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(54) **Heat exchanger element and heating system provided with such heat exchanger element**

Wärmetauscherelement und Heizanlage mit so einem Wärmetauscherelement

Elément d'un échangeur de chaleur et système de chauffage avec un tel élément

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Description

[0001] The invention relates to a heat exchanger element intended for a central heating boiler, which heat exchanger element is designed as a monocasting from substantially aluminum and is manufactured by means of a low pressure casting process, for instance sand casting or die-casting, the heat exchanger element being provided with walls which bound a water-carrying channel, and with at least one wall which bounds at least one flue gas draft to which a burner is connectable, at least one wall which bounds the at least one flue gas draft being water-cooled in that it also forms a boundary of the water-carrying channel, while one said at least one water-cooled wall is provided with heat exchanging surface enlarging pins and/or fins which extend in the respective flue gas draft.

[0002] Such a heat exchanger element is known from European patent application EP-A-0 889 292. The heat exchanger element described therein is particularly intended for great outputs and is thereto provided with several flue gas drafts. However, prior thereto, applicant has marketed central heating boilers with heat exchanger elements with a single flue gas draft. These heat exchanger elements are known as type indications W21C Eco and W28C Eco.

[0003] The known heat exchanger elements have a weight of approximately 0.4 kg/kW. For a heat exchanger element of approximately 25 kW, which is a customary output for a normal house, the weight is therefore approximately 10 kg. Moreover, the known heat exchanger element with such an output has a water-carrying channel with a content of approximately 2.1 litres. This is, inter alia, the result of the fact that with the known heat exchanger elements, the burner is completely surrounded by heat exchanging surface and associated water channel.

[0004] Although the known heat exchanger element is already relatively small for a boiler with such an output, it must be established that in particular when the boiler is used for heating not only central heating water but also tap water, the efficiency can be improved still further, and a still more rapid heating of the tap water is desired.

[0005] To that end, the invention provides a heat exchanger element according to claim 1.

[0006] To the present day, the prejudice existed that it was not possible to utilize pins and/or fins with such a small cross-sectional surface, because the pins and/or fins had to have a length of at least 25 mm, this being so because the flue gas draft is to have a particular width for discharging sufficient flue gas and because this width is to be completely filled with the heat exchanging surface enlarging pins and/or fins. Pins with such a length need to have quite a large cross-sectional surface in connection with casting technique requirements. The known pins, for instance, have a length of 25 mm and a diameter of 8 mm. When, with this length, a smaller diameter were to be chosen, the liquid aluminum would already solidify

during the casting process, before the pin-forming cavity is already completely filled. In casting practice, this phenomenon is known as cold flow. By shortening of the length of the pins, to, for instance, 15 mm, thinner pins and/or fins can nevertheless be used without the risk of cold flow occurring during manufacture of the heat exchanger element. These thinner pins have a greater surface-content ratio, so that their heat exchanging action is better with a smaller weight. As a result of the smaller cross-sectional surface of the pins and/or fins, and as a result of the smaller length thereof, the heat exchanger element will have a smaller weight. It appears that instead of the 0.4 kg/kW which is customary with known cast aluminum heat exchanger elements, with a heat exchanger element according to the invention, a value of 0.16 kg/kW can be achieved. After switching on the burner, the heat exchanger element will therefore, as a result of the more limited heat capacity thereof, heat up much more rapidly. In particular with sanitary water heating, that is, with tap water in use, this has the great advantage that the convenience time, i.e. the time required for obtaining hot water from the tap, is considerably reduced. As the length of the pins and/or fins is smaller, also, the distance between the opposite walls provided with pins and/or fins will be smaller. This results in a smaller cross-section of the flue gas draft which, in turn, leads to a higher flow velocity of the flue gases in the flue gas draft. In turn, a higher flow velocity leads to a higher heat transfer coefficient which, in turn, is favorable to the efficiency.

[0007] Another advantage of the pins and/or fins with the smaller cross-section is that, with the heat exchanging surface remaining the same, the global wall surface, i.e. the dimensions of the wall that bears the pins, can be considerably smaller. This therefore leads to a smaller surface to be cooled with water. As a result thereof, the water-carrying channel will have a smaller content, which also leads to a smaller heat capacity of the heat exchanger element.

[0008] It is noted that from US 5,829,514, mentioned in the novelty search report of the priority application forming the basis of the present application, a so-called heat sink is known, which is provided with pins with a diameter leading to a cross-sectional surface in the claimed range of the present invention. The known pins have a diameter of 2 mm and, hence, a cross-sectional surface of 3.2 mm². A heat sink is a device utilized in electronic equipment, such as computers, for cooling electronic components accommodated therein. The heat sink shown in the US publication comprises a first base plate and a number of pins extending away from this base plate, and a second base plate and a number of pins extending away from this second base plate. After having been manufactured separately in a casting process, the two plates are interconnected. The known heat sink is therefore not a monocasting. Judging by the diameters of the pins mentioned in the text, and the drawings, which represent reality three times enlarged, the dimensions of the base plates are approximately 3,3 * 2.5 cm. The sep-

arate base plates with pins are releasing, and can therefore be manufactured through die-casting. With die-casting, the mold is of metal and can be heated, so that the so-called cold flow occurs much less rapidly. Furthermore, the base plate is relatively thick, so that at there, virtually no cooling of casting material occurs. Optionally, with such a process, the liquid metal can be supplied under excess pressure. This is contrary to a heat exchanger element for a central heating boiler. Firstly, the heat exchanger designed as monocasting is not-releasing. As a result, a mold and cores manufactured from sand, and which are lost after the casting process, have to be utilized. This excludes the possibility of casting under excess pressure. Furthermore, heating a sand cast mold is not possible. When casting a heat exchanger element designed as monocasting, the liquid metal will have to run, from one filling point, through the cavities for forming the thin-walled water channels to, only after that, flow into the cavities for forming the pins. Not only is the distance the liquid metal has to travel from the filling point to the pins much longer, furthermore, as the walls bounding the water channels are thin, already, the extent of cooling of the liquid metal is considerable, which has an adverse affect on the cold flow of the liquid metal in the pin forming cavities. The dimensions of an exemplary embodiment of the present invention are in the range of, for instance, 20 - 50 cm, which is not comparable to the dimensions of the known heat sink. Also, the freedom of choice of metal that can be used for casting a central heating heat exchanger element is much more limited than the freedom of choice for a heat sink. The fact is that in the central heating heat exchanger element, in use, there is an environment of flue gases and water vapour which leads to the formation of highly corrosive acids. With a heat sink, only air flowing by is involved. For a heat sink, high-flowing alloys can be selected that can be cast in a simple manner, which alloys, as regards the corrosion sensitivity, are not suitable for the manufacture of a central heating heat exchanger element.

