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(54) **BURNER PLATE FOR A CENTRAL HEATING BOILER**

(57) The invention relates to a burner plate for a central heating boiler, which burner plate comprises a first pattern of through-holes arranged therein, which through-holes extend between a first, inlet surface and a second, opposite outlet surface of the burner plate, and which holes are configured to allow passage of a combustible gas from the inlet surface to the outlet surface and thus form a permeable surface part of the total outlet surface of the burner plate.

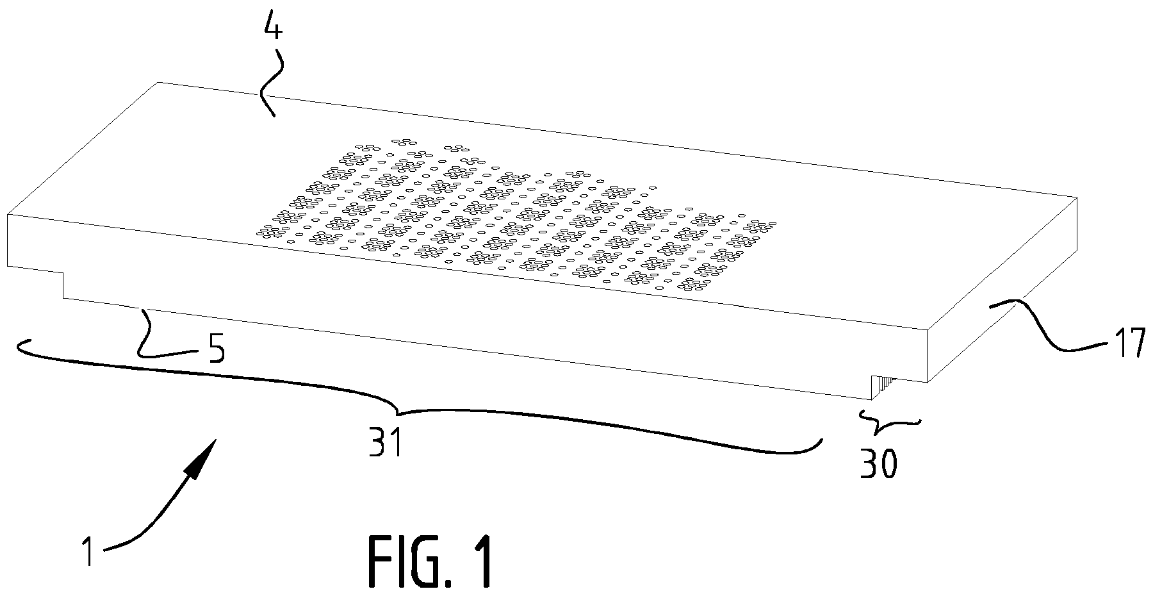

FIG. 1

Description

[0001] The invention relates to a burner plate for a central heating boiler, which burner plate comprises a first pattern of through-holes arranged therein, which through-holes extend between a first, inlet surface and a second, opposite outlet surface of the burner plate, and which holes are configured to allow passage of a combustible gas from the inlet surface to the outlet surface and thus form a permeable surface part of the total outlet surface of the burner plate.

[0002] Such a burner plate is per se known. The combustible gas, for instance natural gas, flows via the inlet surface side, through the through-holes to the outlet surface side, and will there combust in a flame front.

[0003] It is an object of the invention to improve the per se known burner plate.

[0004] It can be a particular object of the invention to provide a burner plate with which a stable combustion and/or a combustion with low CO emission can be obtained in the case of varying inlet speeds of the gas, more particularly when a lowest inlet speed is at least 10x lower than a highest inlet speed.

[0005] The lowest inlet speed of gas is used in the case of low load, i.e. in the case of relatively low heat demand and thereby relatively low power of the central heating (CH) boiler. The highest inlet speed of gas is used in the case of full load, i.e. in the case of relatively high heat demand and thereby relatively high power of the CH boiler. The inlet speed can be any desired speed between the lowest and highest inlet speed. The adaptation of the CH boiler to the heat demand is referred to as modulation, wherein a stable combustion and/or a combustion with low CO emission can preferably be obtained with the burner plate according to the invention in modulation between 10% and 100% of a maximum power of the CH boiler. This power can for instance vary between 1.5 kW and 15 kW.

[0006] The temperature of the flame can influence the CO emission, wherein the flame cooling too much can result in a CO emission which is too high, particularly in the case of low load. Cooling of the flame can take place inter alia because heat of the flame is relinquished to the burner plate. The burner plate according to the invention can particularly be designed such that heat loss from the flame to the burner plate is relatively low. This can for instance be achieved by making a distance from the flame to the burner plate relatively great, i.e. relatively long flames. This is particularly advantageous in the case of low load, i.e. at a low inlet speed of the combustible gas.

[0007] It can be advantageous, particularly in the case of full load, to prevent or at least reduce flame lift-off, since flame lift-off can result in an increase in CO emission. Flame lift-off is here understood to mean that the rate of combustion is at least locally lower than the speed of the supplied gas, whereby the flame will move away from the burner plate at least locally. The burner plate according to the invention can particularly be designed such that flame lift-off is prevented or at least reduced. This is particularly advantageous in the case of full load, i.e. in the case of a high inlet speed of the combustible gas.

[0008] One or more of the above stated objects can be achieved with a burner plate of the type stated in the preamble, wherein for instance the first pattern of through-holes is suitably chosen.

[0009] One or more of these objects can in particular be achieved with a burner plate of the type stated in the preamble, wherein for instance the first pattern is chosen such that a stable combustion and/or a combustion with low CO emission is obtained in the case of varying inlet speeds of the gas, more particularly when a lowest inlet speed is at least 10x lower than a highest inlet speed.

[0010] The burner plate according to the invention, particularly for instance the first pattern thereof, can have one or more of the features described below and/or included in the claims.

[0011] In an embodiment of the burner plate according to the invention the first pattern of through-holes is chosen such that the permeable surface part comprises less than 15% of the total outlet surface of the burner plate, preferably less than 12%, more preferably less than 10%, still more preferably about 7%. The permeable surface part can be greater than 3% of the total outlet surface of the burner plate, preferably greater than 5%.

