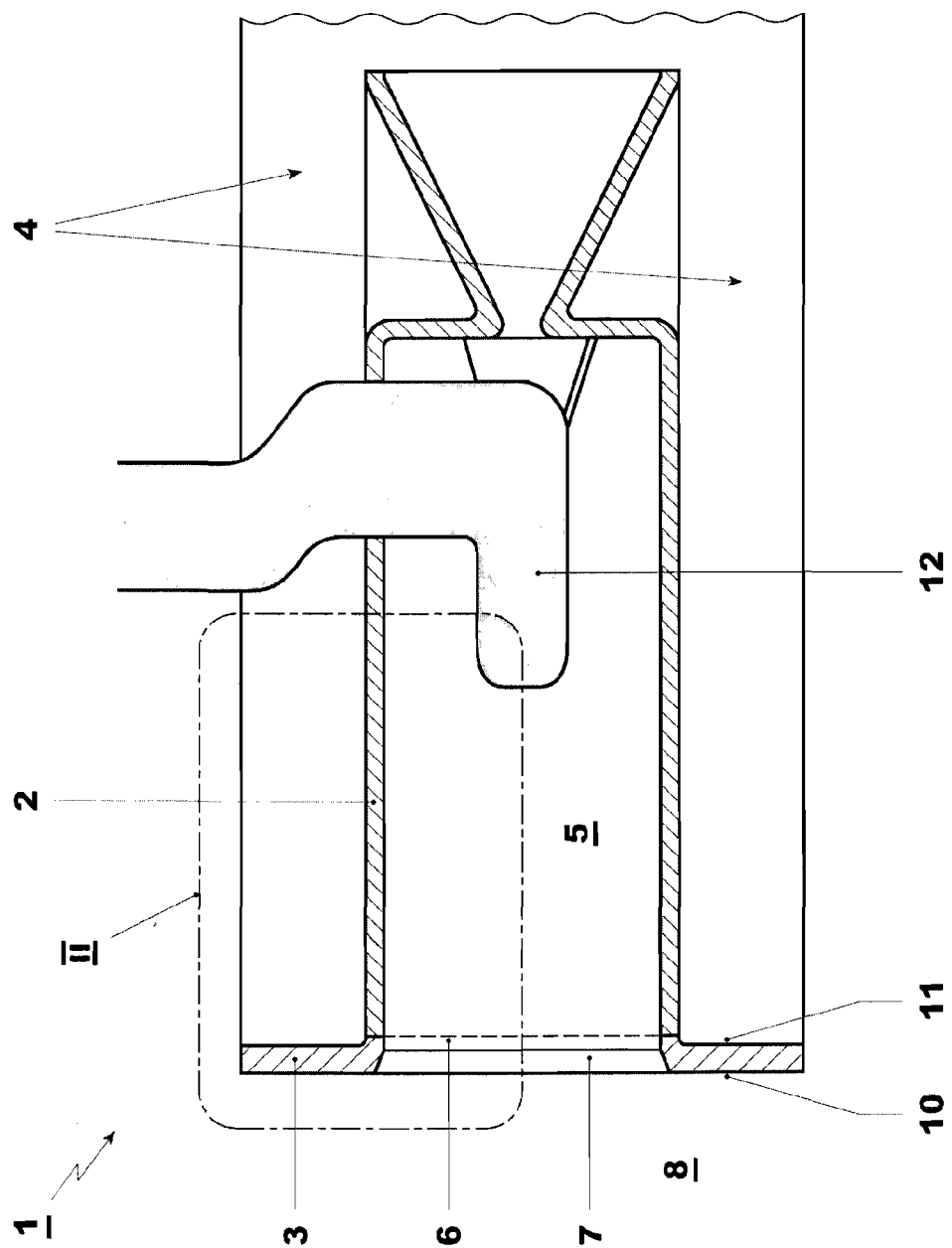
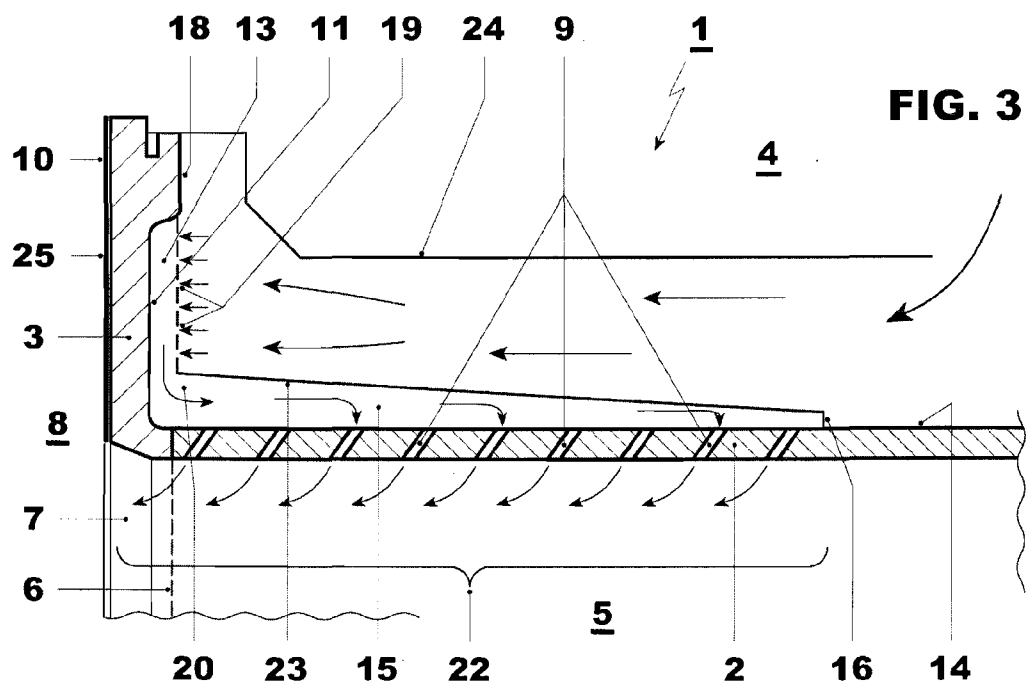
