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(54) BURNER WITH LOCALLY FIXED BURNER DECK

BRENNER MIT LOKAL FIXIERTEM BRENNERDECK

BRÛLEUR DOTÉ D'UN COUVERCLE DE BRÛLEUR FIXÉ LOCALEMENT

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Description

Technical Field

[0001] The present invention relates to a burner with a fiber based burner deck (burner surface), and with an improved flame measuring device by use of an ionization probe.

[0002] The invention further relates to a burner control system with more stable flame controllability over time.

Background Art

[0003] In premix burners operating according to the so-called SCOT system, an ionization signal, which is obtained via an ionization electrode (ionization probe, ionization rod), is used in electronics to measure the presence of the flame and thereby also obtaining a measure for the air-gas ratio lambda. Some methods aim at keeping the air-gas ratio constant, thereby obtaining clean combustion throughout the whole combustion range and/or with differing compositions of the combustion gas and/or with different composition and temperature of the combustion air. An ionization system is generally comprising an electrode (or more than one electrode) and an earth, wherein a voltage is applied over the electrode and the earth. In some systems a further electrode might be the earth, in other systems the burner serves as earth.

[0004] DE 196 32 983 discloses a measuring device for a flame and an associated regulating device in a gas burner, wherein a lambda reference value for low emissions is set by means of an ionization electrode.

[0005] EP1154203 also uses a signal obtained by an ionization electrode which is located in the burner flame area as in DE 196 32 983, but further improvements to the digitizing process are found.

[0006] EP1036984 discloses the use of an ionization electrode in a premix burner wherein the premix burner has locally an increased surface area of the mixture flow passages in order to obtain a representative linear signal throughout the whole working range of the premix burner. This increased surface area of the mixture flow passages is in the direct proximity of the ionization electrode.

[0007] WO2010/094673 A1 discloses a premix gas burner having a burner surface which exhibits a plurality of flow passages and at least two ionization electrodes connected to a measuring device and preferably also to a control device. The ionization electrodes are arranged at different distances from the burner surface and the ionization electrodes are arranged electronically in parallel and electric currents are measured over each ionization electrode and the burner surface, the burner thus serving as earth in the electrical circuit. US 4 900 245 discloses a premix gas burner according to the preamble of claim 1.

[0008] Burners with fiber based burner decks are known in the state of the art. The fiber based burner deck is fixed to the supporting frame, plate or screen structure at the edges of the fiber based burner deck.

[0009] A common disadvantage of burners with fiber based burner deck is that over time or during use instability can exist in the combustion control.

Disclosure of Invention

[0010] The object of the present invention is to provide a burner with a burner deck made out of fiber based material and with improved burner control possibilities. It is a further object of the present invention to provide a burner control system which permits to control the air gas ratio of a burner in a stable way over the complete duration of a combustion process and over the life of the burner.

[0011] An aspect of the invention provides a burner according to claim 1.

[0012] The burner can have any shape as is known in the art. One aspect of the invention relates to a burner with a burner deck having a curved surface. Another aspect of the invention relates to a burner with a cylindrical shape (also called a cylindrical burner). Yet another aspect of the invention relates to a burner with a conical.

[0013] Another aspect of the invention is that the fixation of the burner deck near the ionization probe is present within a specific area of the burner deck. This specific area of the burner deck is defined by the area around the vertical projection of the ionization probe onto the burner deck. In a preferred embodiment the specific area is defined by a distance of 35 mm around the vertical projection of the ionization probe onto the burner deck. In a more preferred embodiment the specific area is defined by a distance of 25 mm around the vertical projection of the ionization probe onto the burner deck. In an even more preferred embodiment the specific area is defined by a distance of 20 mm around the vertical projection of the ionization probe onto the burner deck.

[0014] The burner deck can be a knitted fabric, a woven fabric or a nonwoven fabric. The burner deck can also be made out of sintered fibrous material.

[0015] The fixation of the burner deck near the ionization probe can be via welding, glueing, stapling, riveting, stitching or in any other way that results in fixation of the burner deck near the ionization probe.

[0016] In another aspect of the invention, the fixation of the burner deck near the ionization probe can be via a combination of techniques resulting in fixation of the burner deck near the ionization probe.