[0009] For the above reasons, it is excluded that an average skilled person in the field of central heating heat exchangers will familiarize himself with the literature relating to heat sinks. Even when this average skilled person were to familiarize himself with these publications, he would, without inventive activities, not arrive at what is suggested according to the invention.

[0010] According to a further elaboration of the invention, the water content of the water-carrying channel can be reduced still further by reducing to less than 10 mm, for instance less than 8 mm, the distance between the wall which bounds, on the one side, the water-carrying channel and, on the other side, an outside of the heat exchanger element, and the wall which bounds, on the one side, the water-carrying channel and, on the other side, the flue gas draft.

[0011] With such dimensions, a heat exchanger element with an output of 28 kW can be provided, with the water-carrying channel having a water content of 0.83

liter instead of the 2.1 litres for 25 kW that was customary heretofore. That is to say, 0.03 l/kW instead of 0.084 l/kW which was customary heretofore. Also this dramatic reduction of water to be heated leads to a smaller heat capacity of the heat exchanger element and, hence, to a quicker heating.

[0012] A problem that may arise as a result of the smaller dimensions of the water-carrying channel is that the heat exchanging surface of the wall that forms the boundary between the water-carrying channel and the flue gas draft on the water-side, is insufficient. According to a further elaboration of the invention, this problem can be solved by providing the respective wall with water-side heat exchanging surface enlarging pins and/or fins.

[0013] Notwithstanding the smaller global surface of the wall that bounds the water channel and the flue gas draft, still, sufficiently large heat exchanging surface can be created as a result of the water-side pins/and or fins.

[0014] An improvement of the efficiency and a more rapid heating of tap water can be provided by a heating boiler provided with a central heating heat exchanger element according to any of the claims 1-14, while the heating boiler is also provided with a tap water heat exchanger that can be connected to an outlet of the water-carrying channel and an inlet of the water-carrying channel, a pump being provided for transporting the water through the central heating heat exchanger element and the tap water heat exchanger, while the central heating heat exchanger element, the tap water heat exchanger, the burner the pump have been/are adjusted to each other such that, with tap water in use, the difference between the supply temperature, i.e. the temperature of the water coming from the water-carrying channel, that is led to the tap water heat exchanger, and the return water temperature, i.e. the temperature of the water coming from the tap water heat exchanger that is led into the inlet of the water-carrying channel, is higher than 25°C, and preferably higher than 30°C.

[0015] This is preferably effected by maintaining the central heating side flow rate low.

[0016] As the return water temperature of the tap water heat exchanger is maintained much lower than was customary heretofore, the average temperature of the central heating heat exchanger element is much lower. To the present day, the supply water temperature was, for instance, 70°C, and the return water temperature 50°C. The average temperature across the central heating heat exchanger element was therefore 60°C. When, with the supply water temperature remaining the same, the return water temperature is reduced to, for instance, 30°C, the average temperature of the central heating heat exchanger element is 50°C. When water is tapped, the central heating heat exchanger element, which, generally, is maintained at approximately 30°C, needs only heat up 20 degrees instead of 30 degrees. It will be clear that this leads to a considerably acceleration of the required heating up time, so that hot tap water is available more rapidly. As, furthermore, the return water temperature is lower,

the flue gases can cool down further so that an increased condensation of the flue gases is possible, which results in a better efficiency. The lower return water temperature is, in particular, achieved by reducing the central heating side flow rate, i.e. the flow rate in the water-carrying channel of the central heating heat exchanger element. Also as a result of the limited water flow through the central heating heat exchanger element, the heat transfer coefficient in the water-carrying channel will decrease. As a result thereof, the presence of the water-side pins and/or fins mentioned hereinabove may be required for compensating for this lower heat transfer coefficient.

[0017] The invention will presently be further elucidated on the basis of an exemplary embodiment, with reference to the drawing. In the drawing:

- Fig. 1 shows a perspective view of a central heating heat exchanger element according to the invention;
- Fig. 2 shows a partly cutaway perspective view of the heat exchanger element shown in Fig. 1;
- Fig. 3 shows a view of the water-carrying channel; and
- Fig. 4 shows a diagram of a central heating boiler with tap water heat exchanger and central heating water pipe system.

[0018] The exemplary embodiment of a central heating heat exchanger element 1 shown in Figs. 1 - 3 is a one-piece monocasting from substantially aluminum. The heat exchanger element 1 is provided with a number of walls 2. At least one of these walls 2 bounds a flue gas draft 3, a few of these walls bound a water-carrying channel 4, and at least one wall bounds both the flue gas draft 3 and the water-carrying channel 4, and are therefore water-cooled. A burner 5 (see Fig. 2) can be connected to the flue gas draft 3. In the present exemplary embodiment, three of the walls 2 bounding the flue gas draft are water-cooled in that the water-carrying channel 4 extends therealong. In a horizontal cross-section of the heat exchanger element, the water channel has a U-shaped configuration, which is clearly visible in Fig. 3. The water flows from an inlet 6 to an outlet 7 while, each time, travelling a U-shaped path and, thus, flowing in a zig-zag manner around the flue gas draft 3 in upward direction from the inlet 6 to the outlet 7. The walls 2 are provided, on the side of the flue gas draft 3, with heat exchanging surface enlarging pins and/or fins 8. The pins and/or fins 8 have a cross-sectional surface that is smaller than 25 mm². In the part 3a of the flue gas draft where the walls 2 extend parallel to each other, which, in the present exemplary embodiment, is the lower portion, the pins 8 have a length of approximately 15 mm. Preferably, the pins 8 have a cross-sectional surface of 20 mm² or less. They can have a circular cross-section with a diameter of approximately 4 mm, a square cross-section, with the sides having a length of approximately 4 mm, or an ellipsoid or fin-shaped cross-section with a mentioned cross-sectional surface. At the location where a burner 5 can be

fitted on the heat exchanger element 1, which, in the present exemplary embodiment, is the upper side of the heat exchanger element 1, the flue gas draft 3 is of widened design for forming a burn out space 3b (see Fig. 3). The burn out space 3b is very compact and the exemplary embodiment shown is particularly suitable for cooperation with a high-performance burner 5 with a compact burn out space.

[0019] In order to prevent the pins 8 from overheating near the free ends thereof, the length of the pins 8 is smaller on an upstream side 3b of the flue gas draft 3, to which the burner 5 can be fitted, than the length of the pins 5 on a downstream side 3a of the flue gas draft 3. The ends of the relatively short pins 8 are therefore close to the water-carrying channel 4, so that the risk of these ends overheating is reduced to a minimum. Preferably, the length of the pins and/or fins 8 increases in the widened part 3b forming the burn out space of the flue gas draft 3, according as the pins and/or fins 8 are arranged further downstream of the burner.