[0012] The permeable surface part is defined here as the part of the outlet surface of the burner plate which is permeable to a combustible gas relative to the total outlet surface of the burner plate. The part of the outlet surface of the burner plate which is permeable to a combustible gas can here particularly be formed by the sum of the surface area dimensions of the through-holes.

[0013] It is noted that the above stated percentages are particularly calculated on the basis of and/or apply particularly to the effective total outlet surface area of the burner plate. The effective outlet surface area can at least be understood to mean the part of the outlet surface which is clear and/or is not blocked by for instance a support for supporting the burner plate. In other words, the effective total outlet surface area of the burner plate is substantially the whole surface area of the burner plate, with the exception of a peripheral edge part of the burner plate, which peripheral edge part of the burner plate is supported. The peripheral edge part of the burner plate can for instance be formed by recesses, in which recesses a support can be arranged for the purpose of supporting the burner plate.

[0014] The effective outlet surface area of the burner plate can alternatively be referred to as the effective surface area of the burner plate and/or the effective burner plate surface area.

[0015] It is further noted that the term "about" can in this text at least be understood to mean ±10% relative to the stated values or percentages.

[0016] The permeable surface part relative to the total outlet surface, i.e. the passage ratio, of a burner plate is usually relatively high. It has however been found by applicant that, by choosing a relatively small permeable surface part relative to the total outlet surface, the throughflow speed and thereby outflow speed of supplied gas is relatively high relative to the same amount of supplied gas in the case of a larger permeable surface part. Because of the relatively high outflow speed of the supplied gas, the flame front will stabilize at a relatively great distance from the burner plate, whereby relatively little heat of the flame front will be relinquished thereto, i.e. the heat loss from the flame to the burner plate is relatively low. Because the flame front is able to lose relatively little heat to the burner plate at the chosen relatively low passage ratio, the temperature of the flame can remain relatively high and the CO emission can be relatively low. This can be particularly advantageous in the case of low load, as further elucidated above.

[0017] It is noted that the term relative, such as for instance relatively low or high, can in this text for instance be understood to mean relative to the known burner plates, such as for instance lower or higher relative to known burner plates.

[0018] In another embodiment of the burner plate according to the invention the burner plate comprises a second pattern of non-continuous, blind holes.

[0019] The blind holes reduce the heat conductivity of the burner plate relative to a burner plate without such blind holes, whereby particularly the heat conduction to the periphery of the burner plate can be reduced or can be relatively low. The burner plate hereby cools down relatively little at least in the centre thereof, whereby the flame, which is positioned substantially in the centre above the burner plate, relinquishes relatively little heat to the burner plate and therefore cools relatively little. This can be particularly advantageous in the case of low load, as further elucidated above.

[0020] The second pattern of non-continuous, blind holes can particularly be disposed in the centre of the burner plate, since it is particularly in the centre of the burner plate that the relatively low heat conduction is desired. It is possible here that no non-continuous, blind holes are present in a peripheral edge zone, but if it is useful for any reason, for instance for the sake of simplicity of production engineering, also to arrange the non-continuous, blind holes in the peripheral edge zone, then this is possible since it does not have an adverse effect on the operation of the burner plate.

[0021] The non-continuous, blind holes can be non-continuous or blind on one or both sides of the burner plate, i.e. at the inlet surface and/or at the outlet surface. The holes can preferably be blind at the inlet surface. A temperature at the outlet surface is hereby limited.

[0022] It is noted that, because the blind holes are blind, they are not permeable to combustible gas. The blind holes therefore do not contribute to the permeable part of the burner plate.

[0023] The number of through-holes relative to the total number of through- and blind holes can for instance be a maximum of 35%, preferably a maximum of 30%, more preferably a maximum of 25%.

[0024] The number of through-holes relative to the total number of through- and blind holes can for instance be a minimum of 10%, preferably a minimum of 15%, more preferably a minimum of 20%.

[0025] It has been found by applicant that about 21% through-holes relative to the total number of through- and blind holes can particularly be available.

[0026] The ratio between through-holes and blind holes can here be about 1 : 3.7.

[0027] In an embodiment of the burner plate according to the invention holes, i.e. through-holes and blind holes, can be provided over substantially the whole effective burner surface area of the burner plate, wherein the number of through-holes can be chosen as above.

[0028] It is noted that the above stated percentages and ratio apply to at least the effective burner plate surface area.

[0029] In yet another embodiment of the burner plate a or the peripheral edge zone of the burner plate can have no through-holes of at least the first pattern.

[0030] Not allowing the peripheral edge zone with through-holes of at least the first pattern, and in particular at least locally with no through-holes at all, enables the passage ratio of the burner plate to be relatively low, the advantages of which have already been elucidated above. In addition, this can ensure that the flame positions itself particularly above the burner plate in the centre thereof, which makes it possible to keep the heat loss of the flame relatively low.

[0031] As elucidated above, the peripheral edge zone can optionally be provided with non-continuous, blind holes.

[0032] The peripheral edge zone which is not provided with through-holes of at least the first pattern can have a depth dimension lying between 20 and 60 mm, more preferably between 30 and 50 mm, wherein the depth dimension is defined from the peripheral edge and perpendicularly thereof in the plane of the outlet surface.

[0033] It has been found by applicant that such a depth dimension can be particularly suitable in the case of the above stated passage ratio. Particularly in the case of a passage ratio of about 7% the depth dimension can be about 46.5 mm.

[0034] The burner plate can have for instance an overall surface area dimension of about 155 mm in width by about 158 mm in length. The depth dimension of the peripheral edge zone which is not provided with through-holes of at least the first pattern, i.e. the about 46.5 mm stated, can here be about 30% of the overall width and/or length. The peripheral edge zone which is not provided with through-holes of at least the first pattern can if desired be provided over the whole periphery of the burner plate so that, as seen in the length and/or width, about 60% of the length and/or width is not provided with through-holes of the first pattern.

[0035] It is noted that the depth dimension is here defined in the plane of the outlet surface and is thereby parallel to the length and/or width of the burner plate. The depth dimension is perpendicular of the height or thickness of the burner plate. The depth dimension can alternatively be referred to as dimension.

[0036] The through-holes and/or blind holes can have a diameter of about 1.37 mm.

[0037] The peripheral edge zone can particularly be wholly free of through-holes, irrespective of the pattern.