[0017] In another aspect of the invention, fixations that fix the fiber based burner deck to the perforated plate or the screen near the ionization probe are 1 - 6 mm wide, preferably 2 - 4 mm wide.

[0018] The part of the burner deck that is not fixed to the perforated plate or the screen remains flexible.

[0019] The burner can be a premix gas burner.

[0020] Another aspect of the invention is a burner control system using a burner deck and ionization probe as described in the invention. In a preferred embodiment,

the measured current of the ionization probe is used to control the air-gas ratio lambda of the burner, thereby steering the combustion and guaranteeing proof of combustion in the way as set by the control parameters.

[0021] Another aspect of the invention is a heating apparatus comprising a burner as described in the invention.

[0022] Another aspect of the invention is a heating apparatus comprising a burner control system as defined in the invention.

[0023] Another aspect of the invention is the use of a burner as described in the invention.

[0024] The working principle of the invention is as follows. A common disadvantage of state of the art burners with fiber based burner deck material is that due to its use (as an example due to thermal expansion) the burner deck will gain an offset to the perforated plate or screen that gives the burner deck its shape. As a consequence the distance of the burner deck to the ionization electrode (ionization probe, ionization rod) will change and hence the signal produced with such a setup will change as well. The change of the ionization signal over time during burning and over the lifetime of the burner is negative for a good and stable flame control. Furthermore, if the offset is amply, the distance to the ionization rod can become zero and an electrical shortcut will be the result.

[0025] One benefit of the invention is that it prevents the burner deck from changing its distance to the ionization probe during use of the burner and over the lifetime of the burner, resulting in a more reliable and stable ionization signal.

[0026] Another benefit of the fixation as described in the invention is that a better ground connection of the burner deck is realized, with enhanced ionization signal as a result.

[0027] Yet another benefit of the fixation is that better connection between the burner deck and the perforated plate or the screen will be realized in order to transport heat, with reduced aging of the burner deck material as a result.

[0028] Yet another benefit of the invention is that, at the positions where the burner deck is connected to the perforated plate or the screen, better flame stability is observed, resulting in a better ionization signal over a wider power range.

Brief Description of Figures in the Drawings

[0029] Example embodiments of the invention are described hereinafter with reference to the accompanying drawings wherein

Figure 1 shows a schematic representation of a burner with a textile based burner deck with a curved surface and with the fixation of part of the burner deck near the ionization probe according to the invention.

Figure 2 shows a schematic drawing of the cross section along line I-I' of figure 1.

Figure 3 shows a schematic drawing of an alternative way of fixation of the burner deck to the perforated plate or the screen.

Figure 4 shows a schematic drawing of yet an alternative way of fixation of the burner deck to the perforated plate or the screen.

Figure 5 shows a schematic drawing of yet an alternative way of fixation of the burner deck to the perforated plate or the screen.

Figure 6 shows a schematic drawing of yet an alternative way of fixation of the burner deck to the perforated plate or the screen.

Figure 7 shows a schematic drawing of yet an alternative way of fixation of the burner deck to the perforated plate or the screen.

Figure 8 shows a schematic drawing of a cylindrical burner according to the invention.

Figure 9 shows a burner and burner control system according to the invention.

Mode(s) for Carrying Out the Invention

[0030] In an exemplary embodiment, a burner 10 in figure 1 comprises an ionization probe 12 and a curved fiber based burner deck 14. The curved fiber based burner deck 14 is supported by a perforated plate or a screen 16, providing the fiber based burner deck its curved shape. Near the ionization probe 12, the burner deck is fixed via point fixations 18 to the perforated plate or the screen 16. In one embodiment, the point fixations that fix the fiber based burner deck to the perforated plate or the screen near the ionization probe are 1 - 6 mm wide, in a more preferred embodiment 2 - 4 mm wide.

[0031] Figure 2 shows a cross section of figure 1 along line I-I'. The fiber based burner deck 20 is supported by a perforated plate or a screen 22. The fiber based burner deck 20 and the perforated plate or the screen 22 are fixed to frame 24 of the burner. Via fixation points 26, the fiber based burner deck 20 is fixed to the perforated plate or the screen 22 near the ionization probe 28.