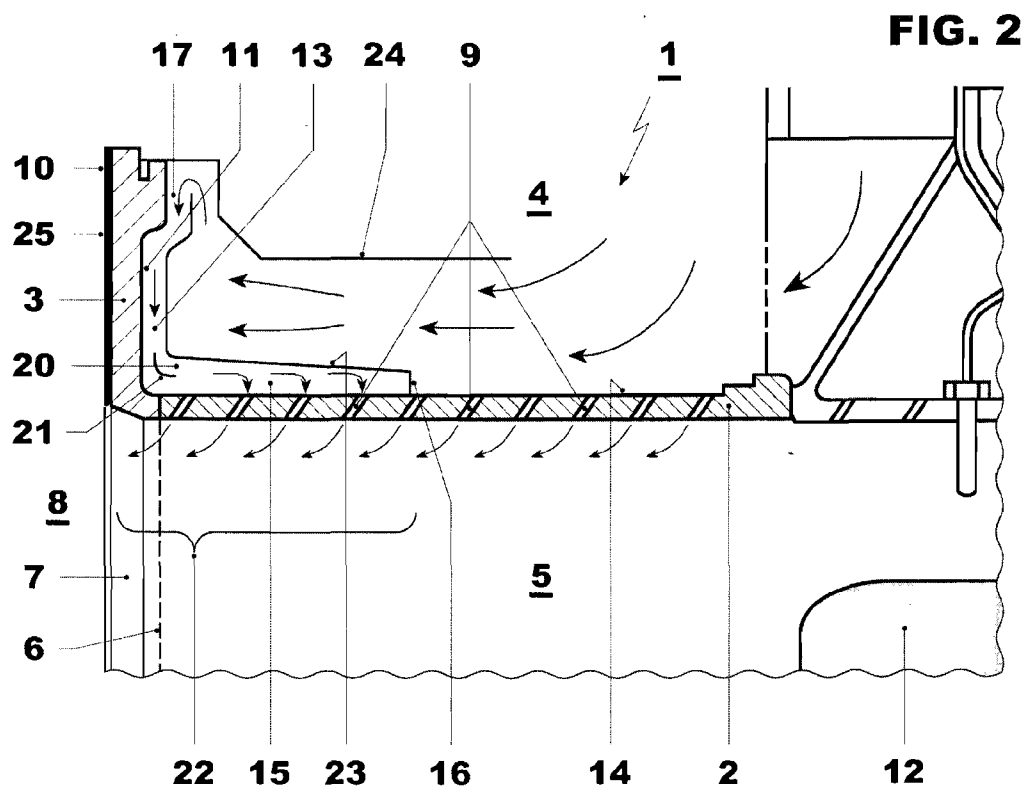