[0038] A third pattern of through-holes can alternatively or additionally be disposed in a part of the peripheral edge zone, particularly a part disposed above an igniter of the CH boiler and/or a part disposed above an ionization pin of the CH boiler.

[0039] This third pattern can likewise have a determined distance to the periphery of the burner plate so that a part of the peripheral edge zone which is free of through-holes is here also provided, although this determined distance, and thereby the depth of this local peripheral edge zone, can be smaller than the above stated depth dimension.

[0040] It is noted that this third pattern can be arranged to compensate for the igniter on/or ionization pin.

[0041] The third pattern can particularly be provided in order to create additional passage relative to the first pattern so as to enable the cold starting, possibly with lean gases, particularly in the area of the igniter and/or ionization pin.

[0042] The peripheral edge zone can particularly have a greater depth dimension than the above stated peripheral edge part on which the burner plate is supported. In other words, according to this embodiment of the burner plate according to the invention, there is an area close to the periphery of the burner plate which is not supported and thereby belongs to the effective burner plate surface area, and which is not provided with through-holes of at least the first pattern, and is preferably wholly free of through-holes. This area is defined here as the peripheral edge zone.

[0043] In yet another embodiment of the burner plate according to the invention the first pattern comprises a number of areas, wherein each area has a number of first through-holes with a maximal mutual first pitch distance, and wherein an area peripheral edge zone wherein no through-holes are formed is formed all around each area.

[0044] Providing areas with first through-holes and disposing therearound area peripheral edge zones without through-holes makes it possible to provide a relatively low passage ratio of the burner plate with thereby a flame front at a relatively great distance from the burner plate as elucidated above, while a surface area of the flame front can be relatively large.

[0045] Recirculation can take place between the areas, whereby relatively warm combusted gases coming from the flame are carried between adjacent areas in the direction of the burner plate. These relatively warm combusted gases provide for pre-heating of the supplied non-combusted gas, which can result in an increase in the rate of combustion. This is particularly advantageous in the case of relatively high speeds of supplied combustible gas, i.e. in the case of full load, since flame lift-off can hereby be prevented or at least reduced.

[0046] The term area peripheral edge zone in which no through-holes are formed can at least be understood to mean that an adjacent through-hole, which is adjacent to the outer through-holes of an area, has a greater pitch distance to these outer holes than said maximal mutual first pitch distance of the holes of the areas. Such an adjacent through-hole can for instance be an outer through-hole of a subsequent area.

[0047] In yet another embodiment of the burner plate according to the invention the areas are disposed in first rows, wherein each first row has a number of areas and wherein the burner plate has a number of first rows.

[0048] In each first row the areas can be disposed substantially aligned in line with each other.

[0049] The adjacent first rows can be disposed substantially parallel to each other as seen in their longitudinal direction.

[0050] The burner plate can particularly comprise nine first rows with a ten areas each.

[0051] It has been found by applicant that areas with nine through-holes each can be particularly advantageous. The nine through-holes can here be disposed in three groups of three through-holes, wherein the through-holes of each group can be disposed parallel to the longitudinal direction of the first rows. The groups can be disposed offset relative to each other in the longitudinal direction of the first rows, wherein it is particularly the middle group which can be disposed offset relative to the two outer groups.

[0052] It is noted that the number of nine through-holes for each area can be particularly advantageous in the case of a diameter of about 1.37 mm for each through-hole. A different diameter of the through-holes could result in a different number of through-holes per area.

[0053] The areas can alternatively also be referred to as islands.

[0054] In yet another embodiment of the burner plate according to the invention the first pattern comprises a number of second through-holes which are in each case disposed in a second row parallel to the longitudinal direction of the first rows, particularly in each case between the first rows, wherein a second pitch distance between the second through-holes of each second row is greater than the maximal first pitch distance between the first through-holes in the areas.

[0055] The second through-holes can be provided to reduce emission from the burner plate between the areas, particularly in that they cool the burner plate locally.

[0056] In each second row the second through-holes can be disposed substantially aligned in line with each other.

[0057] The second pitch distance can particularly be about twice the first pitch distance, when the first pitch distance is determined between first holes which are successive in the longitudinal direction of the first row.

[0058] The first pitch distance between holes which are successive in the longitudinal direction of the first row can particularly be about 2.13 ± 0.15 mm.

[0059] The second pitch distance can particularly be about 4.26 ± 0.15 mm.

[0060] It is noted that the pitch distance is the centre-to-centre distance between successive holes.

[0061] It is further noted that the first pitch distance between successive first through-holes as seen obliquely of the longitudinal direction of the first row can be different than the first pitch distance between first through-holes which are successive as seen in the longitudinal direction of the first row. The first pitch distance between successive first through-holes as seen obliquely of the longitudinal direction of the first row can particularly be smaller than the first pitch distance between first through-holes which are successive as seen in the longitudinal direction of the first row. The maximal first pitch distance can therefore be the first pitch distance between first through-holes which are successive as seen in the longitudinal direction of the first row.

[0062] The distance between two adjacent first rows, between which a second row can optionally be disposed, can be about 5.49 ± 1 mm. The distance between the first row and an adjacent first row is defined here in a transverse direction transversely of the longitudinal direction of the first rows, in the plane of the burner plate.

[0063] The distance between adjacent areas in a row can be about 2.89 ± 0.5 mm.

[0064] The burner plate can for instance be made of ceramic or any other suitable material. The material of which the burner plate is made can for instance have an emissivity of about > 0.5.

[0065] The chosen first pattern and/or second pattern and/or third pattern can be particularly suitable for a ceramic burner plate.

[0066] In yet another embodiment of the burner plate according to the invention the burner plate comprises at least two burner plate parts which are disposed against each other in use so as to together form substantially one continuous burner plate.

[0067] Providing a plurality of burner plate parts which together form a burner plate can be advantageous from a production engineering viewpoint.

[0068] A connecting joint or abutting joint, which preferably has the smallest possible dimension, can be present between the burner plate parts.

[0069] With a view to production costs, the at least two burner plate parts preferably take a symmetrical form, optionally with the exception of the third pattern.