[0032] Figure 3 shows another arrangement for the fixation near the ionization probe of the fiber based burner deck to the perforated plate or screen. The fiber based burner deck 30 is fixed via a linear connection 32 to the underlying perforated plate or screen 34.

[0033] Figure 4 shows yet another arrangement for the fixation near the ionization probe of the fiber based burner deck to the perforated plate or the screen. The fiber based burner deck 40 is fixed via a dotted line connections 42 to the underlying perforated plate or the screen 44.

[0034] Figure 5 shows yet another arrangement for the fixation near the ionization probe of the fiber based burner deck to the perforated plate or the screen. The fiber based burner deck 50 is fixed via point fixations 52 on parallel lines to the underlying perforated plate or the screen 54, near the ionization probe 56.

[0035] Figure 6 shows yet another arrangement for the

fixation near the ionization probe of the fiber based burner deck to the perforated plate or the screen. The fiber based burner deck 60 is fixed via dotted fixations 62 on diagonal lines to the underlying perforated plate or the screen 64, near the ionization probe 66.

[0036] Figure 7 shows yet another arrangement for the fixation near the ionization probe of the fiber based burner deck to the perforated plate or the screen. The fiber based burner deck 70 is fixed via parallel line fixations 72 to the underlying perforated plate or the screen 74. The parallel line fixations 72 are perpendicular to the ionization probe 76.

[0037] In an alternative embodiment, the fixation or fixations near the ionization probe of the fiber based burner deck to the perforated plate or the screen are in the form of dashed lines. In an alternative embodiment of the invention the fixation or fixations comprise crosses. In an alternative embodiment of the invention the fixation or fixations comprise combinations of fixations that can include (but are not limited to) lines, dots, dashes or crosses.

[0038] In an embodiment of the invention, the fixation or fixations near the ionization probe of the fiber based burner deck to the perforated plate or the screen are in line patterns. The line pattern can comprise straight lines or curved lines. In an alternative embodiment, the fixations are in a two dimensionally patterned way.

[0039] Figure 8 shows a schematic drawing of a cylindrical burner 800 according to the invention. The burner has a gas inlet port 805, supplying the gas-air premix into the cylindrical burner 800. A fibre based burner deck 810- originally in rectangular shape - has been bent around an internal cylindrical perforated plate or screen structure (not shown on the drawing) to follow the cylindrical structure of the latter. At the edges 820, 830 and 840; the fibre based burner deck is fixed to the internal cylindrical perforated plate or screen structure. This fixation can be over the full length of the edges of the fibre based burner deck or over only part of the edges. An ionization probe 850 is positioned at the combustion side of the burner. Near ionization probe 850, fixations 860 are fixing the fiber based burner deck to the perforated plate or the screen.

[0040] In one embodiment, an end cap is present at the top side 870 of the cylindrical burner. In an alternative embodiment, an additional fiber based burner deck can be fixed at top side 870. In yet an alternative embodiment, the burner deck on the cylindrical part of the burner and the burner deck at the top side are shaped from one single fiber based substrate.

[0041] In yet another embodiment, a cylindrical burner deck is made out of a tubular fiber based substrate and slid over the internal cylindrical perforated plate or screen structure to form the burner deck. The tubular fiber based substrate can be a circular knitted fabric, or a circular woven fabric or a circular braided fabric; or a circular fabric made in any other technology known in technology.

[0042] In one embodiment, the fixations, with which the fibre based burner deck is fixed at its edges to the internal cylindrical perforated plate or screen structure, are 8 - 10 mm wide. In one embodiment, the fixations that fix the fiber based burner deck to the perforated plate or the screen near the ionization probe are each 1 - 6 mm wide, preferably 2 - 4 mm wide.

