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(54) PREMIX GAS BURNER

GASVORMISCHBRENNER

BRÛLEUR DE GAZ PRÉ-MÉLANGÉ

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Description

Technical Field

[0001] The invention relates to gas premix burners that have a woven, knitted or braided burner deck comprising metal fibers. Such gas premix burners can e.g. be used in boilers or in instantaneous water heaters.

Background Art

[0002] EP0157432 discloses a burner that has a porous combustion membrane of non-woven structure and which is made by compressing a more or less randomly packed structure of steel fibers into a panel and subsequently sintering it to obtain strength, coherence and stability. Further gas premix burners that have a sintered metal fiber web as burner membrane are e.g. known from WO93/18342 and WO94/14608 (in which the sintered metal fiber web is sintered to a screen).

[0003] US6410878B discloses a method for producing a flame support for a gas burner. The method consists in feeding a metal alloy to an overflowing tank, to produce metal fibers from the metal alloy by cooling in contact with a mobile wheel; in arranging in a moulding matrix the resulting disjointed fibers and compressing them to form an agglomerated mat; in connecting the mat to electrodes and a capacitor, thereby bringing the fibers, at their points of contact, to a temperature higher than their melting point, to produce fibers closely welded together, under high voltage.

[0004] By knitting, weaving or braiding yarns comprising metal fibers, an alternative method is provided to obtain a burner membrane comprising metal fibers. Gas premix burners are known that have a knitted or woven fabric comprising metal fibers as burner deck, positioned on a perforated plate or woven screen (a woven wire mesh) which is acting as gas distribution plate. Such gas premix burners can be produced much cheaper than gas premix burners that have a sintered metal fiber web as burner deck. It is a benefit of such burners - compared to nonwoven burner decks that are sintered or welded - that the metal fiber based burner deck (e.g. a knitted or woven fabric) can freely expand when hot, while the perforated plate, the woven wire mesh or the expanded metal sheet is remaining sufficiently cool. Such burners are e.g. known from US4657506 and WO2004/092647.

[0005] JP2001235117 describes a burner with a flat perforated plate, onto which a knitted metal fiber fabric acting as burner deck is over its complete surface fully welded.

Disclosure of Invention

[0006] The primary object of the invention is to provide an improved gas premix burner.

[0007] A first aspect of the invention is a gas premix burner in accordance with claim 1. The woven, knitted or braided burner deck is soft welded over at least part of its surface to the perforated plate, woven wire mesh or expanded metal sheet. Preferably the soft welding is performed over at least 50% of surface of the burner deck, more preferably over at least 75% of its surface, and even more preferably substantially over its full surface; or over its full surface.

[0008] The soft welding is performed such that when pulling the woven, knitted or braided burner deck from the perforated plate, woven wire mesh or expanded metal sheet, the soft welded bonds between the woven, knitted or braided burner deck and the perforated plate, woven wire mesh or expanded metal sheet are broken rather than that breakage of the woven, knitted or braided burner deck occurs. The test method to determine that the burner deck is soft welded, is pulling in peel-off mode: an edge portion of the burner deck is removed from the perforated plate, woven wire mesh or expanded metal sheet, and folded over 180°. Pulling the burner deck is then done by hand or using pliers, wherein the pulling force is exerted parallel with the perforated plate, woven wire mesh or expanded metal sheet, in a direction of 180° to the burner deck. In pulling, the force builds up until the burner deck is progressively peeled off from the supporting perforated plate, woven wire mesh or expanded metal sheet leaving no metal fibers of the burner deck on the supporting perforated plate, woven wire mesh or expanded metal sheet (indicating that soft welding occurred); or until progressively destroying the burner deck at least partly wherein metal fibers of the burner deck remain attached to the supporting perforated plate, woven wire mesh or expanded metal sheet (indicating that no soft welding occurred). Within the limits of the described "pulling in peel-off mode" the conclusion whether or not the burner deck is soft-welded to the supporting perforated plate, woven wire mesh or expanded metal sheet is independent of further parameters.

[0009] In a preferred embodiment, the woven, knitted or braided burner deck comprising metal fibers has a density of less than1500 g/dm^3, preferably less than 1300 g/dm^3, more preferably of less than 1200 g/dm^3, even more preferably of less than 1100 g/dm^3.

[0010] Soft welding differs from spot welding, as in spot welding, welding is performed in a predefined pattern of discrete spots over a surface. This is not the case in soft welding, as in soft welding over a surface itself welding is performed; the welding is not limited to a predefined pattern of discrete spots.

