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(54) **Gas burner for boiler**

(57) A gas burner (1) for a boiler comprising a diffuser (2), suitable for diffusing premixed combustion (7) gases in a combustion chamber is described, wherein said gas burner (1) comprises covering means (5) of the flow of mixture entering the combustion chamber arranged on the side of the diffuser (2) opposite to the combustion

chamber and at peripheral portions of the diffuser (2), said covering means (5) being configured so as to give the direction of the flow of mixture entering the combustion chamber, at such peripheral portions, a component parallel to the diffuser (2).

A method for operating a gas burner (1) for a boiler is also described.

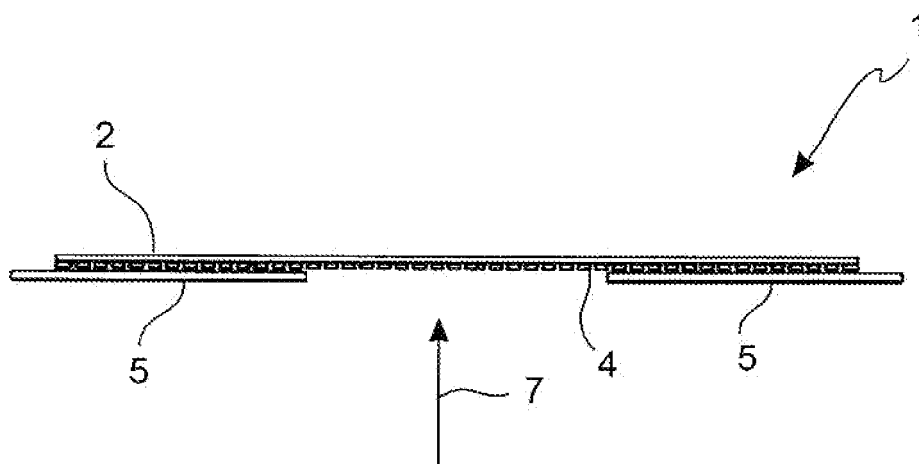


FIG. 2

Description

[0001] The present invention relates to a gas burner for a gas boiler.

[0002] Gas boilers of the prior art comprise a conduit for feeding a burner with a premixed gas-air mixture, a burner for heat production through combustion of such mixture in a combustion chamber, and optionally a support element connectable to the heat exchanger and/or to the feeding conduit for ensuring the closure of the combustion chamber and/or for positioning the burner relative to such combustion chamber.

[0003] The burner further comprises a diffuser through which the premixed fuel and air gas is conveyed and which determines a flame scheme for heat production. The diffuser usually comprises a wall provided with a plurality of openings and having an inside surface in fluid connection with the feeding conduit and thus in contact with the unburnt mixture, and an outside surface whereon the combustion takes place. It therefore defines a surface that in the present context is called outer combustion surface.

[0004] Upstream of the diffuser (with reference to the flow direction of the gas-air mixture) there may further be provided a distribution device, or distributor, arranged on the diffuser side opposite to the combustion surface, usually comprising a wall with a plurality of through openings, configured so as to distribute the gas-air mixture in a substantially even manner or in any case in the desired manner towards the diffuser wall.

[0005] As it is well known, the heat produced by the combustion on the outer side of the diffuser wall is conveyed by the hot combustion gases to a heat exchanger for heating a fluid, for example water, that is then conveyed to a utility, for example to a heating system of an industrial process, of living environments or the like, and/or of sanitary water.

[0006] Due to the specific requirements of a controlled and differentiated heating, it is necessary to be able to vary the heating power of the burner.

[0007] It is possible to pilot the heating power of the burner through the variation of the flow rate of the fuel or of the mixture fed to the diffuser. However, the width of the heating power range, that is, the so-called modulation (ratio between minimum power and maximum power) of the prior art burners is limited. This is due to the fact that when the fuel flow rate goes beyond an optimal range that depends on the material, from the specific passage area (rate between the passage area and the wall area) and from the resistance to the diffuser flow, there occur flame instability problems that impair the proper burner operation.

[0008] In particular, as the heating power increases, the combustion zone and therefore the flame tends to move away from the diffuser with serious consequences from the point of view of safety and of the emissions of polluting substances, such as carbon monoxide (CO).