[0043] Figure 9 shows a burner 910 connected to an air supply 920 and a gas supply 930. Burner 910 has a fiber based burner deck 940 connected to the frame 950 and at least one ionization probe 960. At position 965 near the ionization probe the burner deck is fixed to perforated plate 970 so that the distance between the ionization probe 960 and the burner deck 940 remains constant during burning. The signal obtained from the ionization probe 960 is directed to a first electronic component 980 measuring the current and possibly amplifying the signal for further processing. The electronic component 980 can be any system for measuring currents available in the market and known to the person skilled in the art. In a preferred embodiment, the measured current can then further be used for calculation of the air gas ratio and modulation of the air and/or gas supply by control system 990, which is connected to the air and gas supply lines 920 and 930, thereby steering a clean combustion and guaranteeing proof of clean combustion. Also the control system 990 can be any commercially available system and is known as such to the person skilled in the art. In a further preferred embodiment, control system 990 and electronic component 980 are combined in one system. Such systems are also freely available on the market and known by the person skilled in the art.

[0044] In a first embodiment, the used metal fibers for the burner deck, e.g. stainless steel fibers, with a diameter less than 40 micrometers, e.g. less than 25 micrometers, are obtained by a bundle drawing technique. This technique is disclosed e.g. in US-A-2050298, US-A-3277564 and in US-A-3394213. Metal wires are forming the starting material and are covered with a coating such as iron or copper. A bundle of these covered wires is subsequently enveloped in a metal pipe. Thereafter the thus enveloped pipe is reduced in diameter via subsequent wire drawing steps to come to a composite bundle with a smaller diameter. The subsequent wire drawing steps may or may not be alternated with an appropriate heat treatment to allow further drawing. Inside the composite bundle the initial wires have been transformed into thin fibers which are embedded separately in the matrix of the covering material. Such a bundle preferably comprises no more than 2000 fibers, e.g. between 500 and 1500 fibers. Once the desired final diameter has been obtained the covering material can be removed e.g. by solution in an adequate pickling agent or solvent. The final result is the naked fiber bundle.

[0045] In a second embodiment, metal fibers for the burner deck, such as stainless steel fibers are manufactured in a cost effective way by machining a thin plate material. Such a process is disclosed e.g. in US-A-4930199. A strip of a thin metal plate is the starting ma-

terial. This strip is wound around the cylindrical outer surface of a rotatably supported main shaft a number of times and is fixed thereto. The main shaft is rotated at constant speed in a direction opposite to that in which the plate material is wound. A cutter having an edge line expending perpendicularly to the axis of the main shaft is fed at constant speed. The cutter has a specific face angle parallel to the axis of the main shaft. The end surface of the plate material is cut by means of the cutter.

[0046] In a third embodiment, metal fibers of the burner deck are extracted or extruded from a melt.

[0047] In one embodiment of the invention, the fiber based burner deck is a metal fiber knitted fabric. In another embodiment, the fiber based burner deck is a metal fiber woven fabric. In another embodiment, the fiber based burner deck is a metal fiber nonwoven fabric. In another embodiment, the burner deck is made out of sintered fibrous material.

[0048] In one embodiment, the burner deck is fixed to the perforated plate or to the screen by means of welding. In another embodiment, the burner deck is fixed to the perforated plate or to the screen by means of glueing. In yet another embodiment, the burner deck is fixed to the perforated plate or to the screen by means of stapling. In yet another embodiment, the burner deck is fixed to the perforated plate or to the screen by means of riveting. In yet another embodiment, the burner deck is fixed to the perforated plate or to the screen by means of stitching.

[0049] In yet another embodiment of the invention, the burner deck is fixed to the perforated plate or screen via a combination of techniques. The techniques can include e.g. welding, glueing, stapling, stitching, riveting... When gluing, a glue which is resistant to high temperatures need to be used. An example of such a glue may be a ceramic glue.

[0050] In one embodiment of the invention, the distance between the ionization probe and the burner deck is between 3 and 25 mm. In a preferred embodiment, the distance between between the ionization probe and the burner deck is between 5 and 15 mm. In a more preferred embodiment, the distance between the ionization probe and the burner deck is between 7 and 11 mm.

[0051] In one embodiment of the invention, the fixation of the burner deck near the ionization probe is present within an area of 35 mm around the vertical projection of the ionization probe onto the burner deck. In a more preferred embodiment, the fixation of the burner deck near the ionization probe is present within an area of 25 mm around the vertical projection of the ionization probe onto the burner deck. In an even more preferred embodiment, the fixation of the burner deck near the ionization probe is present within an area of 20 mm around the vertical projection of the ionization probe onto the burner deck.