[0011] The use of soft welding creates benefits compared to the gas premix burners of the prior art. Soft welding combines the positive effects that the woven, knitted or braided burner deck can expand when hot, while the perforated plate, the woven wire mesh or the expanded metal sheet is remaining sufficiently cool; with the benefit that less acoustic instabilities are observed when using the burner. The free expansion when hot and retraction when cool allows to absorb thermal stresses, preventing damage (e.g. rupture) of the burner deck.

[0012] As classical welding of the metal fiber based burner deck to the perforated plate (as in JP2001235117) results in a firm and dense welded connection between all fibers and the supporting perforated plate (and a dense and welded fiber based burner deck - as in a sintered metal fiber nonwoven burner deck), the benefits of the freely expanding woven, knitted or braided burner deck on the one hand; and the perforated plate, the woven wire mesh or the expanded metal sheet remaining sufficiently cool on the other hand; cannot be realized nor observed in burners made that way.

[0013] It is known that boilers where heat is generated by a burner can show thermo acoustical instabilities. The result is noise that can be very irritating. In gas premix burners, air is fed by a fan and mixed with combustible gas, e.g. by means of a venturi, and introduced in a premixing chamber after which the premix of gas and air is combusted after flowing through a porous burner deck. The hot flue gas transfers its thermal energy to a fluid in a heat exchanger after which the flue gas is evacuated through a chimney. The combination of parts of the boiler results in it that noise is generated, e.g. by the gas flow through the fan. The presence of the flame can amplify any noise that is present, from a level that the noise is not audible up to levels that are very annoying. Noise is a standing wave. The flame is not constant over time. The short term fluctuations in the flame can coincide with the frequency of the noise resulting in amplification of the standing waves (and consequently of the noise). This process is called thermo-acoustic instability. The burner needs to be operated over a certain load range and also in a range of the air to gas ratio. This creates a large range of possible conditions of operation of the boiler, that each needs to be sufficiently silent in operation, meaning that acoustic instabilities should be sufficiently low over the full range of modulation of the burner. The interactions between the different parameters are believed to be extremely complex and not understood. A known solution in the use of mufflers in the boilers, however this is an expensive solution.

[0014] The invention further allows using a woven, knitted or braided burner deck of lower specific weight than in the prior art, for a same performance of the burner.

[0015] In a preferred embodiment, the burner deck is one layer of a woven, knitted or braided fabric, placed on the perforated plate, woven wire mesh or expanded metal sheet.

[0016] In a preferred embodiment, the burner deck is knitted, woven or braided using yarns comprising or consisting out of a plurality of metal filaments or metal staple fibers or metal monofilaments.

[0017] In a preferred embodiment, the surface of the woven, knitted or braided burner deck at the other side than the perforated plate, woven wire mesh or expanded metal sheet is not covered by another metallic object, such that the surface of the woven, knitted or braided burner deck is, when the burner is in use, the surface on which combustion takes place.

[0018] In an exemplary embodiment, the burner deck is curved over at least part of its surface.

[0019] In an exemplary embodiment, the burner deck is over at least part of its surface double-curved. Where a surface is at a point on it double curved, there is at that point no direction in which the radius of curvature at that point is infinite. As an example, a cylindrical burner is a burner that has a single curved surface. A sphere is an object that is double curved over its complete surface.

[0020] In an exemplary embodiment, the gas premix burner of the invention has a cylindrical burner deck.

[0021] Examples of preferred metal fibers are stainless steel fibers. A specifically preferred range of stainless steel fibers are chromium and aluminium comprising stainless steel fibers as in DIN 1.4767, e.g. as are known under the trademark FeCrAlloy.

[0022] Preferred are metal fibers with equivalent diameter of less than 50 μm, more preferably less than 40 μm. With equivalent diameter of a fiber is meant the diameter of a circle with the same surface area as the cross sectional area of that fiber.

[0023] Preferred metal fibers for use in the invention, e.g. stainless steel fibers, with an equivalent diameter less than 50 micrometer or less than 40 micrometer, e.g. less than 25 micrometer, can be 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 the 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 not 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 leaching agent or solvent. The result is a bundle of metal fibers.

[0024] Alternatively metal fibers for use in the invention, such as stainless steel fibers, can be 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 or sheet is the starting material. This strip is wound a number of times around a rotatably supported main shaft 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 extending 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.

[0025] Yet an alternative way of producing metal fibers

for use in the invention is via extraction or extrusion from a melt of a metal or metal alloy.