FIG. 1



BURNER FOR A COMBUSTOR OF A TURBOGROUP

FIELD OF INVENTION

[0001] The present invention relates to a burner for a combustor of a turbogroup, especially for a turbogroup with sequential combustion for use in a power generating plant.

BACKGROUND

[0002] A burner customarily has a burner body which encloses a burner interior and which at an outlet end has an outlet port through which the burner interior communicates with a combustion chamber of the combustor. Burners for use in plants with sequential combustion, which are subjected to high inlet temperatures, as a rule, have an effusion cooling by which cooling of the burner body can be realized during operation of the burner.

[0003] In the case of an effusion cooling, the respective cooling medium, as a rule cooling air or cooling vapor, passes through effusion cooling holes through a wall of the body which is to be cooled. In a burner, the cooling medium which enters the burner interior or combustion chamber interior via the cooling holes during the effusion cooling mixes with the gas mixture which is flowing there.

[0004] In addition, a burner customarily has an outlet flange which is arranged at the outlet end of the burner body and surrounds the outlet port of the burner body, and by which the burner body is fastened on the combustor, and which has a combustor side which delimits the combustion chamber. In addition, a burner customarily comprises a plenum which encloses the burner body and which is exposed to admission of cooling medium during operation of the burner.

[0005] During operation of the burner, the outlet flange on its combustor side is subjected to the heat of the combustion chamber. In cooling the outlet flange, it is customary to also provide the outlet flange with a multiplicity of holes which enable an effusion cooling of the outlet flange. Depending upon combustion chamber configuration, a recirculation flow can form in the combustion chamber downstream of the outlet port of the burner, which leads to a flame front which is stable to a greater or lesser degree. It has been shown that the cooling medium, which enters the combustion chamber during the effusion cooling of the outlet flange, leads to a cooling of the backflow vortex with implications on the flame temperature and the flame stability. As a result, undesirable pressure pulsations ensue and carbon monoxide formation and increased nitrogen oxide emissions occur.

SUMMARY

[0006] The invention relates to a burner for a combustor of a turbogroup. The burner includes a burner body enclosing a burner interior and at an outlet end (6) thereof the burner body has an outlet port by which the burner interior communicates with a combustion chamber of the combustor. The burner body also includes a plurality of holes for a cooling medium. The burner also includes an outlet flange arranged at the outlet end and surrounding the outlet opening, and by which the burner body is fastened on the combustor. The flange has a combustion chamber side which delimits the combustion chamber. The burner also includes a plenum enclosing the burner body and which is exposable to admission of cooling medium. A flow passage, which is open to the plenum, is formed on a plenum side of the outlet flange that faces the

plenum. A supply passage is also included, which at one end communicates with the flow passage and which at the other end is closed. The supply passage, between its ends, communicates with a plurality of holes of the burner body, and is formed on an outer side of the burner body that faces the plenum. The flow passage and the supply passage are arranged so that cooling medium from the plenum enters the flow passage and is transferred from the flow passage into the supply passage, and is discharged from the supply passage through the plurality of holes into the burner interior.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Preferred exemplary embodiments of the invention are represented in the drawings and are explained in more detail in the subsequent description, wherein like designations refer to the same, or similar, or functionally the same components. In the drawing, schematically in each case,