[0070] The at least two burner plate parts are preferably embodied such that at least the first pattern, and optionally the second pattern and/or third pattern, runs continuously over the connecting joint or abutting joint between the at least two burner plate parts, particularly without an offset between the first pattern and/or second pattern and/or third pattern of the two burner plate parts in the longitudinal direction of the rows and/or transversely of the longitudinal direction of the rows.

[0071] In particular, the at least two burner plate parts can preferably be embodied such that a distance between successive areas and/or successive second holes of respectively a first and second row on either side of the connecting joint or abutting joint is equal to a distance between successive areas and/or successive second holes of respectively a first and second row on one and the same burner plate part.

[0072] It is noted that the dimensions and/or numbers stated above and possibly below can be chosen in accordance with the CH boiler in which the burner plate will be received and that they are therefore not limitative to the specific embodiments given.

[0073] It is noted that designations such as "first", "second", "third" and so on are used as distinction, but that this must not be interpreted as being limitative.

[0074] The invention further relates to an assembly of a burner plate according to any one of the claims 1-13 and/or as described above and/or below on the basis of one or more exemplary embodiments and/or with one or more of the features stated above and/or below, in any random suitable combination, and a CH boiler.

[0075] The invention relates particularly to an assembly of a burner plate according to any one of the claims 1-13 and/or as described above and/or below on the basis of one or more exemplary embodiments and/or with one or more of the features stated above and/or below, in any random suitable combination, and a CH boiler, wherein the burner plate is accommodated in the CH boiler and is supported at a peripheral edge part by a support, and wherein the burner plate has an effective total outlet surface area which is defined as the total outlet surface area of the burner plate minus the peripheral edge part.

[0076] The burner plate can for instance be accommodated in a housing of the CH boiler.

[0077] The invention will be further elucidated with reference to figures, wherein:

- figures 1-4 show a burner plate part according to the invention in schematic view, wherein figure 1 shows a perspective top view; figure 2 a top view, figure 3 a vertical cross-section and figure 4 a bottom view;
- figure 5 shows a burner plate formed by two burner plate parts in schematic top view.

[0078] Figures 1-4 show a burner plate part 1 according to an embodiment of the invention. The burner plate part according to the invention can form together with a second burner plate part a burner plate of a CH boiler, as will be further elucidated below with reference to figure 5.

[0079] Burner plate part 1 comprises a first pattern 2 of through-holes 3 arranged therein, which through-holes 3 extend between a first, inlet surface 4 and a second, opposite outlet surface 5 of burner plate part 1. In normal use the first, inlet surface 4 will be disposed on the upper side and the second, outlet surface 5 on the underside. Figure 2 therefore shows the inlet surface 4, and figure 4 shows the outlet surface 5. Figure 3 is a cross-section between inlet surface 4 and outlet surface 5. During use a combustible gas, such as for instance natural gas, will be supplied to the inlet surface side and flow via through-holes 3 to the outlet surface side. Through-holes 3 form here an open, permeable surface part of the total outlet surface 5 of the burner plate part, more particularly of the effective outlet surface area 5. The term effective outlet surface area can at least be understood to mean the part of outlet surface 5 which is clear and/or is not blocked by for instance a support for supporting the burner plate. A passage ratio is here defined as the percentage of the (effective) outlet surface 5 which is permeable to combustible gas relative to the total (effective) outlet surface 5, wherein the permeable part of the (effective) outlet surface is thus formed by the through-holes 3. The combustible gas flowing through the through-holes 3 will combust above the burner plate in a flame front during use.

[0080] As can be seen in figure 2 and other figures, the passage ratio of burner plate 1 is relatively low. The passage ratio of the effective surface area of the whole burner plate, this comprising burner plate part 1 and a second burner plate part 20, see figure 5, can particularly be about 7%. The effective surface area of the burner plate is the part of the burner plate which is clear and/or is not blocked by for instance a support for supporting the burner plate. It can be seen in figures 1 and 2 that recesses 30, in which a support (not shown) can be arranged, are provided on outlet surface 5 of the burner plate. The effective outlet surface area is the area 31 of outlet surface 5, i.e. the total surface area of outlet surface 5 minus the surface area of recesses 30.

[0081] In this exemplary embodiment through-holes 3 are disposed in a first pattern 2 and a third pattern 6. It is noted that the third pattern 6 is in this exemplary embodiment provided to compensate for an igniter and/or ionization pin of the CH boiler which is disposed in this area of the burner plate. If this need not be compensated for, it is possible that burner plate part 1 only has the first pattern 2 of through-holes 3. With a view to a simple production and symmetry, both burner plate parts 1, 20 can however have through-holes 3 of the third pattern 6, as is also apparent from figure 5.

[0082] In this example the first pattern 2 comprises a number of areas 7, each with nine through-holes 3. Formed around each area 7 is an area peripheral edge zone 8 in which no through-holes are formed. Areas 7 are disposed in first rows, wherein the longitudinal direction of the first rows in figure 2 is designated with numeral 9. Each first row of burner plate part 1 comprises five areas 7, and there are nine first rows in total. The through-holes 3 in each area 7 have a mutual pitch distance 10, 11. In a direction parallel to the longitudinal direction 9 of the first rows the pitch distance 10 between successive through-holes 3 is about 2.13 ± 0.15 mm. In a direction obliquely of longitudinal direction 9 of the first rows the pitch distance 11 between successive through-holes 3 is about 2.02 ± 0.15 mm. The maximal pitch distance between successive, adjacent through-holes 3 of each area is therefore about 2.13 ± 0.15 mm in this example. The term area peripheral edge zone 8 in which no through-holes 3 are formed is here at least understood to mean that a through-hole 3 adjacent to an area 7, which through-hole 3 is thus not associated with the one area 7 and which is adjacent to the outer through-holes 3 of an area 7, has a greater pitch distance to these outer through-holes 3 than the stated maximal first pitch distance of about 2.13 ± 0.15 mm between the through-holes 3 in areas 7. Such an adjacent through-hole can for instance be an outer through-hole 3 of a subsequent area 7. The distance 12 between adjacent first rows is in this example about 5.49 ± 1 mm.

[0083] The first pattern 2 further comprises in this example a number of second through-holes 3 which are in each case disposed in a second row parallel to the longitudinal direction 9 of the first rows, particularly in each case between the first rows. A second pitch distance 13 between the second through-holes 3 of each second row is in this example greater than the first pitch distance 10, 11 between the first through-holes 3 in areas 7. The second pitch distance 13 is particularly about 4.26 ± 0.15 mm, i.e. about twice the maximal first pitch distance 10.