[0026] Another alternative way of producing metal fibers for use in the invention is machining fibers from a block of solid metal.

[0027] Yarns, comprising or consisting out of metal fibers, for the production of the knitted fabric, the braided fabric or the woven fabric for use as burner deck in the invention can e.g. be spun from stretch broken fibers (such as bundle drawn stretch broken fibers) and/or can e.g. be yarns made from shaved or machined fibers. The yarns can be plied yarns, e.g. two ply, three ply... Preferred fabrics made from metal fibers have a weight of between 0.6 and 3 kg/m^2; preferably between 0.7 and 3 kg/m^2, even more preferred between 1.2 and 2.5 kg/m^2.

[0028] In a preferred embodiment, the knitted fabric, the braided fabric or the woven fabric has weight of between 0.6 and 1.3 kg/m^2, more preferably of between 0.6 and 0.9 kg/m^2.

[0029] The gas premix burner of the invention is suited for use in a boiler or water heater.

[0030] A second aspect of the invention is a method to produce a gas premix burner in accordance with claim 10.

[0031] Soft welding can preferably be performed by means of capacitor discharge welding. In a preferred way of performing the soft welding, a flat perforated plate, a woven wire mesh or an expanded metal sheet is laid on a flat electrode; and a woven, knitted or braided fiber based fabric (that is to become the burner deck of the burner) is placed on it. A second electrode can be placed on the fabric. The pressure applied between the two electrodes and the welding energy can be set - depending on e.g. the type of fabric used - in order to obtain the soft welding between the fabric (that will form the burner deck of the burner) and the perforated plate, woven wire mesh or expanded metal sheet.

[0032] In a preferred method the perforated plate, woven wire mesh or expanded metal sheet is flat at the moment the soft welding is performed.

[0033] In a preferred method the combination of the woven, knitted or braided burner deck soft welded to the perforated plate, woven wire mesh or expanded metal sheet is shaped into a curved (e.g. a cylindrical shape), double curved or cylindrical surface after the soft welding operation, e.g. by means of bending in one or more directions or by means of deep drawing.

[0034] It is an additional benefit of the method of the invention that a gas premix burner can be made in an easy way of curved (e.g. cylindrical) or of - even more complex - double curved shape that has the benefits of the gas premix burner as in the first aspect of the invention.

[0035] Using classical welding as in JP2001235117 only burners with a flat burner deck can be made.

[0036] Preferably, the woven, knitted or braided burner deck (most preferred is a knitted burner deck) is placed on a woven wire mesh. This combination allows even more complex double-curved shapes of burner decks to be made.

[0037] A third aspect of the invention is a boiler or water heater comprising a premix gas burner as in the first aspect of the invention.

[0038] A fourth aspect of the invention is the use of a premix gas premix burner as in the first aspect of the invention in blue flame mode, e.g. in a boiler or in a water heater, e.g. in an instantaneous water heater. With use in blue flame mode is meant that the gas premix burner is used in a way that blue flames are visible on the burner deck, creating flue gas and wherein the heat transfer towards the fluid to be heated is predominantly by conduction or convection by the flue gas. This is contrary to red flame burner operation, where red flames are visible and where the heat transfer is for a major part by means of emission of radiation by the burner deck with red flame combustion.

Brief Description of Figures in the Drawings

[0039]

Figure 1 shows a burner according to the invention.
Figures 2 and 3 show cross sections of the burner of figure 1.
Figure 4 shows test results with a burner of the invention compared to a prior art burner.
Figure 5 shows the test method to evaluate whether or not a burner deck is soft welded to the supporting perforated plate, woven wire mesh or expanded metal sheet.

Mode(s) for Carrying Out the Invention

[0040] Figure 1 shows a gas premix burner according to the invention. Figures 2 and 3 show cross sections of the burner of figure 1 along lines II-II and III-III respectively. The gas premix burner 100 comprises a knitted metal fiber yarn burner deck 110 supported by a woven metal wire mesh 130. The burner 100 further comprises a metal plate 135. Figures 2 and 3 show the woven metal wire mesh 130 supporting the knitted metal fiber yarn burner deck 110 and the plate 135 welded along the edges of the knitted metal fiber yarn burner deck 110.

[0041] The burner deck 110 has a central zone 142 where it is single curved and two end sections 152 where it is double curved.