[0009] Such phenomenon of detachment of the flame

from the diffuser is particularly important at the diffuser ends that are connected to the frame due to temperature that, in such areas, is unavoidably lower.

[0010] In order to solve such problem, it is known to use an additional distributor in the proximity of the diffuser or to use diffusers suitably shaped by moulding. However, both solutions are complex to make and they considerably affect the burner manufacturing costs.

[0011] The object of the present invention is to provide a burner that allows a high power modulation while obviating the above problems of flame instability, and in particular the problem of blow-off.

[0012] This and other objects are achieved by a gas burner for a boiler comprising a diffuser, suitable for diffusing premixed combustion gases in a combustion chamber, wherein the burner further comprises covering means of the flow of mixture entering the combustion chamber which are arranged on the side of the diffuser opposite to the combustion chamber and at peripheral portions of the diffuser, said covering means being configured so as to give the direction of the flow of mixture entering the combustion chamber, at such peripheral portions, a component parallel to the diffuser and said covering means being at least partially in contact with the diffuser.

[0013] Thanks to the presence of covering means provided with the above cited features it is possible to achieve a flame stability also in case of increase of the heating power.

[0014] In other words, said covering means, reducing the mixture flow at the peripheral portions of the distributor, allow preventing the blow-off problem even with high power modulations.

[0015] To better understand the invention and appreciate its advantages, some exemplary non-limiting embodiments of the burner of the invention will now be described with reference to the annexed figures, wherein:

- figure 1 shows a longitudinal sectional view of a portion of boiler comprising a gas burner according to the prior art;
- figure 2 shows a longitudinal sectional view of a gas burner for boiler according to a first embodiment of the invention;
- figure 3 shows a illustrative view of the burner of figure 2 in operation;
- figure 4 shows a longitudinal sectional view of a gas burner for boiler according to a second embodiment of the invention;
- figure 5 shows a longitudinal sectional view of a gas burner for boiler according to a third embodiment of the invention; and
- figure 6 shows a longitudinal sectional view of a gas burner for boiler according to a fourth embodiment of the invention.

[0016] With reference to figures 1-6, a gas burner for a boiler is globally indicated with reference number 1.

[0017] In particular, reference number 1 indicates a burner that produces heat by the combustion of a premixed fuel gas, generally comprising fuel gas and air. Preferably, such fuel gases are totally premixed, that is, no further component is added to the mixture supplied to the burner.

[0018] Burner 1 comprises a diffuser 2, which is suitable for diffusing combustion gases in a combustion chamber 3 (shown with a dashed line in figure 1).

[0019] Burner 1 is mounted on a frame 9. The latter may be connected to the combustion chamber 3 by connecting portions.

[0020] Frame 9 further delimits an opening for the passage of the fuel and air mixture.

[0021] Diffuser 2 includes a wall provided with a plurality of openings whose inside surface is in fluid connection with the gas feeding conduit. The combustion takes place on the outside surface of such wall.

[0022] Diffuser 2 may comprise a distributor 4 of the known type, suitable for distributing the mixture to diffuser 2 and arranged on the side of diffuser 2 opposite the combustion chamber 3.

[0023] Figure 1 also shows a schematic representation of a heat exchanger 6 in contact with the combustion chamber 3, which is suitable for receiving the heat produced by the combustion on the outer side of the wall of diffuser 2.

[0024] According to the present invention, burner 1 comprises covering means 5 of the flow of mixture entering the combustion chamber 3.

[0025] In the figures, the mixture flow direction is indicated by arrows 7 and 7'.

[0026] As is shown in figures 2-6, the covering means 5 are arranged on the side of diffuser 2 opposite to the combustion chamber 3 and at peripheral portions of diffuser 2. By "peripheral portions of the diffuser" it is meant the ends of the diffuser that extend along the entire perimeter of the same diffuser.

[0027] In the cases where diffuser 2 comprises a distributor 4, such covering means 5 are arranged on distributor 4.

[0028] According to the present invention, the covering means 5 are configured so as to give the direction of the flow of mixture entering the combustion chamber 3, at such peripheral portions, a component parallel to diffuser 2.