[0020] The present exemplary embodiment shows a heat exchanger element with an output of approximately 25 kW. Here, the weight of the heat exchanger element per kW to provide, is less than 0.20 kg/kW. In the present exemplary embodiment, the weight is only 0.16 kg/kW. With a heat exchanger element with such an output, the water-carrying channel 4 has a volume smaller than 1 litre. In the present exemplary embodiment, the water volume is even only 0.9 litre. This limited volume is, inter alia, achieved in that the distance between the wall 9 which bounds, on the one side, the water-carrying channel 4 and, on the other side, the outside of the heat exchanger element 1 and the wall 2, which bounds, on the one side, the water-carrying channel and, on the other side, the flue gas draft, is smaller than 10 mm, preferably smaller than 8 mm.

[0021] In the present exemplary embodiment, the flue gases flow from the top to the bottom through the flue gas draft 3, and the water to be heated flows from the bottom, via the already described U-shaped zig-zag path, to the top.

[0022] The heat exchanger element 1 is preferably manufactured by means of a casting process, such as, for instance, sand casting or die-casting. Preferably, use is then made of one water-side core for forming the water channel and one flue gas side core for forming the flue gas channel. The water-side core has substantially a shape as represented in Fig. 3.

[0023] In order to form a heating boiler from the heat exchanger element 1, a burner 5 is to be fitted on the heat exchanger element, while, for the present exemplary embodiment, preferably, a high-performance burner 5 is used. This high-performance burner 5 is schematically represented, in part, in Fig. 2. To the underside 3a of the flue gas draft, as a rule, a flue gas discharge is connected, extending in upward direction.

[0024] Finally, Fig. 4 shows a schematic exemplary embodiment of a heating boiler 11 connected to a central

heating water pipe system 12. The central heating heat exchanger element 14 of the heating boiler 11 can also be connected, via a valve assembly 15, to a tap water heat exchanger 16. However, also an elaboration with two pumps and a number of check valves as described in EP-A-0 608 030 is a possibility. As, per kW output, the weight of the central heating heat exchanger element 14 according to the invention is so limited, and as, furthermore, the water content of the water-carrying channel 4 is so limited, the heat capacity of the central heating heat exchanger element 14 is particularly limited. This leads to a very rapid heating of the heat exchanger element 14 when the burner 17 is switched on. In particular with tap water in use, such a rapid heating is of great importance for realizing a good convenience time, for preventing a temperature dip from occurring when tapping hot tap water, and for realizing a high efficiency.

[0025] This efficiency can even be further increased by adjusting to each other the pump 18, provided for transporting water through the central heating heat exchanger element 14 and the tap water heat exchanger 16, the central heating heat exchanger element 14, the tap water heat exchanger 16 and the burner, in a manner such that the difference between supply water temperature and the return water temperature is greater than 25°C and, more particularly, greater than 30°C. This is preferably effected by maintaining the central heating side flow rate, i.e. the flow rate in the water-carrying channel of the central heating heat exchanger element, low. When the temperature of the supply water that is led from the central heating heat exchanger element to the tap water heat exchanger is then in the range of 65 to 90°C, more particularly approximately 70°C, and when, for instance, the return water temperature is approximately 30°C, the average temperature of the central heating heat exchanger element is lower than was customary heretofore. The fact is that up to the present day, the return water temperature is 50°C, while the supply temperature is approximately 70°C. Due to this lower average temperature, heating the central heating heat exchanger element requires less heat, which, with the tap water in use, results in a rapid response. Due to the low return water temperature, the flue gases can be cooled further, and in a condensing manner, which, with the tap water in use, results in a better efficiency. As the central heating side flow rate is maintained low, also, the flow velocity in the water-carrying channel in the central heating heat exchanger element will be low. This may result in the heat transfer surface on the water-side in the central heating heat exchanger element 11 becoming too small. In order to solve this problem, heat exchanging surface enlarging pins 10 are provided in the water-carrying channel 4. Naturally, such water-side pins 10 can also be designed as fins and they can also have, instead of a circular cross-section, a square, rectangular or other cross-section.

[0026] It is noted that the great temperature difference between the supply water temperature and return water

temperature has the advantages described not only with the heat exchanger element, but leads to the described advantages with any type of heating boiler provided with a central heating heat exchanger element which can be connected to a tap water heat exchanger. It will be clear that the combination of the new heat exchanger element described herein, and an embodiment of a heating boiler with tap water heat exchanger with the great ΔT between supply water temperature and return water temperature, leads to particularly rapid heating of tap water with tap water in use in combination with a high efficiency.

[0027] The invention is not limited to the exemplary embodiment described. Various modifications within the framework of the invention, as defined in the claims, belong to the possibilities.

Claims

1. A heat exchanger element (1) intended for a central heating boiler, which heat exchanger element (1) is designed as a monocasting from substantially aluminum and is manufactured by means of a low pressure casting process, for instance sand casting or die-casting, the heat exchanger element being provided with walls (2, 9) which bound a water-carrying channel (4), and with at least one wall (2) which bounds at least one flue gas draft (3) to which a burner is connectable, at least one wall (2) which bounds the at least one flue gas draft (3) being water-cooled in that it also forms a boundary of the water-carrying channel (4), while a said at least one water-cooled wall (2) is provided with heat exchanging surface enlarging pins and/or fins (8) which extend in the respective flue gas draft (3), **characterized in that** the cross-sectional surface of said pins and/or fins (8) is smaller than 25 mm², wherein the length of said pins and/or fins is 15 mm or less, wherein the distance between two opposite walls (2), which bear the pins and/or fins (8) and bound a flue gas draft (3), is smaller than 35 mm, at least in a downstream portion of the respective flue gas draft (3).
2. A heat exchanger element (1) according to claim 1, wherein the cross-sectional surface of said pins and/or fins (8) is smaller than 20 mm².
3. A heat exchanger element (1) according to any one of the preceding claims, wherein the pins (8) have a substantially circular cross-section with a diameter of approximately 4 mm.
4. A heat exchanger element (1) according to any one of claims 1 - 2, wherein the pins (8) have a substantially square cross-section, the sides of which having a length of approximately 4 mm.
5. A heat exchanger element (1) according to any one

of the preceding claims, wherein a flue gas draft (3) is widened on a side to which a burner (5) can be fitted, for forming a burn out space (3b) which is very compact, while the heat exchanger element (1) is suitable for cooperation with a high-performance burner (5) with compact burn out space (3b).

6. A heat exchanger element (1) according to any one of the preceding claims, wherein the length of the pins and/or fins (8) on an upstream side of a flue gas draft (3) to which a burner (5) can be fitted is smaller than the length of the pins (8) on a downstream side.

7. A heat exchanger element (1) according to claim 6, wherein the length of the pins and/or fins (8) in the widened part of the flue gas draft (3) forming the burn out space (3b) increases according as the pins and/or fins (8) are arranged further downstream of the burner (5), while the pins and/or fins (8) in a further downstream part of the flue gas draft (3) have substantially the same length.