[0052] In one embodiment of the invention, the perforated plate supporting the burner deck has equal perforation patterns over the full surface of the perforated plate. In another embodiment, the perforated plate has a higher percentage of perforated area in the region of the ionization probe. In yet another embodiment, the perforated plate has extra perforations in the region of the ionization probe.

[0053] In one embodiment of the invention, the perforated plate supporting the burner deck is made out of stainless steel.

[0054] In one embodiment of the invention, the screen supporting the burner deck is a woven metal wire screen.

Claims

1. A burner (10) comprising a fiber based burner deck (14), a perforated plate or a screen (16) supporting said fiber based burner deck, and at least one ionization probe (12) mounted at the burner side of said burner (10) and defining a distance. between said ionization probe (12) and said burner deck (14), **characterised in that** near said ionization probe (12), said burner deck (14) is fixed to said perforated plate or to said screen (16) so that said distance remains constant during burning.

2. The burner of claim 1 in which the fixation of the burner deck to the perforated plate or to the screen is present within an area of 35 mm around the vertical projection of the ionization probe onto the burner deck.

3. The burner as in claims 1 or 2 in which the burner deck is a knitted fabric

4. The burner as in claims 1 or 2 in which the burner deck is a woven fabric

5. The burner as in claims 1 or 2 in which the burner deck is a nonwoven fabric

6. The burner as in claims 1 - 5 in which the burner deck is made out of sintered fibrous material

7. The burner as in claims 1 - 6 in which the fixation is made by means of welding.

8. The burner as in claims 1 - 6 in which the fixation is made by means of glueing.

9. The burner as in claims 1 - 6 in which the fixation is made by means of stapling.

10. The burner as in claims 1 - 6 in which the fixation is made by means of riveting.

11. The burner as in claims 1 - 6 in which the fixation is made by means of stitching.

12. A burner control system comprising the arrangement

of ionization probe and burner deck as described in claims 1 to 11.

13. A heating apparatus comprising a burner control system as defined in claim 12.

14. Use of the burner as defined in any of the claims 1 to 11.

15. Use of a burner control system as described in claim 12.

Patentansprüche

1. Brenner (10), umfassend ein faserbasiertes Brennerdeck (14), eine Lochplatte oder ein Sieb (16), das das faserbasierte Brennerdeck abstützt, und mindestens eine Ionisierungssonde (12), die an der Brennerseite (10) montiert ist und einen Abstand zwischen der Ionisierungssonde (12) und dem Brennerdeck (14) definiert, **dadurch gekennzeichnet, dass** in der Nähe der Ionisierungssonde (12) das Brennerdeck (14) teilweise an der Lochplatte oder dem Sieb (16) befestigt ist, damit der Abstand während des Brennens konstant bleibt.

2. Brenner nach Anspruch 1, wobei die Befestigung des Brennerdecks an der Lochplatte oder dem Sieb in einem Bereich von 35 mm um den vertikalen Vorsprung der Ionisierungssonde auf dem Brennerdeck vorhanden ist.

3. Brenner nach einem der Ansprüche 1 oder 2, wobei das Brennerdeck ein Gestrick ist.

4. Brenner nach einem der Ansprüche 1 oder 2, wobei das Brennerdeck ein Gewebe ist.

5. Brenner nach einem der Ansprüche 1 oder 2, wobei das Brennerdeck ein Vliesstoff ist.

6. Brenner nach einem der Ansprüche 1 bis 5, wobei das Brennerdeck aus gesintertem Fasermaterial hergestellt ist.

7. Brenner nach einem der Ansprüche 1 bis 6, wobei die Befestigung durch Schweißen hergestellt wird.

8. Brenner nach einem der Ansprüche 1 bis 6, wobei die Befestigung durch Ankleben hergestellt wird.

9. Brenner nach einem der Ansprüche 1 bis 6, wobei die Befestigung durch Klammern hergestellt wird.

10. Brenner nach einem der Ansprüche 1 bis 6, wobei die Befestigung durch Nieten hergestellt wird.

11. Brenner nach einem der Ansprüche 1 bis 6, wobei die Befestigung durch Annähen hergestellt wird.

12. Brennersteuersystem, umfassend die Anordnung der Ionisierungssonde und des Brennerdecks nach einem der Ansprüche 1 bis 11.