[0042] A knitted metal fiber fabric of 1400 g/m^2 is used as burner deck. The fabric was cut to shape. A flat woven metal wire mesh of appropriate dimensions was put on a flat electrode. The knitted metal fiber fabric was put onto the flat woven metal wire mesh. A second flat electrode was placed on the combination of fabric and woven metal wire mesh, and capacitor discharge welding was performed, using such parameters of pressure and welding energy that the density of the knitted fiber burner deck was 1070 g/dm^3 and that soft welding was performed.

[0043] After performing the soft welding operation, the knitted burner deck soft welded to the woven metal wire mesh was deformed by means of deep-drawing into shape to form the gas premix burner as shown in figure 1. Plate 135 was subsequently added via welding. The knitted burner deck could be pulled from the woven metal wire mesh, whereby the bonds between the knitted burner deck and the woven metal wire mesh were broken rather than that breakage of the knitted fiber based burner deck occurred. The test is performed in the way as shown in figure 5. The test method to determine that the woven, knitted or braided burner deck 510 comprising metal fibers is soft welded; is pulling in peel-off mode: an edge portion of the burner deck 510 is removed from the perforated plate, woven wire mesh or expanded metal sheet 530, and folded over 180°. Pulling the burner deck is then done by hand or using pliers, wherein the pulling force is exerted parallel with the perforated plate, woven wire mesh or expanded metal sheet, in a direction of 180° to the burner deck (in the direction indicated by the direction F in figure 5). In pulling, the force builds up until the burner deck is progressively peeled off from the supporting perforated plate, woven wire mesh or expanded metal sheet leaving no metal fibers of the burner deck on the supporting perforated plate, woven wire mesh or expanded metal sheet (indicating that soft welding occurred); or until progressively destroying the burner deck at least partly wherein metal fibers of the burner deck remain attached to the supporting perforated plate, woven wire mesh or expanded metal sheet (indicating that no soft welding occurred). Within the limits of the described "pulling in peel-off mode" the conclusion whether or not the burner deck is soft-welded to the supporting perforated plate, woven wire mesh or expanded metal sheet is independent of further parameters.

[0044] In a similar way as for the burner shown in figures 1-3, and using appropriate shaping techniques (bending, pressing or deep drawing) single curved burner shapes and cylindrically shaped burner decks can be obtained.

[0045] Figure 4 shows test results - under the same test conditions - comparing a gas premix burner according to the invention with a prior art burner of the same dimensions and with the same knitted fabric as burner deck. In the prior art burner that has been used for the comparison, the knitted fabric burner deck was point welded at its circumference only to the supporting perforated plate. The horizontal axis (X) shows the burner load, A is representing minimum burner load and B is full (maximal) burner load. The vertical axis (Y) indicates the percentage of CO_2 measured in the flue gas generated by the burner, which is an indication for the amount of excess of air in the combustible premix air and gas fed to the burner deck. The rectangle E indicates the normal range of operation of the burner in terms of burner load and percentage of CO_2 in the flue gas. The lines G, for the prior art burner, and H, for the burner according to the invention, indicate the limits of operational conditions of burner load and percentage of CO_2 in the flue gas where thermo-acoustic instabilities started to occur: above the line (G or H according to the burner) no thermo-acoustic instabilities occurred, below the line, thermo-acoustic instabilities occurred.

[0046] In practice, the occurrence of thermo-acoustic instabilities can depend on a range of other aspects besides the burner load and the excess of air. Slight constructional differences, burner settings, temperature of the supplied combustion air, the quality of the gas (e.g. presence of impurities), in summary disturbing factors, - many of them not or not easily controllable - are known to have an effect on the thermo-acoustic instabilities. Figure 4 illustrates - as the distance between the normal operational range of the burner of the invention is more distant from the line of occurrence of acoustical instabilities than for prior art burners - that the risk that disturbing factors will push the gas premix burner of the invention into thermo-acoustic instability is reduced to a large extent compared to prior art gas premix burners.

Claims

1. Gas premix burner (100) comprising

   - a perforated plate, a woven wire mesh (130) or an expanded metal sheet;
   - a woven, knitted (110) or braided burner deck comprising metal fibers, placed on said perforated plate, woven wire mesh (130) or expanded metal sheet; **characterized in that** said woven, knitted (110) or braided burner deck is soft welded over at least part of its surface to said perforated plate, woven wire mesh (130) or expanded metal sheet;

   wherein with soft welded is meant that when pulling said woven, knitted or braided burner deck from said perforated plate, woven wire mesh or expanded metal sheet, the soft welded bonds between said woven, knitted or braided burner deck and said perforated plate, a woven wire mesh or expanded metal sheet are broken rather than that breakage of said woven, knitted or braided burner deck occurs.