8. A heat exchanger element (1) according to any one of the preceding claims, wherein the water channel (4) per kW output, has a volume that is smaller than 0.05 l/kW, more particularly smaller than 0.04 l/kW, preferably approximately 0.03 l/kW.

9. A heat exchanger element (1) according to any one of the preceding claims, wherein in the water channel (4) heat exchanging surface enlarging pins and/or fins (10) are arranged, which water-side pins and/or fins (10) are connected to a base with a wall (2) which bounds a said flue gas draft (3).

10. A heat exchanger element (1) according to any one of the preceding claims, wherein the weight of the heat exchanger element (1) per kW to be provided is less than 0.20 kg/kW, preferably less than 0.16 kg/kW.

11. A heat exchanger element (1) according to any one of the preceding claims, wherein the distance between the wall (9) which bounds, on the one side, the water-carrying channel (4) and, on the other side, an outside of the heat exchanger element (1), and the wall (2) which bounds, on the one side, the water-carrying channel (4) and, on the other side, the flue gas draft (3), is smaller than 10 mm, preferably smaller than 8 mm.

12. A heat exchanger element (1) according to any one of the preceding claims, wherein the burner (5) can be fitted to a top side of the heat exchanger element (1), while the flue gas flow direction is directed from the top to the bottom.

13. A heat exchanger element (1) according to any one

of the preceding claims, wherein the water-carrying channel (4) is provided with an inlet (6) for water to be heated, this entrance being provided adjacent the downstream end of the at least one flue gas draft (3), while the water-carrying channel (4) is provided with an outlet (7) for heated water, this outlet (7) being provided adjacent an upstream end of the at least one flue gas draft (3).

14. A heat exchanger element according to any one of claims 1-13, wherein in the casting process, use is made of one water-side core for forming the water channel and of one flue gas side core for forming the flue gas channel.

15. A heating boiler (11) including:

- the central heating heat exchanger element (1, 14) according to any one of claims 1- 14, and
- a high-performance burner (5, 17) which is fitted on the heat exchanger element (1, 14).

16. A heating boiler (11) including:

- the central heating heat exchanger element (1, 14) according to any one of the claims 1-14;
- a burner;
- a tap water heat exchanger (16) which is connectable to an outlet (7) of the water-carrying channel (4) and an inlet (6) of the water-carrying channel (4),
- a pump (18) for transporting the water through the central heating heat exchanger element (1, 14) and the tap water heat exchanger (16),

wherein the central heating heat exchanger element (1, 14), the tap water heat exchanger (16), the burner (5, 17) and the pump (18) are adjusted to each other such that, with tap water in use, the difference between the supply water temperature, i.e. the temperature of the water coming from the water-carrying channel (4) that is led to the tap water heat exchanger (16), and the return water temperature, i.e. the temperature of the water coming from the tap water heat exchanger (16) that is led into the inlet (6) of the water-carrying channel (4), is greater than 25°C and is preferably greater than 30°C.

17. A heating boiler according to claim 16, wherein the dimensioning of the central heating heat exchanger element and the tap water heat exchanger, and the dimensioning, or the control of the pump is such that the flow rate in the water-carrying channel of the central heating heat exchanger element is relatively low, resulting in the said relatively great temperature difference.

18. A heating boiler according to claim 16 or 17, wherein

the return water temperature with tap water in use is approximately 30°C.

19. A heating boiler according to any one of claims 16 - 18, wherein the supply water temperature with tap water in use is in the range of 65 - 90, more particularly is approximately 70°C.
20. A heating boiler (11) according to any one of claims 16 - 19, wherein the flow rate provided by the pump (18) is adjustable.
21. A heating boiler (11) according to any one of claims 16 - 20, wherein the output provided by the burner (5, 17) is adjustable.

Patentansprüche

1. Wärmetauschererelement (1), bestimmt für einen Zentralheizungsboiler, welches Wärmetauschererelement (1) als ein Monoguss aus im Wesentlichen Aluminium konzipiert ist und mittels eines Niederdruck-Gießverfahrens, zum Beispiel Sandstrahlen oder Spritzguss, hergestellt wird, das Wärmetauschererelement versehen mit Wänden (2, 9), die einen Wasser führenden Kanal (4) begrenzen, und mit mindestens einer Wand (2), die mindestens einen Rauchgasabzug (3) begrenzt, an den ein Brenner angeschlossen werden kann, und mindestens einer Wand (2), die den mindestens einen Rauchgasabzug (3), der wassergekühlt ist, begrenzt, indem sie auch eine Begrenzung des Wasser führenden Kanal (4) begrenzt, während die mindestens eine wassergekühlte Wand (2) versehen ist mit die Wärmetauscheroberfläche vergrößernden Stiften und/oder Flossen (8), die sich in den jeweiligen Rauchgasabzug (3) erstrecken, **dadurch gekennzeichnet, dass** die Querschnittsoberfläche der Stifte und/oder Flossen (8) kleiner als 25 mm² ist, wobei die Länge der Stifte und/oder Flossen 15 mm oder weniger ist, wobei der Abstand zwischen zwei gegenüberliegenden Wänden (2), die die Stifte und/oder Flossen (8) tragen und einen Rauchgasabzug (3) begrenzen, kleiner als 35 mm ist, zumindest in einem stromabwärts liegenden Abschnitt des jeweiligen Rauchgasabzugs (3).
2. Wärmetauschererelement (1) nach Anspruch 1, wobei die Querschnittsoberfläche der Stifte und/oder Flossen (8) kleiner als 20 mm² ist.
3. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei die Stifte (8) einen im Wesentlichen kreisförmigen Querschnitt mit einem Durchmesser von ungefähr 4 mm haben.
4. Wärmetauschererelement (1) nach einem der Ansprü-

che 1-2, wobei die Stifte (8) einen im Wesentlichen quadratischen Querschnitt haben, dessen Seiten eine Länge von ungefähr 4 mm haben.

5. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei der Rauchgasabzug (3) auf einer Seite, an der ein Brenner (5) angebracht werden kann, erweitert ist, um einen Ausbrennraum (3b), der sehr kompakt ist, zu bilden, während das Wärmetauschererelement (1) zum Zusammenarbeiten mit einem Hochleistungsbrenner (5) mit kompaktem Ausbrennraum (3b) geeignet ist.
6. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei die Länge der Stifte und/oder Flossen (8) auf einer stromaufwärts liegenden Seite eines Rauchgasabzugs (3), an dem ein Brenner (5) angebracht werden kann, kleiner als die Länge der Stifte (8) auf einer stromabwärts liegenden Seite ist.
7. Wärmetauschererelement (1) nach Anspruch 6, wobei die Länge der Stifte und/oder Flossen (8) in dem erweiterten Teil des Rauchgasabzugs (3), der den Ausbrennraum (3b) bildet, zunimmt, je weiter die Stifte und/oder Flossen (8) stromabwärts von dem Brenner (5) angeordnet sind, während die Stifte und/oder Flossen (8) in einem weiter stromabwärts liegenden Teil des Rauchgasabzugs (3) im Wesentlichen dieselbe Länge haben.
8. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei der Wasserkanal (4) pro kW Ausgabe ein Volumen hat, das kleiner als 0,05 l/kW ist, insbesondere kleiner als 0,04 l/kW, bevorzugt ungefähr 0,03 l/kW.
9. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei in dem Wasserkanal (4) die Wärmetauscheroberfläche vergrößernde Stifte und/oder Flossen (10) angeordnet sind, welche wasserseitigen Stifte und/oder Flossen (10) mit einer Basis mit einer Wand (2), die den Rauchgasabzug (3) begrenzt, verbunden sind.
10. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei das Gewicht des Wärmetauschererelements (1) pro bereitzustellendem kW weniger als 0,20 kg/kW ist, bevorzugt weniger als 0,16 kg/kW.
11. Wärmetauschererelement (1) nach einem der vorhergehenden Ansprüche, wobei der Abstand zwischen der Wand (9), die auf der einen Seite den Wasser führenden Kanal (4) und auf der anderen Seite eine Außenseite des Wärmetauschererelements (1) begrenzt, und der Wand (2), die auf der einen Seite den Wasser führenden Kanal (4) und auf der ande-

ren Seite den Rauchgasabzug (3) begrenzt, kleiner als 10 mm ist, bevorzugt kleiner als 8 mm.

12. Wärmetauscherelement (1) nach einem der vorhergehenden Ansprüche, wobei der Brenner (5) an einer Oberseite des Wärmetauscherelements (1) angebracht werden kann, während die Rauchgasfließrichtung von der Oberseite zur Unterseite gerichtet ist. 5
13. Wärmetauscherelement (1) nach einem der vorhergehenden Ansprüche, wobei der Wasser führende Kanal (4) mit einem Einlass (6) für zu erhitzendes Wasser versehen ist, welcher Eingang neben dem stromabwärts liegenden Ende des mindestens einen Rauchgasabzugs (3) bereitgestellt ist, während der Wasser führende Kanal (4) mit einem Auslass (7) für erhitztes Wasser versehen ist, welcher Auslass (7) neben einem stromaufwärts liegenden Ende des mindestens einen Rauchgasabzugs (3) bereitgestellt ist. 10 15 20
14. Wärmetauscherelement nach einem der Ansprüche 1-13, wobei in dem Gießverfahren ein wasserseitiger Kern zum Bilden des Wasserkanals und ein rauchgasseitiger Kern zum Bilden des Rauchgaskanals verwendet werden. 25
15. Heizungsboiler (11), umfassend: 30
 - das Zentralheizungs-Wärmetauscherelement (1, 14) nach einem der Ansprüche 1-14 und
 - einen Hochleistungsbrenner (5, 17), der an dem Wärmetauscherelement (1, 14) angebracht ist. 35
16. Heizungsboiler (11), umfassend: 40
 - das Zentralheizungs-Wärmetauscherelement (1, 14) nach einem der Ansprüche 1-14;
 - einen Brenner;
 - einen Leitungswasser-Wärmetauscher (16), der an einen Auslass (7) des wasserführenden Kanals (4) und einen Einlass (6) des Wasser führenden Kanals (4) angeschlossen werden kann; 45
 - eine Pumpe (18) zum Transportieren des Wassers durch den Zentralheizungs-Wärmetauscherelement (1, 14) und den Leitungswasser-Wärmetauscher (16), wobei das Zentralheizungs-Wärmetauscherelement (1, 14), der Leitungswasser-Wärmetauscher (16), der Brenner (5, 17) und die Pumpe (18) so aneinander angepasst sind, dass, bei Verwendung von Leitungswasser, der Unterschied zwischen der Versorgungswassertemperatur, d. h., der Temperatur des von dem Wasser führenden Kanal (4) kommende Wasser, das zu dem Leitungs- 50 55

wasser-Wärmetauscher (16) geleitet wird, und die Rückführwassertemperatur, d. h., die Temperatur des von dem Leitungswasser-Wärmetauscher (16) kommende Wasser, das in den Einlass (6) des wasserführenden Kanals (4) geleitet wird, größer als 25 C ist und bevorzugt größer als 30 C ist.

17. Heizungsboiler nach Anspruch 16, wobei die Dimensionierung des Zentralheizungs-Wärmetauscherelement und des Leitungswasser-Wärmetauschers und die Dimensionierung oder die Steuerung der Pumpe derart ist, dass die Strömungsrate in dem wasserführenden Kanal des Zentralheizungs-Wärmetauscherelements relativ niedrig ist, was zu dem relativ großen Temperaturunterschied führt. 10
18. Heizungsboiler nach Anspruch 16 oder 17, wobei die Rückführwassertemperatur bei Verwendung von Leitungswasser ungefähr 30 C ist. 15
19. Heizungsboiler nach einem der Ansprüche 16-18, wobei die Versorgungswassertemperatur bei Verwendung von Leitungswasser im Bereich von 65 - 90, insbesondere ungefähr 70 C ist. 20
20. Heizungsboiler (11) nach einem der Ansprüche 16-19, wobei die von der Pumpe (18) bereitgestellte Strömungsrate einstellbar ist. 25
21. Heizungsboiler (11) nach einem der Ansprüche 16-20, wobei die von dem Brenner (5, 17) bereitgestellte Ausgabe einstellbar ist. 30

Revendications

1. Élément d'échangeur de chaleur (1) destiné à une chaudière de chauffage central, lequel élément d'échangeur de chaleur (1) est conçu comme un moulage unique sensiblement à partir d'aluminium et est fabriqué au moyen d'un processus de moulage basse pression, par exemple moulage au sable ou moulage sous pression, l'élément d'échangeur de chaleur étant pourvu de parois (2, 9) qui bordent un canal d'arrivée d'eau (4), et avec au moins une paroi (2) qui borde au moins un canal d'évacuation de fumée (3) auquel un brûleur peut être connecté, au moins une paroi (2) qui borde l'au moins un canal d'évacuation de fumée (3) étant refroidie par eau en ce qu'il forme aussi une frontière du canal d'arrivée d'eau (4), alors qu'une dite au moins une paroi (2) refroidie par eau est pourvue de picots et/ou d'ailettes (8) d'augmentation de surface d'échange de chaleur qui s'étendent dans le canal d'évacuation de fumée (3) respectif, **caractérisé en ce que** la surface en section transversale desdits picots et/ou ailettes (8) est inférieure à 25 mm², dans lequel la lon-