[0029] In other words, the covering means 5 deviate the mixture flow at the peripheral portions of diffuser 2 as shown by arrows 7' in figure 3. The flow that is initially perpendicular to diffuser 2 (arrows 7), is deviated by such covering means 5 and is able to filter through the air spaces of diffuser 2 and any air space present between said means 5 and diffuser 2. In this way, the flow mixture entering the combustion chamber 3, at the peripheral portions of the distributor, is less than the mixture flow entering the combustion chamber 3 at the central portions of the diffuser 2.

[0030] In this way, the blow-off at the ends of diffuser

2 is prevented.

[0031] According to preferred embodiments, the covering means 5 are arranged at a peripheral portion of the diffuser 2 that extends for a surface equal to at least 2/5 of the total surface of diffuser 2.

[0032] Preferably, such covering means 5 are arranged at a peripheral portion of diffuser 2 having a width comprised between about 10 mm and about 25 mm, more preferably said width is comprised between about 10 mm and about 15 mm. According to a particularly preferred embodiment, it is equal to about 10 mm. Such values are referred to household boilers, of course the values of such peripheral portions in industrial boilers shall be suitably calculated according to the boiler dimensions.

[0033] Advantageously, the covering means 5 are integral with frame 9 of burner 1.

[0034] According to the embodiments shown in figures 2-6, the covering means 5 comprise a metal plate.

[0035] According to embodiments not shown in the figures, the covering means 5 comprise a film.

[0036] The covering means 5 may be parallel to diffuser 2 at the peripheral portions thereof. The outline of the covering means 5 follows the outline of the peripheral portions of diffuser 2, thus if the latter are curved, the covering means are curved too.

[0037] The covering means 5 are at least partly in contact with diffuser 2, as shown in figures 2-6.

[0038] According to alternative embodiments, the covering means 5 are configured so as to gradually, in particular increasingly, cover the peripheral portions of diffuser 2. In other words, they are configured so as to gradually approach diffuser 2 proceeding in the direction that goes from the centre of diffuser 2 towards the peripheral portions thereof, that is, towards frame 9.

[0039] According to the second embodiment shown in figure 4, the covering means 5 include a metal plate whose profile comprises an outer portion 7 in contact with diffuser 2 and an inner portion 8 spaced apart from diffuser 2. The latter is connected to the outer portion 7 by a jointing portion 10 of the gradual type, however the jointing portion 10 may also be of step-wise, that is, having an inclination variation substantially great in a substantially small space.

[0040] According to the third embodiment shown in figure 5, burner 1 comprises an additional distribution wall 11 arranged at the central portion of diffuser 2. Such additional distribution wall 11 allows regulating the flow also at the central zone of diffuser 2 and thus it further increases the modulation of burner 1.

[0041] The geometry of the covering means 5 depends on the geometry of burner 1 and thus of diffuser 2. In particular, in case of flat diffuser 2, said covering means 5 have a substantially plane configuration, as shown in the embodiments illustrated in figures 2-5; in case of convex diffuser 2 relative to the combustion chamber 3, said covering means 5 have a substantially convex configuration.

[0042] In case of cylindrical diffuser 2, the covering

means 5 have a cylindrical configuration, as shown in figure 6 that illustrates the fourth embodiment of the present invention.

[0043] In case of frusto-conical diffuser 2, the covering means 5 have a frusto-conical configuration.

[0044] In a known manner, diffuser 2 comprises a metal or ceramic sheet or grid woven in wires or fibres or a metal or ceramic sintered material or a compact material having openings.

[0045] On the other hand, distributor 4 comprises a pierced or micro-stretched sheet or a metal mesh or a porous material.

[0046] The present invention also discloses a method for operating a gas burner 1 for a boiler provided with a diffuser 2, suitable for diffusing combustion gases in a combustion chamber 3. Such method comprises the steps of:

- providing a flow of mixture entering the burner 1 on the side opposite to the combustion chamber 3;
- conveying said flow onto diffuser 2;
- giving the direction of the flow of mixture, at peripheral portions of diffuser 2, a component parallel to diffuser 2.

[0047] Preferably, the step of giving a component parallel to diffuser 2 is carried out through covering means 5 arranged on the side of diffuser 2 opposite to the combustion chamber 3 and at the peripheral portions of diffuser 2.