2. Gas premix burner (100) as in any of the preceding claims, wherein said woven, knitted (110) or braided burner deck comprising metal fibers has a density of less than 1500 g/dm^3.

3. Gas premix burner as in any of the preceding claims, wherein said soft welding is over substantially the complete surface of said burner deck.

4. Gas premix burner as in any of the preceding claims, wherein said burner deck is one layer of a woven, knitted or braided fabric, placed on said perforated

plate, woven wire mesh or expanded metal sheet.

5. Gas premix burner as in any of the preceding claims, wherein said burner deck is knitted, woven or braided using yarns comprising or consisting out of a plurality of metal filaments or metal staple fibers.

6. Gas premix burner as in any of the preceding claims, wherein the surface of said woven, knitted or braided burner deck at the other side than said perforated plate, woven wire mesh or expanded metal sheet is not covered by another metallic object, such that said surface of said woven, knitted or braided burner deck is - when the burner is in use - the surface on which combustion takes place.

7. Gas premix burner as in any of the preceding claims, wherein said burner deck is curved over at least part of its surface.

8. Gas premix burner as in any of the preceding claims, wherein said burner deck is over at least part of its surface double-curved.

9. Gas premix burner as in claims 1 - 7, wherein said burner deck has a cylindrical shape.

10. Method to produce a gas premix burner, comprising the steps of

- providing a woven, knitted or braided fabric comprising metal fibers that is to form the burner deck of the gas premix burner;
- providing a perforated plate, woven wire mesh or expanded metal sheet;
- soft welding, e.g. via capacitor discharge welding, said woven, knitted or braided fabric onto said perforated plate, woven wire mesh or expanded metal sheet;

wherein with soft welded is meant that when pulling said woven, knitted or braided burner deck from said perforated plate, woven wire mesh or expanded metal sheet, the soft welded bonds between said woven, knitted or braided burner deck and said perforated plate, a woven wire mesh or expanded metal sheet are broken rather than that breakage of said woven, knitted or braided burner deck occurs.

11. Method as in claim 10, wherein said perforated plate, woven wire mesh or expanded metal sheet is flat at the moment the soft welding is done.

12. Method as in claims 10 - 11, wherein said combination of said woven, knitted or braided burner deck soft welded to said perforated plate, woven wire mesh or expanded metal sheet is shaped into a curved, double curved or cylindrical shape after said soft welding operation.

13. Boiler or water heater comprising a gas premix burner as in claims 1 to 9.

14. Use of a gas premix burner as in claims 1 - 9 in blue flame mode, e.g. in a boiler or in a water heater.

Patentansprüche

1. Gasvormischbrenner (100), umfassend

- eine perforierte Platte, ein gewebtes Drahtgeflecht (130) oder ein Streckmetallblech;
- ein gewebtes, gewirktes (110) oder geflochtenes Brennerdeck, das Metallfasern umfasst, das auf der perforierten Platte, dem gewebten Drahtgeflecht (130) oder dem Streckmetallblech platziert ist; **dadurch gekennzeichnet, dass** das gewebte, gewirkte (110) oder geflochtene Brennerdeck zumindest über einem Teil seiner Oberfläche auf die perforierte Platte, das gewebte Drahtgeflecht (130) oder das Streckmetallblech weichgelötet ist;

wobei Weichlöten bedeutet, dass beim Abziehen des gewebten, gewirkten oder geflochtenen Brennerdecks von der perforierten Platte, vom gewebten Drahtgeflecht oder vom Streckmetallblech die Weichlötverbindungen zwischen dem gewebten, gewirkten oder geflochtenen Brennerdeck und der perforierten Platte, einem gewebten Drahtgeflecht oder Streckmetallblech brechen, statt dass das gewebte, gewirkte oder geflochtene Brennerdeck bricht.

2. Gasvormischbrenner (100) nach einem der vorhergehenden Ansprüche, wobei das gewebt, gewirkte (110) oder geflochtene Brennerdeck, das Metallfasern umfasst, eine Dichte von weniger als 1500 g/dm^3 aufweist.

3. Gasvormischbrenner nach einem der vorhergehenden Ansprüche, wobei das Weichlöten im Wesentlichen über die komplette Oberfläche des Brennerdecks erfolgt.

4. Gasvormischbrenner nach einem der vorhergehenden Ansprüche, wobei das Brennerdeck eine Schicht aus einem gewebten, gewirkten oder geflochtenen Textilmaterial ist, die über der perforierten Platte, dem gewebten Drahtgeflecht oder dem Streckmetallblech platziert ist.