- gueur desdits picots et/ou ailettes est de 15 mm ou moins, dans lequel la distance entre les deux parois (2) opposées, qui portent les picots et/ou ailettes (8) et bordent un canal d'évacuation de fumée (3), est inférieure à 35 mm, au moins dans une partie aval du canal d'évacuation de fumée (3).
2. Elément d'échangeur de chaleur (1) selon la revendication 1, dans lequel la surface de section transversale desdits picots et/ou ailettes (8) est inférieure à 20 mm².
 3. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel les picots (8) ont une section transversale sensiblement circulaire avec un diamètre d'approximativement 4 mm.
 4. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications 1-2, dans lequel les picots (8) ont une section transversale sensiblement carrée, dont les côtés ont une longueur d'approximativement 4 mm.
 5. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel un canal d'évacuation de fumée (3) est élargi sur un côté sur lequel un brûleur (5) peut être monté, pour former un espace de combustion (3b) qui est très compact, alors que l'élément d'échangeur de chaleur (1) convient pour coopérer avec un brûleur (5) à haute performance avec un espace de combustion (3b) compact.
 6. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel la longueur des picots et/ou ailettes (8) sur un côté amont d'un canal d'évacuation de fumée (3) sur lequel un brûleur (5) peut être monté est inférieure à la longueur des picots (8) sur un côté aval.
 7. Elément d'échangeur de chaleur (1) selon la revendication 6, dans lequel la longueur des picots et/ou ailettes (8) dans la partie élargie du canal d'évacuation de fumée (3) formant l'espace de combustion (3b) augmente quand les picots et/ou ailettes (8) sont agencées plus en aval du brûleur (5), alors que les picots et/ou ailettes (8) dans une partie plus en aval du canal d'évacuation de fumée (3) ont sensiblement la même longueur.
 8. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel la sortie par kW du canal d'eau (4), a un volume qui est inférieur à 0,05 l/kW, plus particulièrement inférieur à 0,04 l/kW, de préférence approximativement 0,03 l/kW.
 9. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel dans le canal d'eau (4) des picots et/ou ailettes (10) d'agrandissement de surface d'échange de chaleur sont agencés, lesquels picots et/ou ailettes (10) côté eau sont connectés à une base avec une paroi (2) qui borde un dit canal d'évacuation de fumée (3).
 10. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel le poids de l'élément d'échangeur de chaleur (1) par kW à fournir est inférieur à 0,2 kg/kW, de préférence inférieur à 0,16 kg/kW.
 11. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel la distance entre la paroi (9) qui borde, sur l'un côté, le canal d'arrivée d'eau (4) et, sur l'autre côté, un extérieur de l'élément d'échangeur de chaleur (1), et la paroi (2) qui borde, sur l'un côté, le canal d'arrivée d'eau (4) et, sur l'autre côté, le canal d'évacuation de fumée (3), est inférieure à 10 mm, de préférence inférieure à 8 mm.
 12. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel le brûleur (5) peut être monté sur un côté supérieur de l'élément d'échangeur de chaleur (1), alors que la direction d'écoulement de fumée est dirigée du haut vers le bas.
 13. Elément d'échangeur de chaleur (1) selon l'une quelconque des revendications précédentes, dans lequel le canal d'arrivée d'eau (4) est pourvu d'un orifice d'entrée (6) pour l'eau à chauffer, cette entrée étant placée adjacente à l'extrémité aval de l'au moins un canal d'évacuation de fumée (3), alors que le canal d'arrivée d'eau (4) est pourvu d'un orifice de sortie (7) pour l'eau chauffée, cet orifice de sortie (7) étant placé adjacent à une extrémité amont de l'au moins un canal d'évacuation de fumée (3).
 14. Elément d'échangeur de chaleur selon l'une quelconque des revendications 1-13, dans lequel dans le processus de moulage, utilisation est faite d'un noyau côté eau pour former le canal d'eau et d'un noyau côté fumée pour former le canal d'évacuation de fumée.
 15. Chaudière de chauffage (11) incluant :
 - l'élément d'échangeur de chaleur (1, 14) de chauffage central selon l'une quelconque des revendications 1-14, et
 - un brûleur (5, 17) haute performance qui est monté sur l'élément d'échangeur de chaleur (1, 14).

16. Chaudière de chauffage (11) incluant :

l'élément d'échangeur de chaleur (1, 14) de chauffage central selon l'une quelconque des revendications 1-14 ; 5
 un brûleur ;
 un échangeur de chaleur (16) d'eau du robinet qui peut être connecté à un orifice de sortie (7) du canal d'arrivée d'eau (4) et un orifice d'entrée (6) du canal d'arrivée d'eau (4), 10
 une pompe (18) pour transporter l'eau à travers l'élément d'échangeur de chaleur (1, 14) de chauffage central et l'échangeur de chaleur (16) d'eau du robinet, dans lequel l'élément d'échangeur de chaleur (1, 14) de chauffage central, 15
 l'échangeur de chaleur (16) d'eau du robinet, le brûleur (5, 17) et la pompe (18) sont ajustés ensemble de telle manière que, avec l'eau du robinet en utilisation, la différence entre la température d'eau d'alimentation, c'est à dire, la température de l'eau venant du canal d'arrivée d'eau (4) qui est amenée vers l'échangeur de chaleur (16) d'eau du robinet, et la température d'eau de retour, c'est à dire la température de l'eau venant de l'échangeur de chaleur (16) d'eau du robinet qui est amenée dans l'orifice d'entrée (6) du canal d'arrivée d'eau (4), est supérieure à 25° et est de préférence supérieure à 30°. 20
 25
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17. Chaudière de chauffage selon la revendication 16, dans laquelle le dimensionnement de l'élément d'échangeur de chaleur de chauffage central et de l'échangeur de chaleur d'eau du robinet, et le dimensionnement, ou la commande de la pompe est tel que le débit dans le canal d'arrivée d'eau de l'élément d'échangeur de chaleur de chauffage central est relativement faible, ayant pour résultat ladite relativement grande différence de température. 35
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18. Chaudière de chauffage selon la revendication 16 ou 17, dans laquelle la température d'eau de retour avec l'eau du robinet en utilisation est approximativement de 30°C. 45

19. Chaudière de chauffage selon l'une quelconque des revendications 16-18, dans laquelle la température d'eau d'alimentation avec l'eau du robinet en utilisation est dans la plage de 65-90, plus particulièrement d'approximativement 70°C. 50

20. Chaudière de chauffage (11) selon l'une quelconque des revendications 16-19, dans laquelle le débit fourni par la pompe (18) est réglable. 55

21. Chaudière de chauffage (11) selon l'une quelconque des revendications 16-20, dans laquelle la sortie fournie par le brûleur (5, 17) est réglable.