[0048] Such covering means 5 are of the type described above.

[0049] Within the scope of the above description and in the following claims, all numerical values indicating amounts, parameters, percentages and so on are always to be deemed as preceded by the term "about", if not otherwise stated. Moreover, all numerical value ranges include all possible combinations of the maximum and minimum numerical values and all possible intermediate ranges, besides those specifically indicated in the text.

[0050] A man skilled in the art may make further changes and adjustments to the gas burner for boilers according to the present invention in order to meet specific and incidental needs, all falling within the scope of protection of the present invention.

Claims

1. Gas burner (1) for a boiler comprising a diffuser (2), suitable for diffusing premixed combustion gases in a combustion chamber (3), **characterised in that** it comprises covering means (5) of the flow of mixture entering the combustion chamber (3) arranged on the side of the diffuser (2) opposite to the combustion chamber (3) and at peripheral portions of the diffuser (2), said covering means (5) being configured so as to give the direction of the flow of mixture entering

the combustion chamber (3), at such peripheral portions, a component parallel to the diffuser (2) and said covering means (5) being at least partially in contact with the diffuser (2).

2. Gas burner (1) according to claim 1, wherein said covering means (5) are arranged at a peripheral portion of the diffuser (2) that extends for a surface equal to at least 2/5 of the total surface of the diffuser (2).
3. Gas burner (1) according to claim 1 or 2, wherein said covering means (5) are arranged at a perimeter peripheral portion of the diffuser (2) having a width of between about 10 mm and about 25 mm.
4. Gas burner (1) according to any one of the previous claims, wherein said covering means (5) are integral with a frame of the gas burner (1) itself.
5. Gas burner (1) according to any one of the previous claims, wherein said covering means (5) comprise a film.
6. Gas burner (1) according to any one of claims 1 to 4, wherein said covering means (5) comprise a metal plate.
7. Method for operating a gas burner (1) for a boiler provided with a diffuser (2), suitable for diffusing combustion gases in a combustion chamber (3), comprising the steps of:
 - providing a flow of mixture entering the burner (1) on the side opposite to the combustion chamber (3) ;
 - conveying said flow onto the diffuser (2);
 - giving the direction of the flow of mixture, at peripheral portions of the diffuser (2), a component parallel to the diffuser (2).
8. Method according to claim 7, wherein the step of giving a component parallel to the diffuser (2) is carried out through covering means (5) arranged on the side of the diffuser (2) opposite to the combustion chamber (3) and at the peripheral portions of the diffuser (2).