5. Gasvormischbrenner nach einem der vorhergehenden Ansprüche, wobei das Brennerdeck unter Verwendung von Garnen gewirkt, gewebt oder gefloch-

ten wird, die eine Vielzahl von Metallfäden oder Metallstapelfasern umfassen oder daraus bestehen.

6. Gasvormischbrenner nach einem der vorhergehenden Ansprüche, wobei die Oberfläche des gewebten, gewirkten oder geflochtenen Brennerdecks auf der anderen Seite als an der perforierten Platte, dem gewebten Drahtgeflecht oder dem Streckmetallblech nicht von einem anderen metallischen Objekt bedeckt ist, so dass die Oberfläche des gewebten, gewirkten oder geflochtenen Brennerdecks - im Gebrauch des Brenners - die Oberfläche ist, auf der die Verbrennung erfolgt.

7. Gasvormischbrenner nach einem der vorhergehenden Ansprüche, wobei das Brennerdeck zumindest über einem Teil seiner Oberfläche gebogen ist.

8. Gasvormischbrenner nach einem der vorhergehenden Ansprüche, wobei das Brennerdeck zumindest über einem Teil seiner Oberfläche doppelt gebogen ist.

9. Gasvormischbrenner nach einem der Ansprüche 1-7, wobei das Brennerdeckeine zylinderförmige Gestalt aufweist.

10. Verfahren zum Herstellen eines Gasvormischbrenners, umfassend die folgenden Schritte

- Bereitstellen eines gewebten, gewirkten oder geflochtenen Textilmaterials, das Metallfasern umfasst, welches das Brennerdeck des Gasvormischbrenners bilden soll;
- Bereitstellen einer perforierten Platte, eines gewebten Drahtgeflechts oder eines Streckmetallblechs;
- Weichlöten, z.B. durch Kondensatorentladungsschweißen, des gewebten, gewirkten oder geflochtenen Textilmaterials auf die perforierte Platte, das gewebte Drahtgeflecht oder das Streckmetallblech;

wobei Weichlöten bedeutet, dass beim Abziehen des gewebten, gewirkten oder geflochtenen Brennerdecks von der perforierten Platte, vom gewebten Drahtgeflecht oder vom Streckmetallblech die Weichlötverbindungen zwischen dem gewebten, gewirkten oder geflochtenen Brennerdeck und der perforierten Platte, einem gewebten Drahtgeflecht oder Streckmetallblech brechen, statt dass das gewebte, gewirkte oder geflochtene Brennerdeck bricht.

11. Verfahren nach Anspruch 10, wobei die perforierte Platte, das gewebte Drahtgeflecht oder das Streckmetallblech zum Zeitpunkt der Durchführung des Weichlötens flach ist.

12. Verfahren nach den Ansprüchen 10-11, wobei die Kombination aus dem gewebten, gewirkten oder geflochtenen Brennerdeck, das auf die perforierte Platte, das gewebte Drahtgeflecht oder das Streckmetallblech weichgelötet ist, nach dem Weichlötvorgang in eine gebogene, doppelt gebogene oder zylindrische Gestalt geformt wird.

13. Boiler oder Warmwasserbereiter, umfassend einen Gasvormischbrenner nach den Ansprüchen 1 bis 9.

14. Verwendung eines Gasvormischbrenners nach den Ansprüchen 1-9 im blauen Flammenmodus, z.B. in einem Boiler oder in einem Warmwasserbereiter.

Revendications

1. Brûleur à gaz prémélangé (100) comprenant :

- une plaque perforée, une maille métallique tissée (130) ou une tôle de métal déployé ;
- un plateau de brûleur tissé, tricoté (110) ou tressé comprenant des fibres métalliques, placé sur ladite plaque perforée, maille métallique tissée (130) ou tôle de métal déployé ; **caractérisé en ce que** ledit plateau de brûleur tissé, tricoté (110) ou tressé est soudé par soudure tendre sur au moins une partie de sa surface à ladite plaque perforée, maille métallique tissée (130) ou tôle de métal déployé ;

dans lequel « soudé par soudure tendre » signifie que lorsqu'on tire ledit plateau de brûleur tissé, tricoté ou tressé de ladite plaque perforée, maille métallique tissée ou tôle de métal déployé, les liaisons soudées par soudure tendre entre ledit plateau de brûleur tissé, tricoté ou tressé et ladite plaque perforée, maille métallique tissée ou tôle de métal déployé sont cassées au lieu qu'il y ait une rupture dudit plateau de brûleur tissé, tricoté ou tressé.