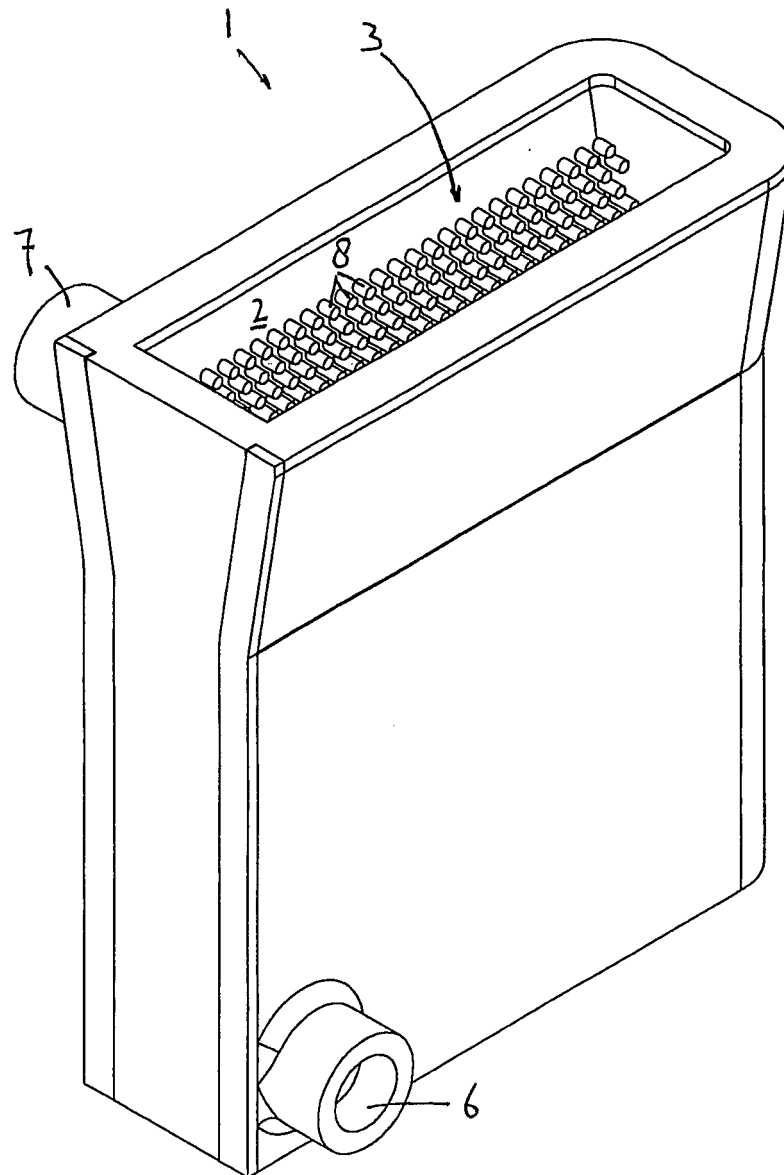
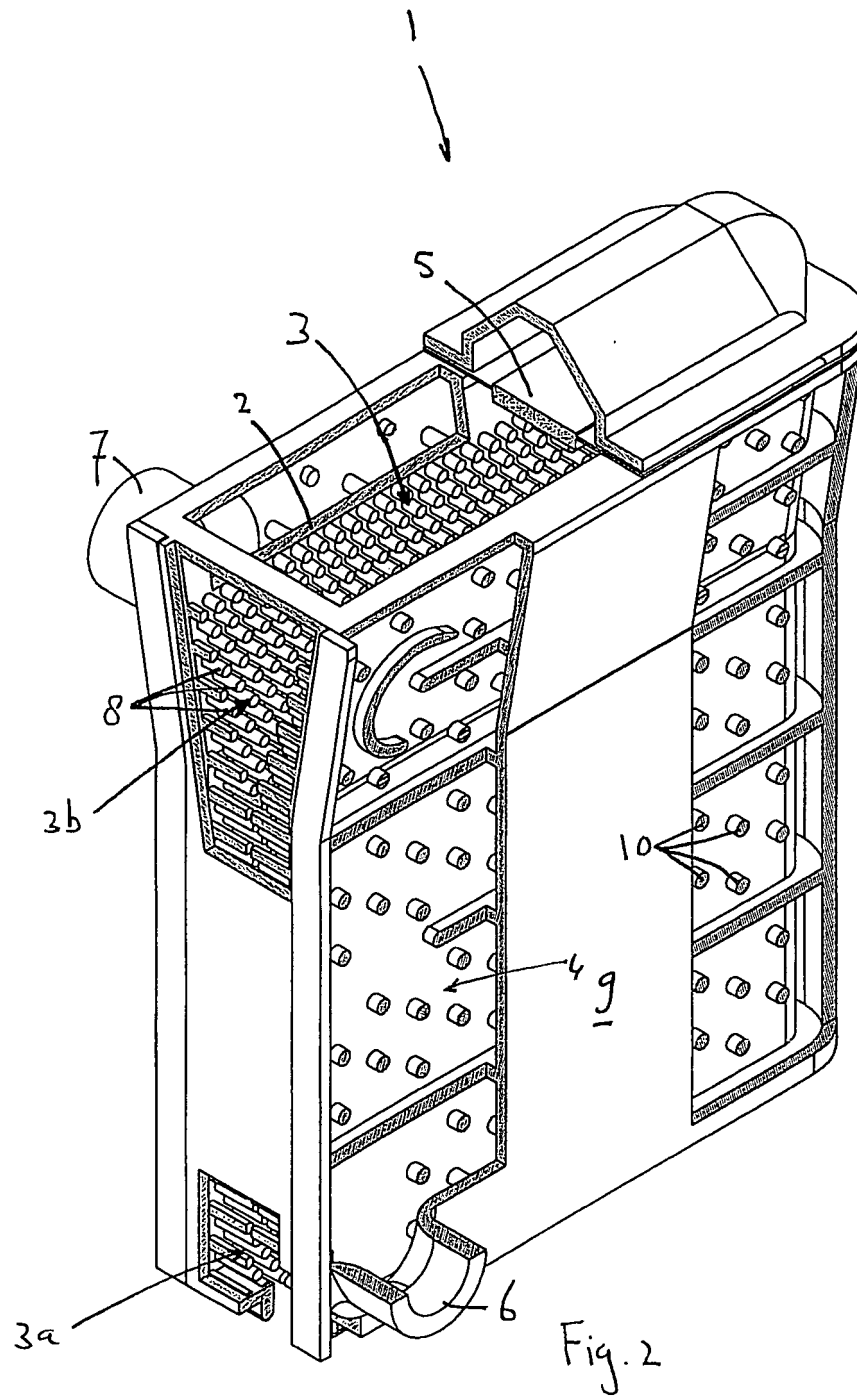