[0008] FIG. 1 shows a simplified basic sectional view of a burner,

[0009] FIG. 2 shows an enlarged view of a detail of the burner which is identified by II in FIG. 1,

[0010] FIG. 3 shows a view as in FIG. 2, of another embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Introduction to the Embodiments

[0011] The invention is based on the general idea of cooling the outlet flange on a plenum side which faces the plenum by impingement with cooling medium, wherein the cooling medium is then used for achieving an effusion cooling of the burner body. By this course of action, an effusion cooling of the outlet flange can basically be reduced or completely dispensed with. The interaction with the reaction zone in the combustion chamber is reduced as a result. The pressure pulsations and also the pollutant emissions are reduced accordingly. Providing effusion cooling holes can be dispensed with, the wall thicknesses of the outlet flange can be reduced, which on the one hand lowers the production costs for the outlet flange and on the other hand reduces the temperature gradient in the outlet flange, which extends its service life.

[0012] In the case of the invention, the impingement of the plenum side of the outlet flange is achieved by a flow passage being formed on the plenum side, which communicates with the plenum. The use of cooling medium for the effusion cooling of the burner body is realized by a supply passage which communicates with the flow passage and into which, or on which, open a plurality of holes of the burner body. By a corresponding arrangement and design of the flow passage and of the supply passage, conditions can be created under which cooling medium from the plenum enters the flow passage, subjects the plenum side of the burner body to impingement with cooling medium, and as a result convectively cools it. From the flow passage, the cooling medium can then transfer into the supply passage and discharge therefrom through the cooling holes.

[0013] In the case of an advantageous development, the flow passage at one end can communicate with the connecting passage, and at the other end can be arranged open to the plenum. The cooling medium, which especially reaches the plenum at an increased pressure, can therefore penetrate into the flow passage through the open end. The cooling medium

then flows through the flow passage and so reaches the supply passage. In doing so, the cooling medium flows past the plenum side of the outlet flange and brings about a convection cooling there. Since the flow is established as a result of the pressure ratios, in this case it is a forced convection cooling.

[0014] In the case of another embodiment, the flow passage at one end can communicate with the supply passage, but at the other end can be closed and between its ends can have inlet openings which communicate with the plenum. In the case of this type of construction, the plenum side of the outlet flange can be subjected to impingement with cooling medium at the same time over a larger area, as a result of which the cooling action is intensified. In the case of an especially advantageous development, the inlet openings can be arranged so that they bring about an impingement cooling of the outlet flange on the plenum side. The inflow with cooling medium against the outlet flange on its plenum side is carried out in this case by a correspondingly selected orientation of the inlet openings which is preferably essentially perpendicular to the plenum side. Such an impingement cooling can bring about an especially effective cooling.

[0015] Further important features and advantages of the burner according to the invention result from the dependent claims, from the drawings, and from the associated figure description with reference to the drawings.

Detailed Description

[0016] FIG. 1 comprises a burner 1, which is only partially shown here, a burner body 2, an outlet flange 3, and also a plenum 4 accordingly. The burner 1 in this case is a component part of a combustor, which is not referred to in detail here, particularly of a turbogroup. A combustor customarily has a plurality of such burners 1 which for example can be arranged annularly.