2. Brûleur à gaz prémélangé (100) selon l'une quelconque des revendications précédentes, dans lequel ledit plateau de brûleur tissé, tricoté (110) ou tressé comprenant des fibres métalliques a une densité inférieure à 1 500 g/dm^3.

3. Brûleur à gaz prémélangé selon l'une quelconque des revendications précédentes, dans lequel ladite soudure tendre couvre la quasi-totalité de la surface dudit plateau de brûleur.

4. Brûleur à gaz prémélangé selon l'une quelconque des revendications précédentes, dans lequel ledit plateau de brûleur est une couche d'un tissu tissé, tricoté ou tressé, placée sur ladite plaque perforée, maille métallique tissée ou tôle de métal déployé.

5. Brûleur à gaz prémélangé selon l'une quelconque des revendications précédentes, dans lequel ledit plateau de brûleur est tricoté, tissé ou tressé à l'aide de fils comprenant ou constitués d'une pluralité de filaments métalliques ou de fibres métalliques discontinues.

6. Brûleur à gaz prémélangé selon l'une quelconque des revendications précédentes, dans lequel la surface dudit plateau de brûleur tissé, tricoté ou tressé de l'autre côté que ladite plaque perforée, maille métallique tissée ou tôle de métal déployé n'est pas couverte par un autre objet métallique, de telle sorte que ladite surface dudit plateau de brûleur tissé, tricoté ou tressé est - lorsque le brûleur est en cours d'utilisation - la surface sur laquelle la combustion a lieu.

7. Brûleur à gaz prémélangé selon l'une quelconque des revendications précédentes, dans lequel ledit plateau de brûleur est courbe sur au moins une partie de sa surface.

8. Brûleur à gaz prémélangé selon l'une quelconque des revendications précédentes, dans lequel ledit plateau de brûleur présente une double courbure sur au moins une partie de sa surface.

9. Brûleur à gaz prémélangé selon les revendications 1 à 7, dans lequel ledit plateau de brûleur est de forme cylindrique.

10. Procédé de fabrication d'un brûleur à gaz prémélangé, comprenant les étapes qui consistent à :

- fournir un tissu tissé, tricoté ou tressé comprenant des fibres métalliques, destiné à former le plateau de brûleur du brûleur à gaz prémélangé ;
- fournir une plaque perforée, une maille métallique tissée ou une tôle de métal déployé ;
- souder par soudure douce, par exemple par soudage avec décharge de condensateurs, ledit tissu tissé, tricoté ou tressé sur ladite plaque perforée, maille métallique tissée ou tôle de métal déployé ;

dans lequel « soudé par soudure tendre » signifie que lorsqu'on tire ledit plateau de brûleur tissé, tricoté ou tressé de ladite plaque perforée, maille métallique tissée ou tôle de métal déployé, les liaisons soudées par soudure tendre entre ledit plateau de brûleur tissé, tricoté ou tressé et ladite plaque perforée, maille métallique tissée ou tôle de métal déployé sont cassées au lieu qu'il y ait une rupture dudit plateau de brûleur tissé, tricoté ou tressé.

11. Procédé selon dans la revendication 10, dans lequel ladite plaque perforée, maille métallique tissée ou tôle de métal déployé est plate au moment où la soudure tendre est réalisée.

12. Procédé selon les revendications 10 ou 11, dans lequel ladite combinaison dudit plateau de brûleur tissé, tricoté ou tressé soudé par soudure tendre à ladite plaque perforée, maille métallique tissée ou tôle de métal déployé est mise en forme pour prendre une forme courbe, à double courbure ou cylindrique après ledit soudage par soudure tendre.

13. Chaudière ou chauffe-eau comprenant un brûleur à gaz prémélangé selon les revendications 1 à 9.

14. Utilisation d'un brûleur à gaz prémélangé selon les revendications 1 à 9 en mode flamme bleue, par exemple dans une chaudière ou dans un chauffe-eau.