13. Heizvorrichtung, umfassend ein Brennersteuersystem nach Anspruch 12.

14. Verwendung des Brenners nach einem der Ansprüche 1 bis 11.

15. Verwendung des Brennersteuersystems nach Anspruch 12.

Revendications

1. Brûleur (10) comprenant un couvercle de brûleur à base de fibres (14), une plaque perforée ou un tamis (16) soutenant ledit couvercle de brûleur à base de fibres, et au moins une sonde d'ionisation (12) montée du côté brûleur dudit brûleur (10) et définissant une distance entre ladite sonde d'ionisation (12) et ledit couvercle de brûleur (14), **caractérisé en ce que** près de ladite sonde d'ionisation (12), ledit couvercle de brûleur (14) est fixé à ladite plaque perforée ou audit tamis (16) de telle sorte que ladite distance reste constante pendant la combustion.

2. Brûleur selon la revendication 1, la fixation du couvercle de brûleur à la plaque perforée ou au tamis étant présente dans une zone de 35 mm autour de la projection verticale de la sonde d'ionisation sur le couvercle de brûleur.

3. Brûleur selon les revendications 1 et 2, le couvercle de brûleur étant un tricot.

4. Brûleur selon les revendications 1 et 2, le couvercle de brûleur étant un tissu.

5. Brûleur selon les revendications 1 et 2, le couvercle de brûleur étant un non-tissé.

6. Brûleur selon les revendications 1 à 5, le couvercle de brûleur étant constitué d'un matériau fibreux fritté.

7. Brûleur selon les revendications 1 à 6, la fixation étant réalisée au moyen d'une soudure.

8. Brûleur selon les revendications 1 à 6, la fixation étant réalisée au moyen d'un collage.

9. Brûleur selon les revendications 1 à 6, la fixation étant réalisée au moyen d'un agrafage.

10. Brûleur selon les revendications 1 à 6, la fixation étant réalisée au moyen d'un rivetage.

11. Brûleur selon les revendications 1 à 6, la fixation étant réalisée au moyen d'une couture.

12. Système de commande de brûleur comprenant l'agencement de sonde d'ionisation et couvercle de brûleur tel que décrit dans les revendications 1 à 11.