Fig. 1



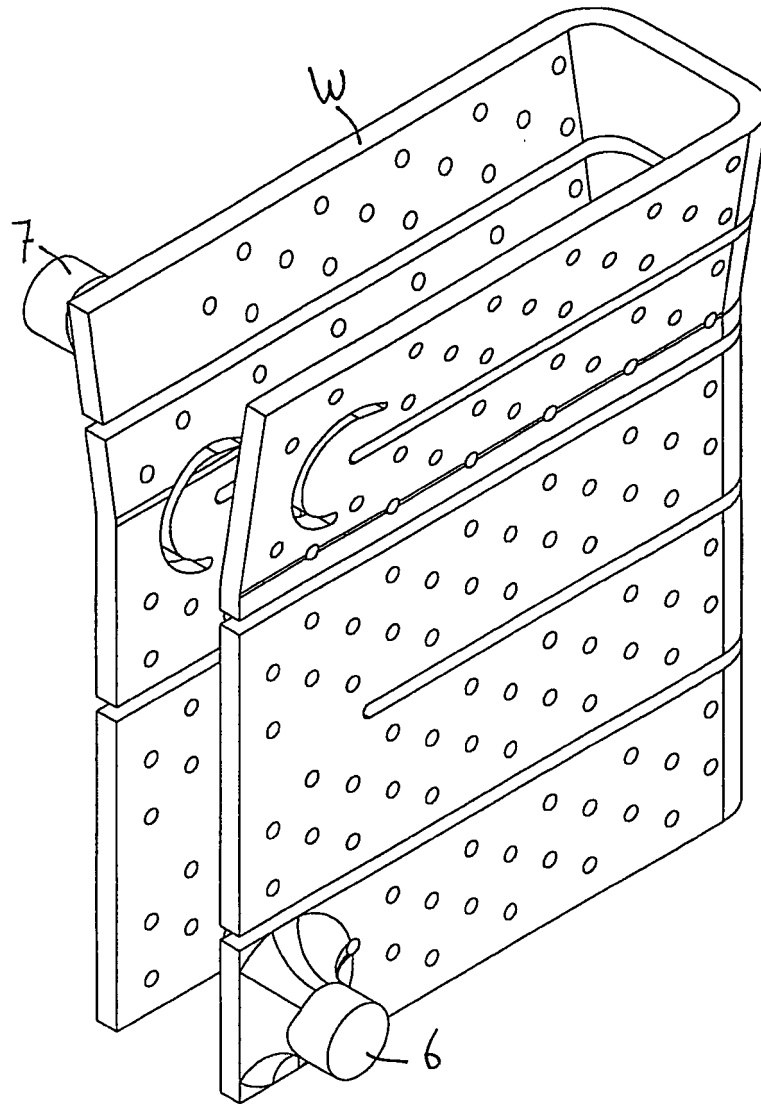


Fig. 3

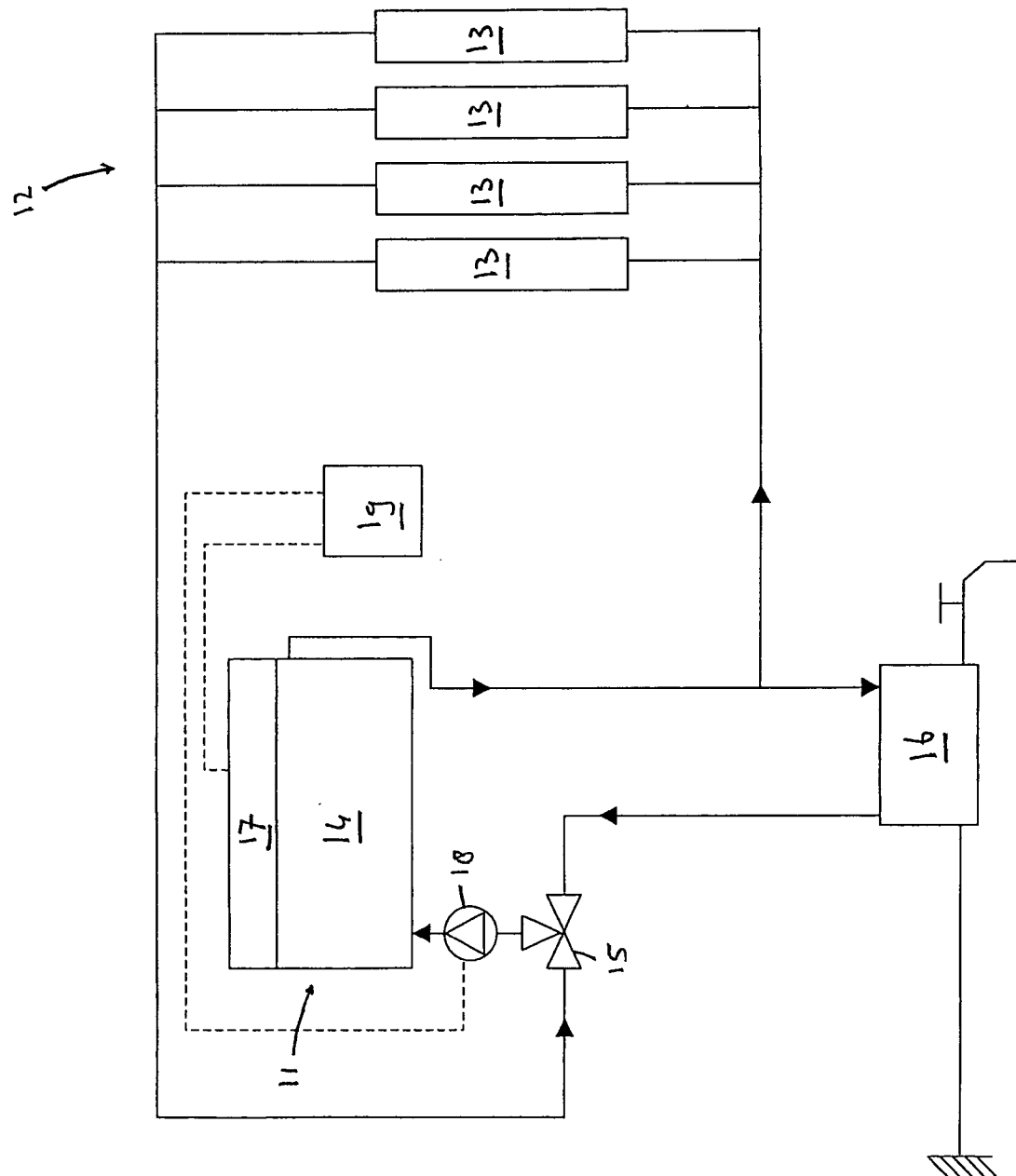


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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