[0084] The third pattern 6 comprises a number of through-holes 3 which are disposed locally to compensate for an igniter and/or ionization pin (not shown) present in the CH boiler in this area. These through-holes 3 locally provide an additional passage for combustible gas, so that the combustible gas can easily ignite into a flame, particularly in the case of a cold start.

[0085] Provided all around first pattern 1 is a peripheral edge zone 14 which is free of through-holes 3 of at least the first pattern 2. This peripheral edge zone 14 has a depth dimension 15 of about 46.5 mm, wherein the depth dimension is defined in outlet surface 5, perpendicularly of peripheral edge 17, from peripheral edge 17 up to the through-holes 3 of first pattern 2.

[0086] As is apparent from figure 2 and other figures, third pattern 6 is disposed in peripheral edge zone 14 so that in, the area of third pattern 6, peripheral edge zone 14 does have through-holes 3 of the third pattern 6. A part of peripheral edge zone 14 is here however also wholly free of through-holes 3, at least over a depth dimension 16, which is defined here in outlet surface 5, perpendicularly of peripheral edge 17, from peripheral edge 17 up to the through-holes 3 of third pattern 6.

[0087] As can further be seen in figure 2, peripheral edge zone 14 has a greater depth dimension 15 than recesses 30, wherein the depth dimension is here also defined in outlet surface 5, perpendicularly of peripheral edge 17. In other words, in this embodiment there is an area close to peripheral edge 17 of the burner plate which is not supported and thereby belongs to the effective burner plate surface area, and which is not provided with through-holes of at least the first pattern 2, and is in this embodiment even wholly free of through-holes.

[0088] Outlet surface 5 is shown in figure 4. This shows that a large part of outlet surface 5, particularly substantially the whole outlet surface 5, is provided with holes. Some of these holes are the through-holes 3 of first pattern 2 and third pattern 6. The other holes are non-continuous, blind holes 18, as can also be seen in figure 3. These blind holes 18 extend from the outlet surface side in the direction of inlet surface 4, but not all the way up to inlet surface 4, so that they are blind, i.e. not open, at inlet surface 4. These blind holes 18 form a second pattern of blind holes.

[0089] The ratio between through-holes and blind holes is in this exemplary embodiment 1 : 3.7.

[0090] Figure 5 shows a burner plate with the burner plate part 1 and another burner plate part 20. The other burner plate part 20 is embodied substantially symmetrically and/or identically to burner plate part 1. Burner plate parts 1 and 20 are disposed mutually abutting with a side thereof against each other, so that together they form a substantially through-running or continuous burner plate. The abutting sides of burner plate parts 1, 20 are particularly the long sides thereof, which long sides are disposed in a plane perpendicularly of the surfaces 4, 5. The first rows and second rows of burner plate parts 1, 20 are disposed aligned in the longitudinal direction 9 of the first rows, so that they run on substantially in a continuous row or line. A connecting joint or abutting joint 21 between burner plate parts 1, 20 is preferably a small as possible, so that burner plate parts 1, 20 are substantially continuous. The inlet surfaces 4 and outlet surfaces 5 of burner plate parts 1, 20 particularly form substantially one continuous surface.

[0091] It is noted that optionally both burner plate parts 1, 20 or one of the two burner plate parts 1, 20, for instance the other burner plate part 20, can if desired have no through-holes 3 of the third pattern 6, for instance because an igniter and/or ionization pin need not be compensated for.

[0092] It is noted that the invention is not limited to the shown embodiments but also extends to variants within the scope of the appended claims.

[0093] All stated dimensions thus serve only as example, and can be chosen as desired.

Claims

1. Burner plate for a central heating boiler, which burner plate comprises a first pattern of through-holes arranged therein, which through-holes extend between a first, inlet surface and a second, opposite outlet surface of the burner plate, and which holes are configured to allow passage of a combustible gas from the inlet surface to the outlet surface and thus form a permeable surface part of the total outlet surface of the burner plate.

2. Burner plate according to claim 1, wherein the permeable surface part comprises less than 15% of the total outlet surface of the burner plate, preferably less than 12%, more preferably less than 10%, still more preferably about 7%.

3. Burner plate according to claim 1 or 2, wherein the permeable surface part comprises more than 3% of the total outlet surface of the burner plate, preferably more than 5%.

4. Burner plate according to any one of the foregoing claims, wherein the burner plate comprises a second pattern of non-continuous, blind holes.

5. Burner plate according to claim 4, wherein the number of through-holes relative to the total number of through- and blind holes is a maximum of 35%, preferably a maximum of 30%, more preferably a maximum of 25%, more preferably about 21%.

6. Burner plate according to claim 4 or 5, wherein the number of through-holes relative to the total number of through- and blind holes is a minimum of 10%, preferably a minimum of 15%, more preferably a minimum of 20%.

7. Burner plate according to any one of the foregoing claims, wherein a peripheral edge zone of the burner plate has no through-holes of at least the first pattern.

8. Burner plate according to claim 7, wherein the peripheral edge zone which is not provided with through-holes of at least the first pattern has a depth dimension lying between 20 and 60 mm, more preferably between 30 and 50 mm, wherein the depth dimension is defined from the peripheral edge and perpendicularly thereof in the plane of the outlet surface.

9. Burner plate according to any one of the foregoing claims, wherein the first pattern comprises a number of areas, wherein each area has a number of first through-holes with a mutual first pitch distance, and wherein an area peripheral edge zone wherein no through-holes are formed is formed all around each area.

10. Burner plate according to claim 9, wherein the areas are disposed in first rows, wherein each first row has a number of areas and wherein the burner plate has a number of first rows.

11. Burner plate according to claim 10, wherein the first pattern comprises a number of second through-holes which are in each case disposed in a second

row parallel to the longitudinal direction of the first rows, particularly in each case between the first rows, wherein a second pitch distance between the second through-holes of each second row is greater than the first pitch distance between the first through-holes in the areas.

12. Burner plate according to any one of the foregoing claims, wherein the burner is made of ceramic material.

13. Burner plate according to any one of the foregoing claims, wherein the burner plate comprises at least two burner plate parts which are disposed against each other in use so as to together form substantially one continuous burner plate.