[0017] The burner body 2 encloses a burner interior 5. The burner body 2, as here, can be designed in the shape of a prism. A cylindrical or conical design is also conceivable. Furthermore, the burner body 2 can comprise two or more half-shell bodies which are arranged in a symmetrically and eccentrically offset manner to each other with regard to a longitudinal center axis of the burner 1. At an outlet end 6, the burner body 2 has an outlet port 7 through which the burner interior 5 can communicate with a combustion chamber 8 of the combustor. The burner body 2 has a plurality of holes 9, which are shown in FIGS. 2 and 3. These holes penetrate the burner body 2. In particular, the aforementioned holes 9 can be designed as effusion cooling holes. According to FIGS. 2 and 3, the holes 9 are oriented in an inclined manner in relation to a longitudinal center axis of the burner 1, specifically so that cooling gas, which enters the burner interior 5 through the holes 9, has an axial component which points in the direction of the combustion chamber 8.

[0018] The outlet flange 3 delimits the combustion chamber 8. It is arranged at the outlet end 6 of the burner body 2 and surrounds the outlet port 7. The outlet flange 3 is welded onto the outlet end 6, for example. By the outlet flange 3, the burner body 2 can be fastened on the combustor. The outlet flange 3 has a combustion chamber side 10 which faces the combustion chamber 8, and also a plenum side 11 which faces the plenum 4.

[0019] The plenum 4 encloses the burner body 2 and is subjected to admission of cooling gas during operation of the burner 1. According to FIG. 1, the burner 1 can also be equipped with a lance 12 which in this case projects radially

through the burner body 2 into the burner interior 5 and then extends axially and centrally within the burner interior 5. Via the lance 12, fuel can be introduced into the burner interior 5 or into the combustion chamber 8 in a conventional manner.

[0020] In accordance with FIG. 2 and 3, the burner 1 according to the invention is equipped with a flow passage 13 on the plenum side 11 of the outlet flange 3 and is open to the plenum 4. Furthermore, a supply passage 15 is formed on an outer side 14 of the burner body 2 which faces the plenum 4. This supply passage 15 at one end communicates with the flow passage 13, and at the other end 16 is closed. Between its ends, the supply passage 15 communicates with a plurality of holes 9 of the burner body 2. That is to say, the supply passage 15 is positioned so that it extends across a plurality of holes 9 of the burner body 2. According to the invention, the flow passage 13 and the supply passage 15 are now matched to each other so that during operation of the burner 1 a defined cooling gas flow is created. The cooling gas flow in this case is indicated by arrows which are not referred to in detail. The cooling gas in this case flows from the plenum 4 into the flow passage 13 and can transfer from the flow passage 13 into the supply passage 15. From the supply passage 15, the cooling gas reaches the burner interior 5 via the holes 9.

[0021] In the case of the embodiment which is shown in FIG. 2, the flow passage 13 is arranged so that at one end 17 it is open to the plenum 4, while at the other end it communicates with the supply passage 15. In this arrangement, a cooling gas flow which is parallel to the plenum side 11 is created. This creates a convection cooling of the outlet flange 3. In contrast to this, in the case of the embodiment which is shown in FIG. 3, the flow passage 13 at one end is reconnected to the supply passage 15 in a communicating manner. At the other end 18, it is closed. For that reason, between its ends it has inlet openings 19 which communicate with the plenum 4. As a result, cooling gas can enter the flow passage 13 by the inlet openings 19. In the case of the preferred embodiment which is shown in FIG. 3, the inlet openings 19 are oriented so that as a result an impingement cooling of the outlet flange 3 on its plenum side 11 can be realized. In the example, the inlet openings 19 are arranged so that a virtually perpendicular inflow against the plenum side 11 of the outlet flange 3 can be formed. Since the cooling gas in the flow passage 13 follows the pressure drop, a force-guided convection flow, which feeds the cooling gas to the supply passage 15 and consequently to the holes 9 of the burner body 2, is also formed in the case of this embodiment.