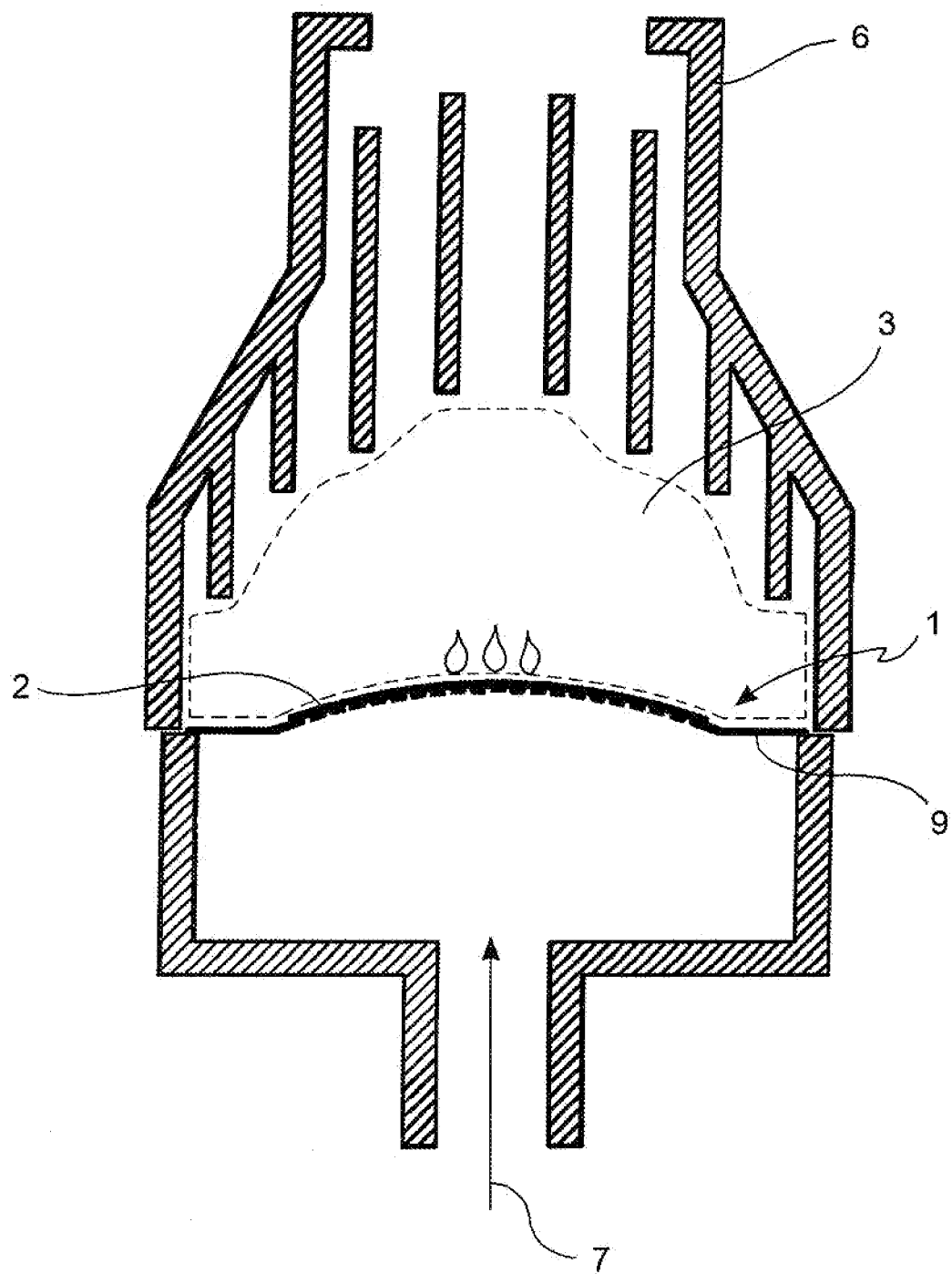


FIG. 1

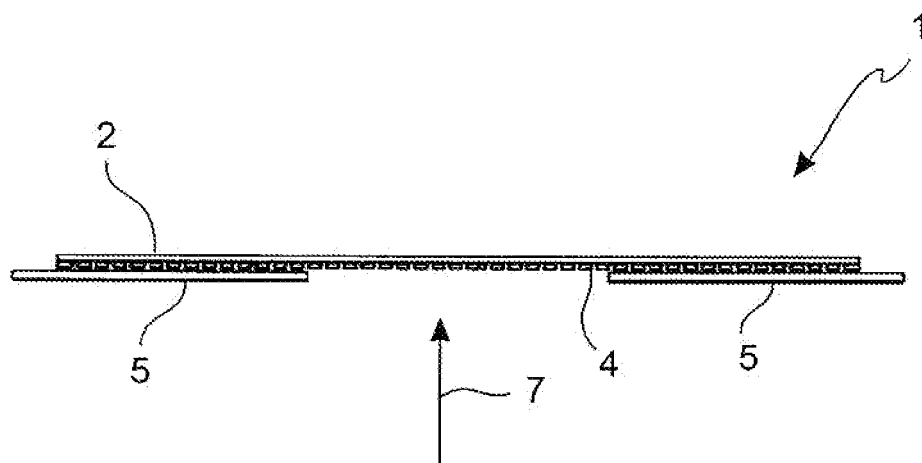


FIG. 2

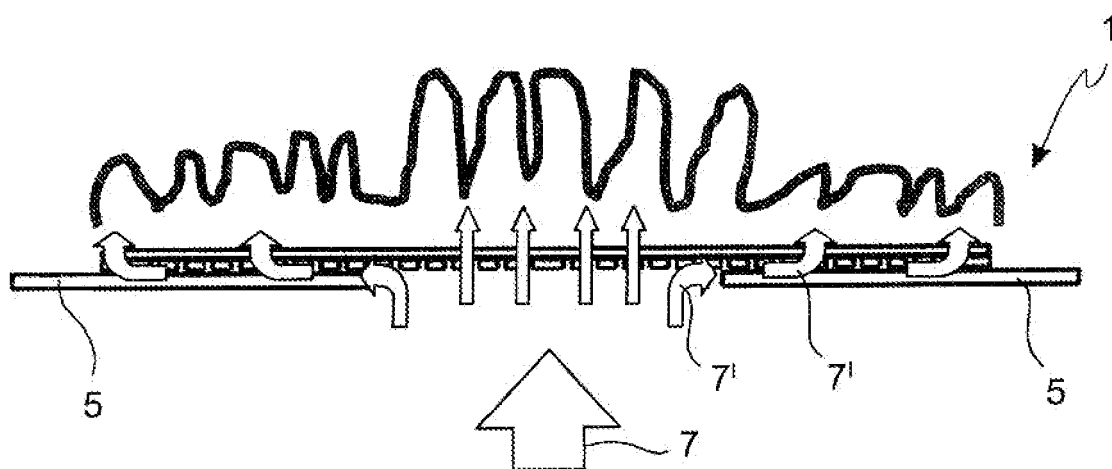


FIG. 3

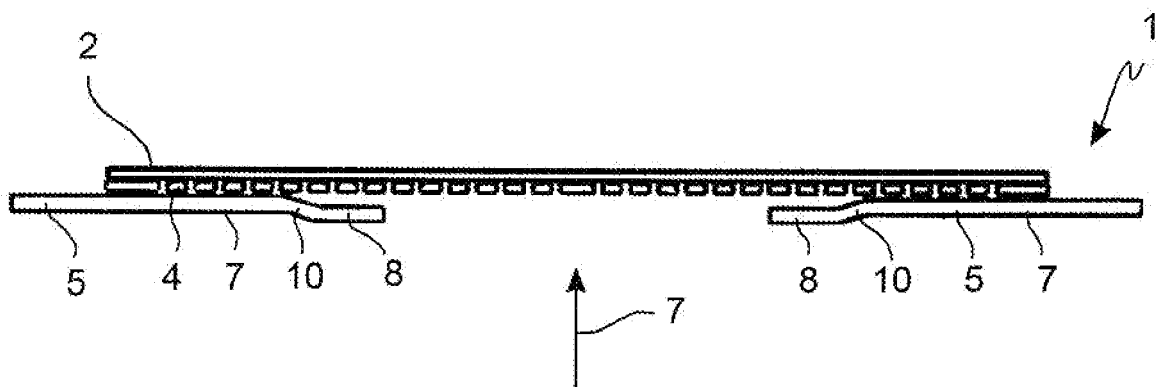