14. Assembly of a burner plate according to any one of the claims 1-13 and a central heating boiler.

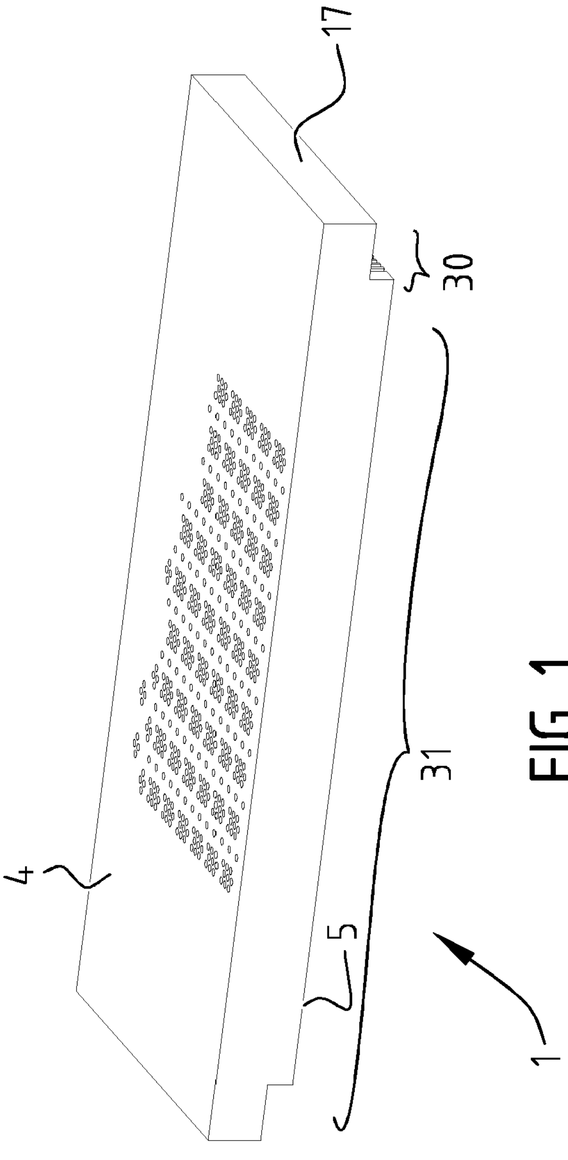

FIG. 1

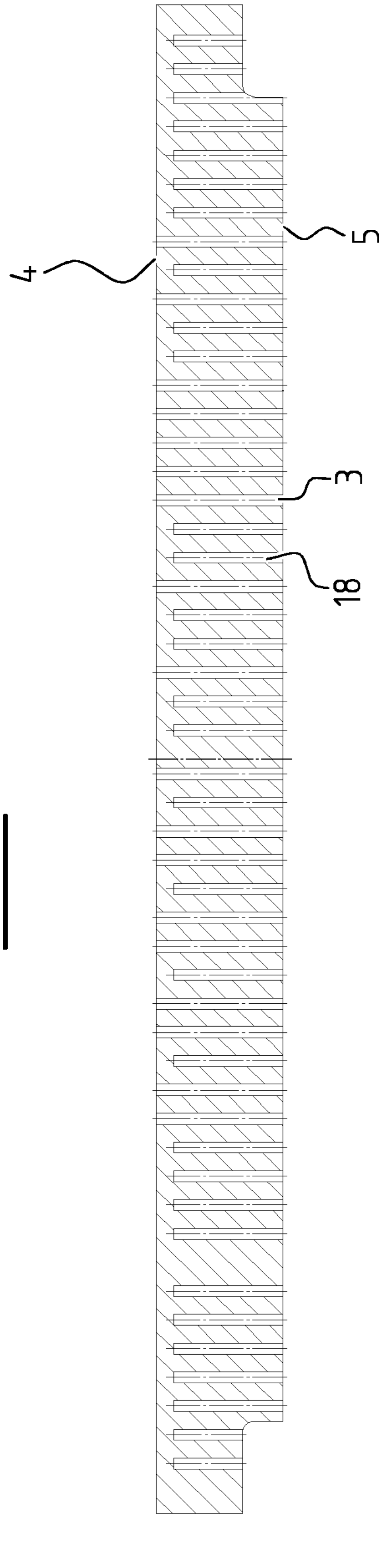

FIG. 3

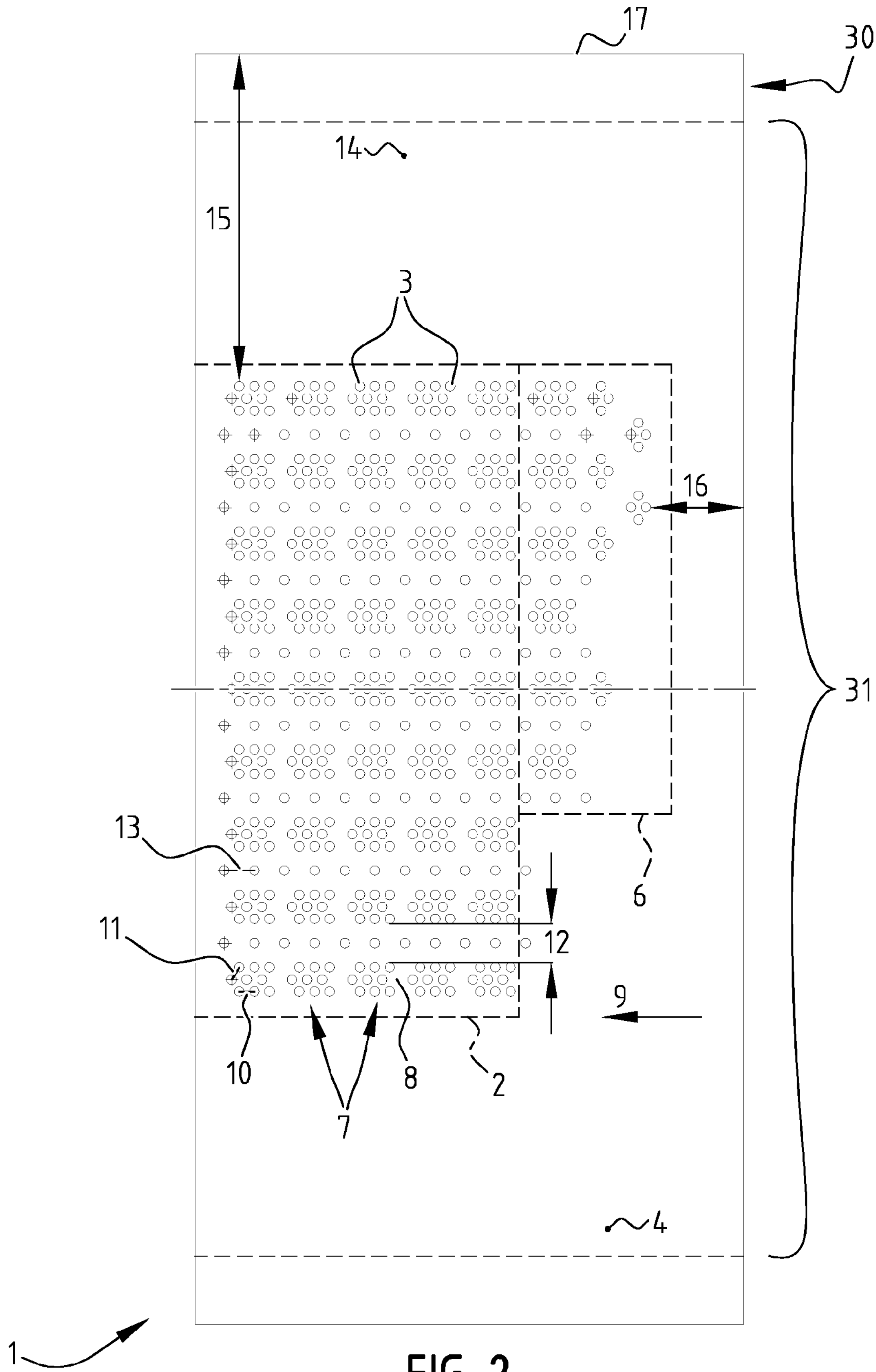

FIG. 2

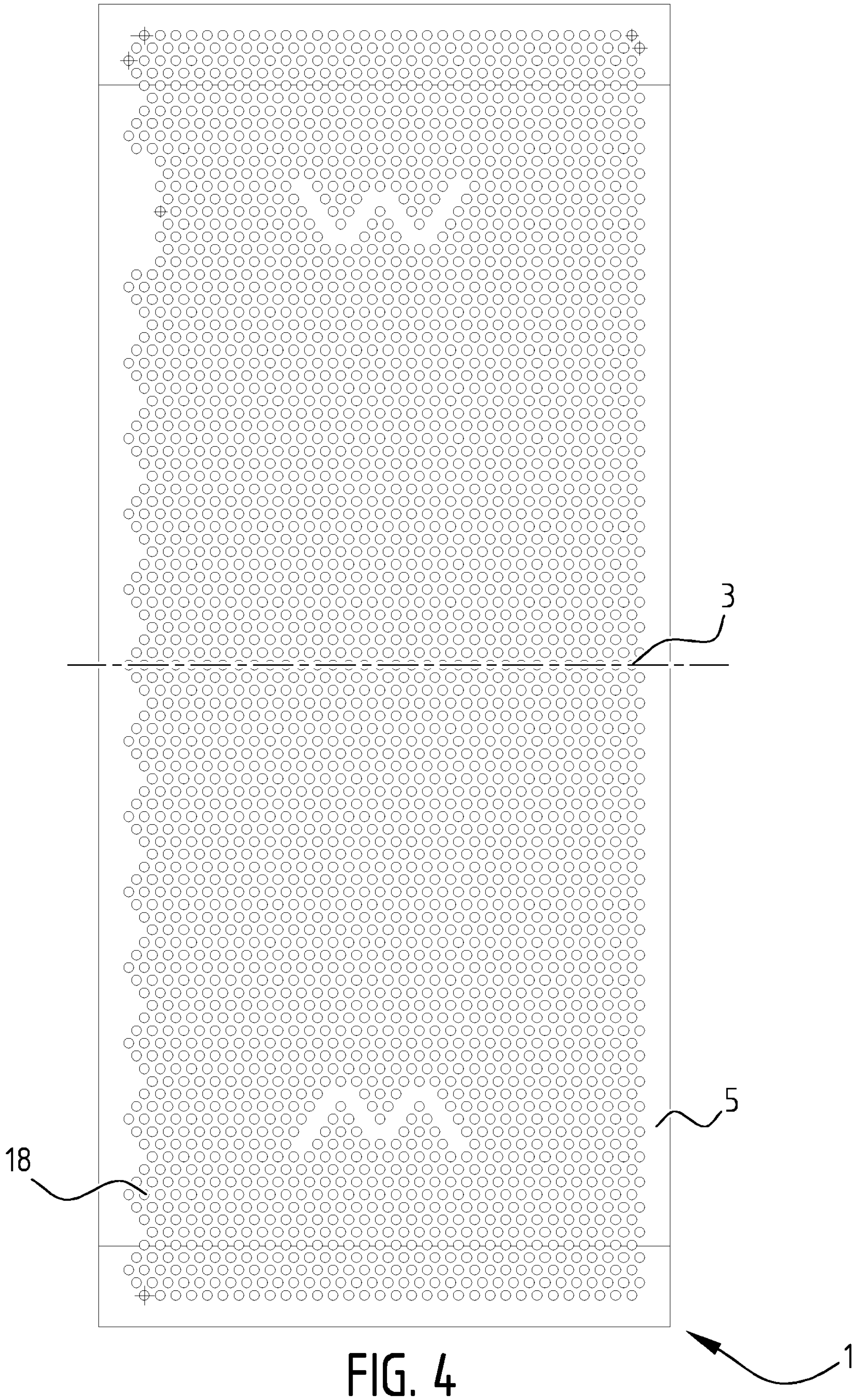

FIG. 4

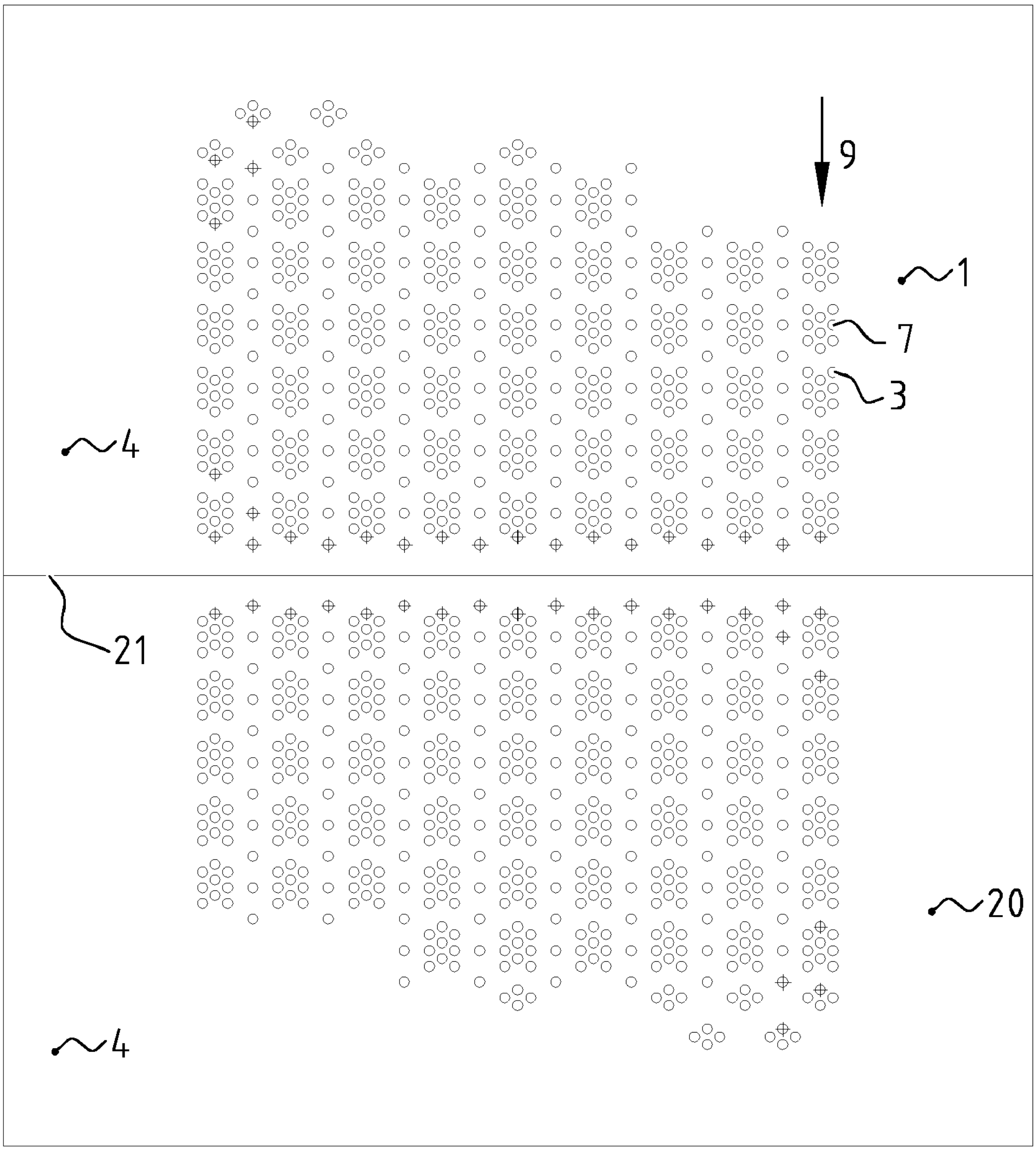

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 19 15 2278

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 0 949 453 A2 (RINNAI KK [JP]) 13 October 1999 (1999-10-13) * paragraph [0001] - paragraph [0003]; figures 1-6 * * paragraph [0009] * * paragraphs [0022], [0024], [0025] * * paragraph [0030] - paragraph [0047] * -----	1,4, 6-10, 12-14 2	INV. F23D14/02 F23D14/58
X	EP 0 876 570 A1 (YGNIS HOLDING SA [CH]) 11 November 1998 (1998-11-11) * paragraphs [0001] - [0003]; figures 1-3 * * paragraph [0013] * * paragraph [0020] - paragraph [0027] * -----	1-3,14	