[0022] A transition region 20, in which, in the case of a preferred embodiment, a flow guide plate 21 can be arranged, is formed at the transition between the flow passage 13 and the supply passage 15. Such a flow guide plate 21 is provided in the case of the embodiment which is shown in FIG. 2. The flow guide plate 21 brings about a deflection of the cooling gas flow which issues from the flow passage 13 in the direction of the supply passage 15 so that the cooling gas flow can enter the supply passage 15 with reduced pressure loss. This is especially advantageous when, as in this case, the flow passage 13 extends essentially radially with regard to the longitudinal center axis of the burner 1, that is to say brings about a radial guiding of the cooling gas in the flow passage 13. In contrast to this, the supply passage 15 is oriented axially with regard to the longitudinal center axis of the burner 1, that is to say is oriented so that it brings about a guiding of the cooling gas in the axial direction.

[0023] In the case of the embodiments shown here, the supply passage 15 extends in each case exclusively in an outlet-side end region 22 of the burner body 2, which is symbolized in FIGS. 2 and 3 by a brace. The end region 22 comprises the outlet end 6 and for example extends over a third or over half of the overall length of the burner body 2.

[0024] Embodiments in which in the region of the supply passage 15, that is to say especially in the end region 22, a hole density in the burner body 2 is greater than outside the region of the burner body 2 which is covered by the supply passage 15 are preferred in this case. The number of holes per area unit is understood by "hole density" in this case. For example, it can be seen in FIG. 2 that the distances of adjacent holes 9 in the end region 22 which is covered by the supply passage 15 are greater than in the region of the burner body 2 which adjoins the end region 22.

[0025] The flow passage 13, in the case of the embodiments which are shown here, encompasses the burner body 2 along the plenum side 11 of the outlet flange 3. Furthermore, the supply passage 15, in the case of the embodiments which are shown here, encompasses at least the outlet-side end region 22 of the burner body 2.

[0026] In the case of the embodiments shown here, a guide plate arrangement 23 is provided for realizing the flow passage 13 and the supply passage 15. This guide plate arrangement is arranged in the plenum 4 on the outer side 14 of the burner body 2 and also on the plenum side 11 of the outlet flange 3. For example the guide plate arrangement 23 can comprise at least one shell-shaped plate body which is mounted on the burner body 2 on the outside and essentially follows its contour. In addition, the guide plate arrangement 23 can comprise a further flow guide plate 24 which serves as the boundary to the plenum 4 and brings about the guiding of the cooling gas to the respective inlet side of the flow passage 13. Where the existing structure allows it, this function can also be entirely or partially undertaken by a support component. By the proposed type of construction, an intensive cooling of the outlet flange 3 can be achieved. In this case, an effusion cooling of the outlet flange 3 can especially be dispensed with. At least the number of effusion cooling holes in the outlet flange 3 can be significantly reduced. As a result of the reduced or avoided effusion cooling of the outlet flange 3, interactions in the combustion chamber 8 between cooling gas and combustion reaction can be minimized which correspondingly reduces the formation of pressure pulsations and the occurrence of CO emissions and NO_x emissions. Furthermore, the outlet flange 3, on its combustion chamber side 10 which delimits the combustion chamber 8, can be provided with a reinforced thermal barrier coating 25 which enables an intensive thermal protection for the outlet flange 3. In the case of an effusion cooling in the outlet flange 3, such a barrier coating 25 would be repeatedly interrupted because of the effusion holes and would not be able to be applied so thickly. Furthermore, the material thickness of the outlet flange 3 can be reduced since a minimum thickness which is required for realizing effusion cooling passages no longer has to be observed. The reduced wall thickness improves the temperature distribution inside the outlet flange 3 and reduces its thermal load.

[0027] Inside the flow passage 13 or inside the supply passage 15, for example turbulators can also be arranged in order to boost the cooling action of the convection cooling inside the respective passage 13, 15.

[0028] By selection of the cross sections and also of the cross sectional variations of the passages 13, 15, the cooling demand can be adapted to local requirements. The same also applies to the number, the density and the distribution of the effusion cooling holes 9 inside the region of the burner 2 which is covered by the supply passage 15.