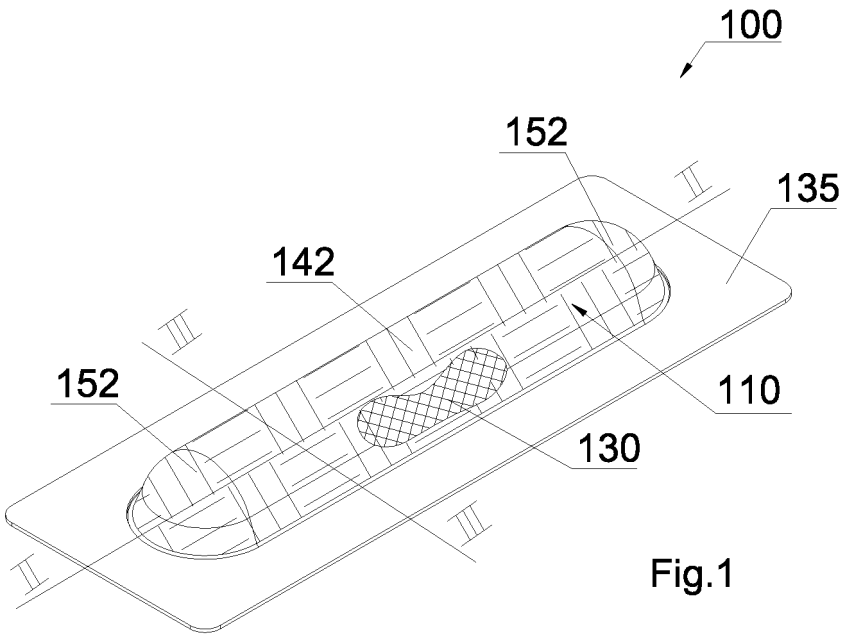

Fig.1

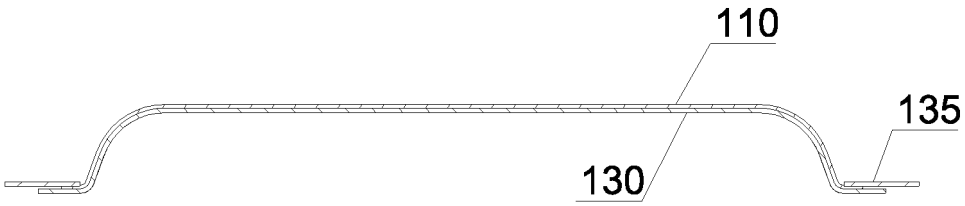

Fig.2

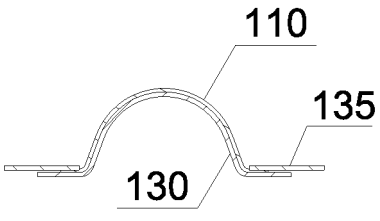

Fig.3

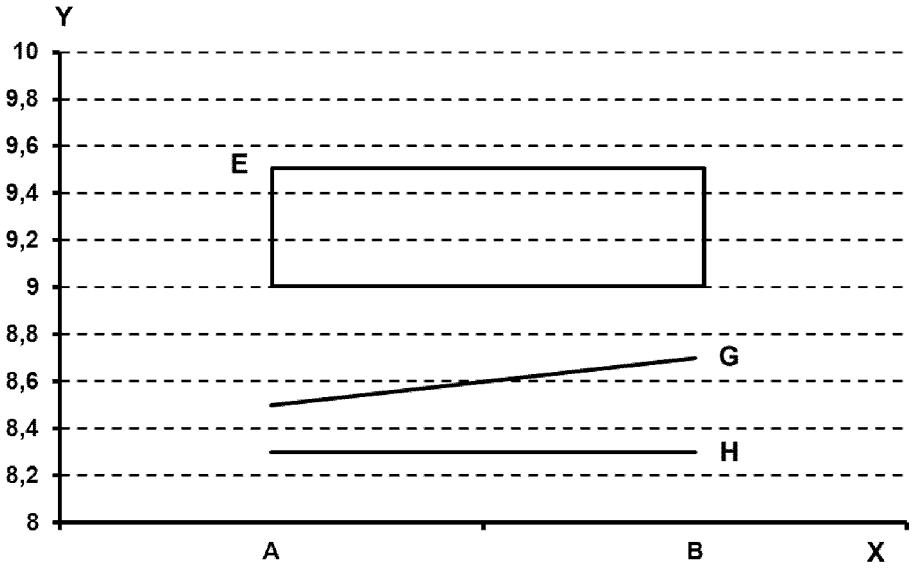

Fig. 4

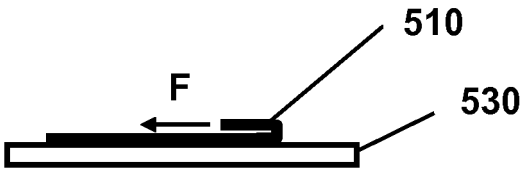

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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