X A	EP 1 582 811 A2 (RINNAI KK [JP]) 5 October 2005 (2005-10-05) * paragraphs [0001], [0017]; figures 1,2,3(a),3(b) * -----	1,4,6-8, 12-14 2,3,5, 9-11	
X A	US 2016/161113 A1 (TAKEUCHI MASARU [JP]) 9 June 2016 (2016-06-09) * paragraph [0002] - paragraph [0004]; figures 1,2,3a-3c * * paragraph [0011] * * paragraph [0020] * * paragraph [0025] - paragraph [0035] * * paragraph [0037] * -----	1-3,7-14 5	TECHNICAL FIELDS SEARCHED (IPC) F23D
A	GB 976 850 A (MOFFATS LTD) 2 December 1964 (1964-12-02) * page 1, line 9 - line 35; figures 1,2 * * page 1, line 46 - line 67 * * page 1, line 78 - page 2, line 9 * -----	13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 April 2019	Hauck, Gunther

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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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11-04-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0949453 A2	13-10-1999	DE 69913414 T2	07-10-2004
		EP 0949453 A2	13-10-1999
		ES 2210978 T3	01-07-2004
		JP 3695201 B2	14-09-2005
		JP H11351522 A	24-12-1999
EP 0876570 A1	11-11-1998	AT 220189 T	15-07-2002
		AU 1137697 A	20-08-1997
		CA 2244103 A1	31-07-1997
		DE 59707649 D1	08-08-2002
		DK 0876570 T3	04-11-2002
		EP 0876570 A1	11-11-1998
		ES 2180020 T3	01-02-2003
		JP 2000503381 A	21-03-2000
		NO 315483 B1	08-09-2003
		WO 9727428 A1	31-07-1997
EP 1582811 A2	05-10-2005	EP 1582811 A2	05-10-2005
		JP 4034749 B2	16-01-2008
		JP 2005282923 A	13-10-2005
US 2016161113 A1	09-06-2016	NONE	
GB 976850 A	02-12-1964	NONE	

EPO FORM P0459

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