13. Appareil de chauffage comprenant un système de commande de brûleur tel que défini dans la revendication 12.

14. Utilisation du brûleur tel que défini dans l'une quelconque des revendications 1 à 11.

15. Utilisation d'un système de commande de brûleur tel que décrit dans la revendication 12.

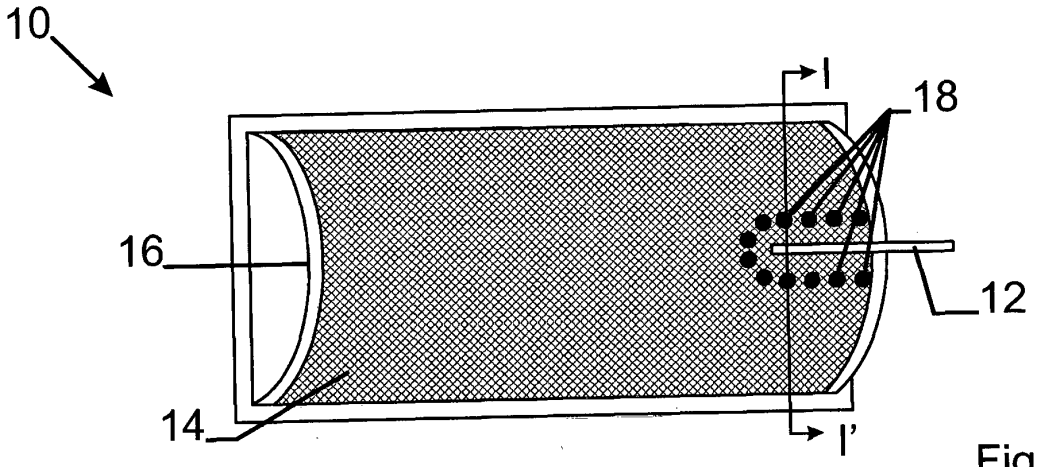

Fig. 1

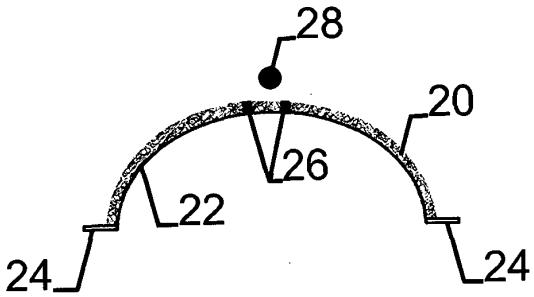

Fig. 2