FIG. 4

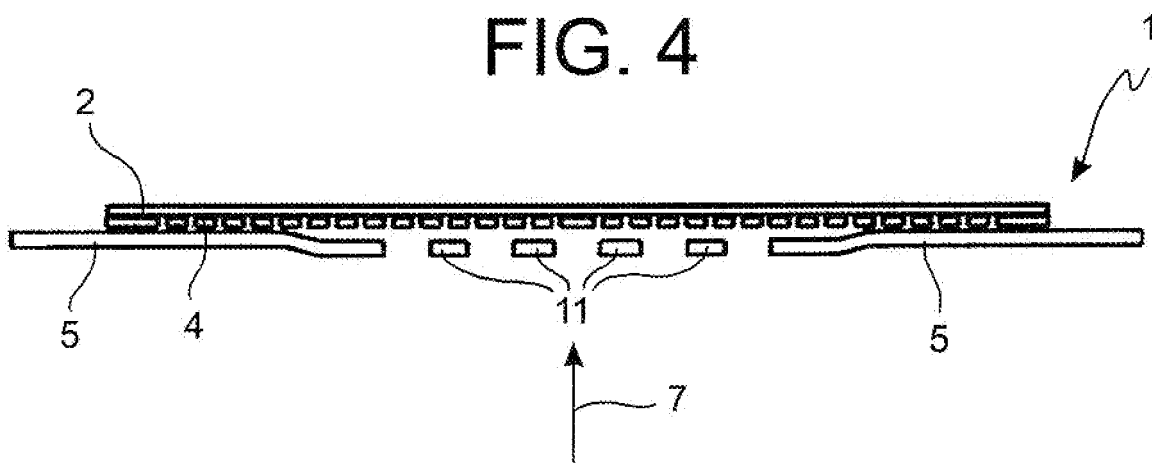


FIG. 5

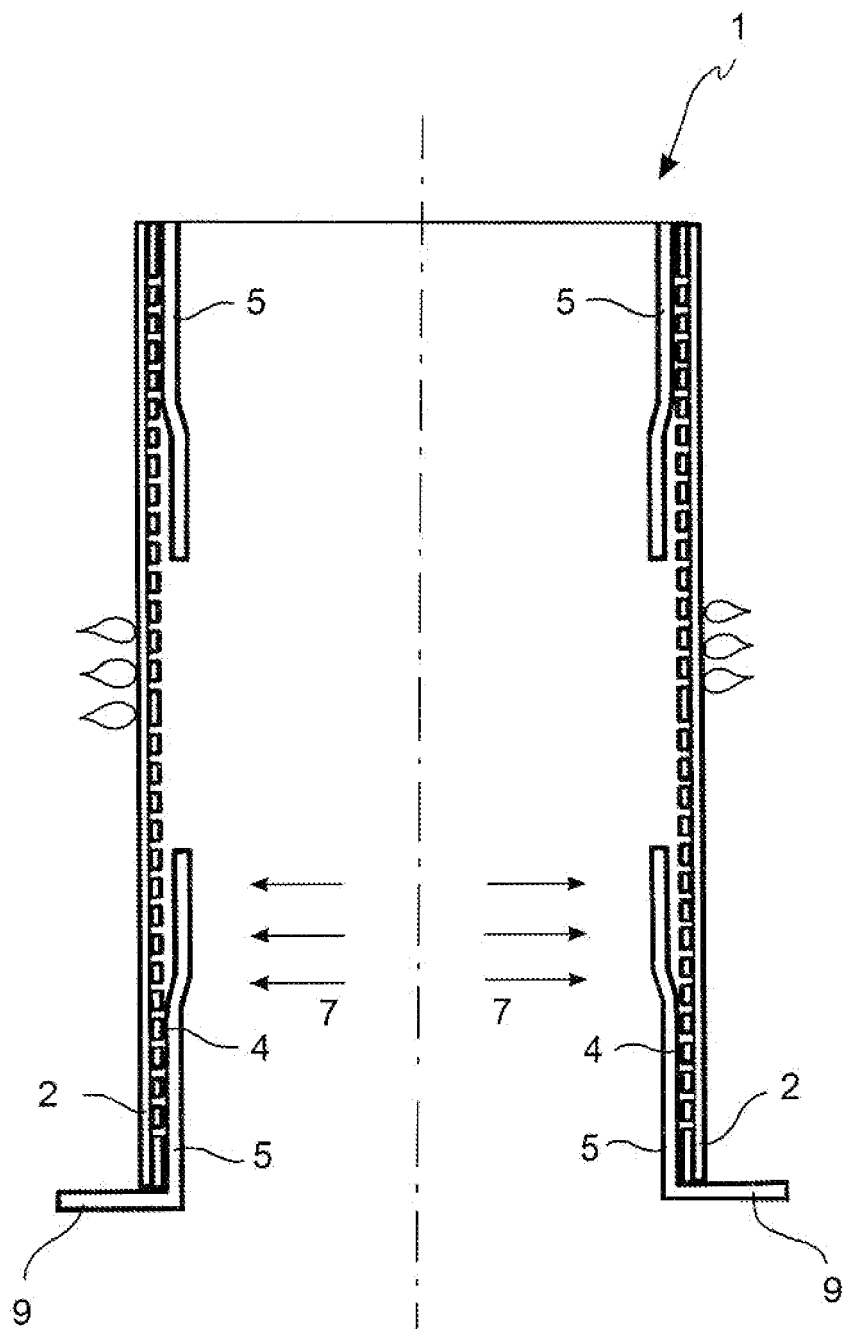


FIG. 6



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Application Number
EP 11 16 4793

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The members are as contained in the European Patent Office EDP file on
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