List of Designations

[0029]	1 Burner
[0030]	2 Burner body
[0031]	3 Outlet flange
[0032]	4 Plenum
[0033]	5 Burner interior
[0034]	6 Outlet end
[0035]	7 Outlet port
[0036]	8 Combustion chamber
[0037]	9 Effusion cooling hole
[0038]	10 Combustion chamber side
[0039]	11 Plenum side
[0040]	12 Fuel lance
[0041]	13 Flow passage
[0042]	14 Outer side
[0043]	15 Supply passage
[0044]	16 Closed end
[0045]	17 Open end
[0046]	18 Closed end
[0047]	19 Inlet opening
[0048]	20 Transition region
[0049]	21 Flow guide plate
[0050]	22 End region
[0051]	23 Guide plate arrangement
[0052]	24 Flow guide plate
[0053]	25 Thermal barrier coating

What is claimed is:

1. A burner for a combustor of a turbogroup, comprising a burner body (2) enclosing a burner interior (5) and at an outlet end (6) thereof has an outlet port (7) by which the burner interior (5) communicates with a combustion chamber (8) of the combustor, and which includes a plurality of holes (9) for a cooling medium; an outlet flange (3) arranged at the outlet end (6) and surrounding the outlet opening (7), and by which the burner body (2) is fastened, on the combustor, and which has a combustion chamber side (10) which delimits the combustion chamber (8); a plenum (4) enclosing the burner body (2) and which is exposable to admission of cooling medium; a flow passage (13), which is open to the plenum (4), is formed on a plenum side (11) of the outlet flange (3) that faces the plenum (4); a supply passage (15), which at one end communicates with the flow passage (13) and which at the other end is closed, and which between its ends communicates with a plurality of holes (9) of the burner body (2), is formed on an outer side (14) of the burner body (2) that faces the plenum (4), the flow passage (13) and the supply passage (15) are arranged so that cooling medium from the plenum (4) enters the flow passage (13), is transferred from the flow passage (13) into the supply passage (15), and is discharged from the supply passage (15) through the plurality of holes (9) into the burner interior (5).

2. The burner as claimed in claim 1, wherein the flow passage (13) at one end communicates with the supply passage (15) and at the other end is open to the plenum (4).

3. The burner as claimed in claim 1, wherein the flow passage (13) at one end communicates with the supply pas-

sage (15), at the other end is closed, and between its ends has inlet openings (19) which communicate with the plenum (4).

4. The burner as claimed in claim 3, wherein the inlet openings (19) are arranged for creating an impingement cooling of the outlet flange (3) on its plenum side (11).

5. The burner as claimed in claim 1, wherein a flow guide plate (21) is arranged in a transition region (20) in which the flow passage (13) merges into the supply passage (15), and deflects the flow which issues from the flow passage (13) for entering the supply passage (15).

6. The burner as claimed in claim 1, wherein the supply passage (15) only extends in an outlet-side end region (22) of the burner body (2).

7. The burner as claimed in claim 1, wherein in the region of the supply passage (15) the number of holes per area unit in the burner body (2) is greater than outside it.

8. The burner as claimed in claim 1, wherein the flow passage (13) encompasses the burner body (2) in an annular manner along the outlet flange (3) and guides the cooling medium in a radial direction with regard to a longitudinal center axis of the burner (1).

9. The burner as claimed in claim 1, wherein the supply passage (15) encompasses at least an outlet-side end region (22) of the burner body (2) in an annular manner and guides the cooling medium in an axial direction with regard to a longitudinal center axis of the burner (1).

10. The burner as claimed in claim 1, wherein the flow passage (13) and the supply passage (15) are formed with a guide plate arrangement (23) which is arranged in the plenum (4) on the outer side (14) of the burner body (2) and on the plenum side (11) of the outlet flange (3).

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