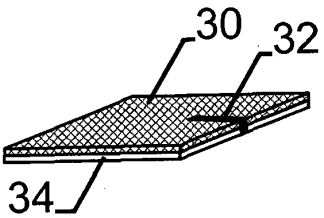

Fig. 3

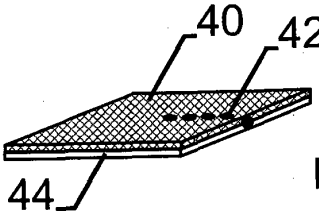

Fig. 4

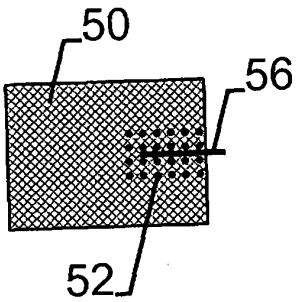

Fig. 5

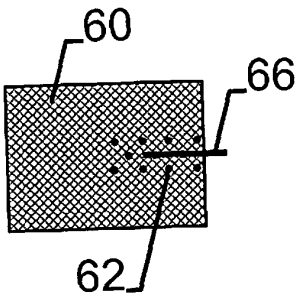

Fig. 6

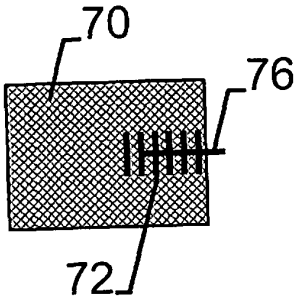

Fig. 7

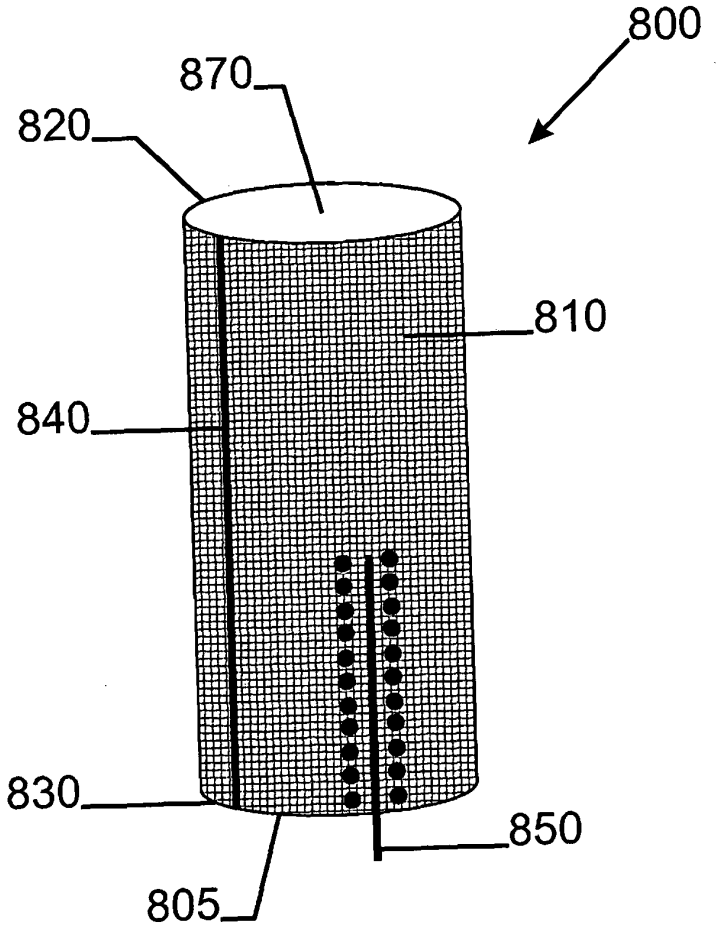

Fig. 8

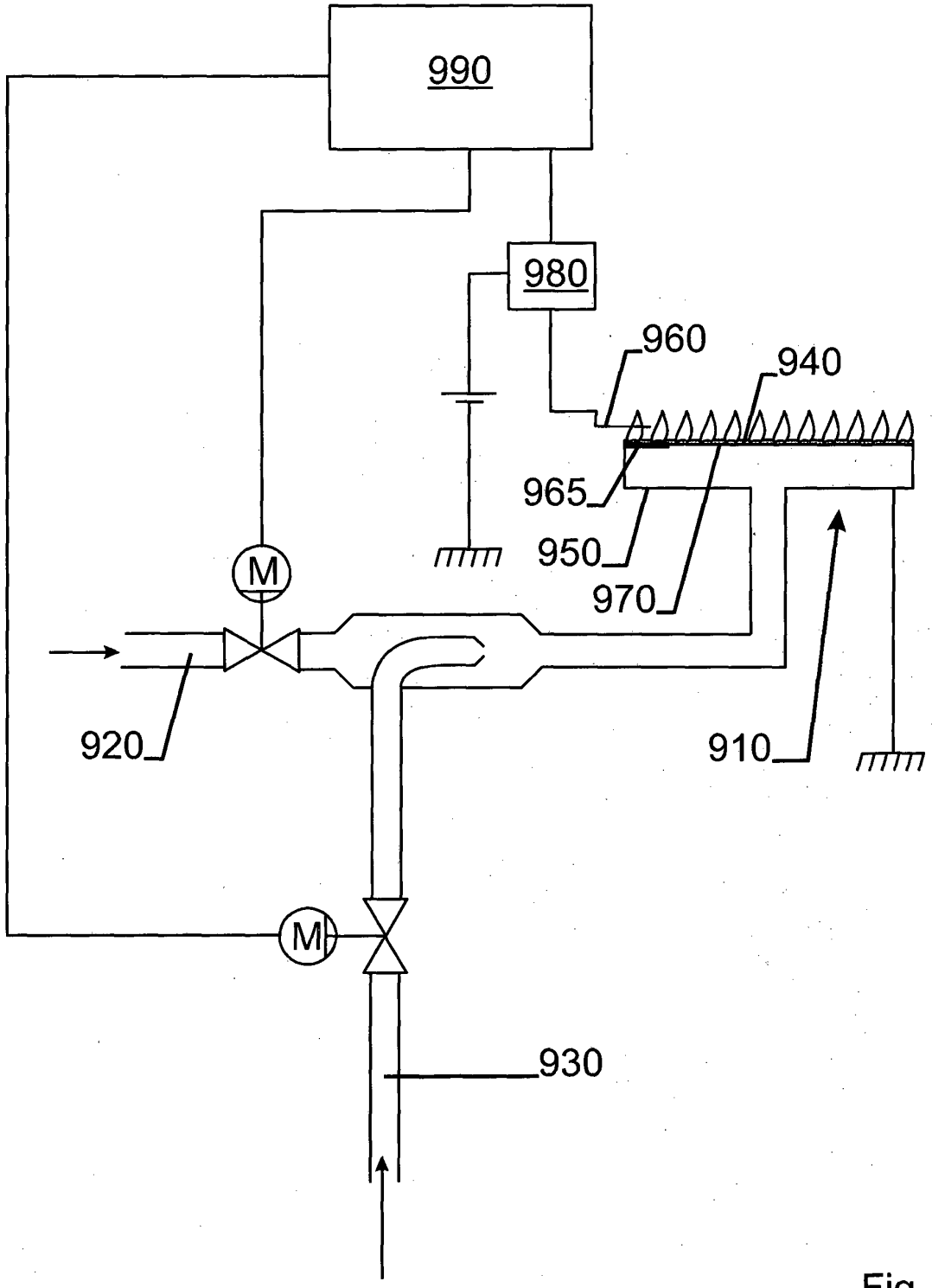

Fig. 9

REFERENCES CITED IN THE DESCRIPTION

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