



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.07.2015 Bulletin 2015/30

(21) Application number: **14151589.0**

(22) Date of filing: **17.01.2014**

(51) Int Cl.:
F28D 7/00 (2006.01) **F24H 1/12** (2006.01)
F24H 1/14 (2006.01) **F24D 3/08** (2006.01)
F24D 3/18 (2006.01) **F28D 7/08** (2006.01)
F28D 21/00 (2006.01)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) **Heat exchanger and heating comprising the heat exchanger**

(57) A heat exchanger comprising: a first chamber (13) and a second chamber (20) separated by a fluid channel (24,25) to be flown through by a working fluid, wherein the first chamber (13) is configured to be flown through by a heat transfer medium for heat transfer with

the working fluid flowing through the fluid channel (24,25) and the second chamber (20) is configured to be flown through by a refrigerant for heat transfer with the fluid flowing through the fluid channel (24,25). Further disclosed is a heating having such a heat exchanger.

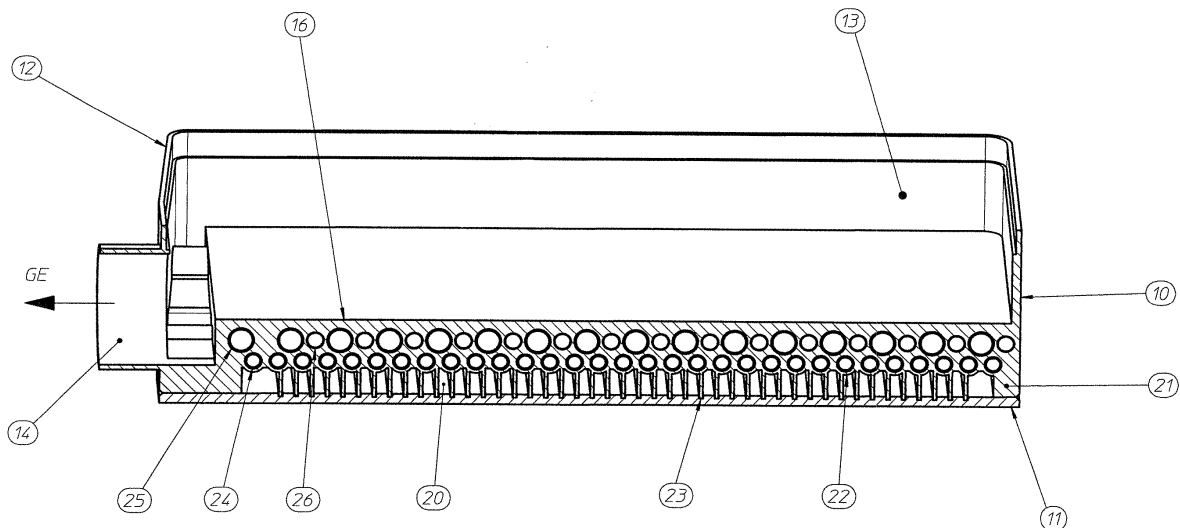


Fig. 4

Description

Technical Field

[0001] The present invention relates to heat exchangers used for example in a central heating of a building and to a heating comprising such a heat exchanger. In particular, the present invention relates to heat exchangers that may be implemented in so-called hybrid heating which depending on the outer circumstances make use of different heat sources and in this context, a combined heat exchanger in which the heat of either one of the heat sources may be transferred to a working fluid.

Background Art

[0002] A hybrid heating is for example known from EP 2 463 951 B1. This heating uses a heat pump, particularly an air heat pump as a first heat source for transfer of heat to the working fluid and a fuel (e.g. gas, oil, etc.) fired boiler as a second heat source for transfer of heat to the working fluid. The electricity driven heat pump and the fuel fired boiler each have a separate heat exchanger connected to the flow circuit for flowing the working fluid to a heat emitting section for space heating.

[0003] Other hybrid systems are known from EP 2 159 495 A1, US 2009/159076 A1 or US 2010/090017 A1. Each of these systems, however, implements a separate heat exchanger for each heat source.

[0004] One such heat exchanger which may be used for a fluid fired boiler is disclosed in WO 2010/002255 A1. This heat exchanger suggests a die cast aluminum body embedding two water (working fluid) loops. These loops are manufactured from copper tubes which are U-bent. One water loop is used for space heating and, thus, connected to a space heating circuit including a heat emitting section. The other loop is connected to a domestic household water circuit for heating domestic household water (tap water). Heat from the combustion gas is transferred to both of the loops.

Summary of the Present Invention

[0005] In view of the prior art cited above, it is aimed to reduce the costs and the complexity of such heating, particularly a hybrid heating without, however, impairing the efficiency, particularly a heat transfer efficiency of the heat exchanger.

[0006] In this context, it is the basic idea of the present invention to combine the heat exchanger of two different heat sources into one combined hybrid heat exchanger. In other words, according to an aspect of the invention, the function of exchanging heat from a first heat source, preferably a combustion process of hydrocarbons (methane, butane or propane gas) and of exchanging heat from a refrigerant (e.g. R32, R410H or other HFC's), particularly used in a heat pump are combined in one body.

[0007] If the skilled person intends to implement this

basic idea in a heat exchanger known from WO 2010/002255 A1, one would implement a third loop consisting of a U-bent tube for flowing the refrigerant and transfer heat by phase change of the refrigerant from vapor to liquid to release latent heat to one or both of the two water loops.

[0008] Yet, the present inventors found that such a refrigerant loop embedded in a cast aluminum body of such a common heat exchanger would not provide for sufficient heat transfer efficiency as the diameter of the tubing for such a refrigerant loop as well as the U-bents (that is the bending characteristics of the tube) limit the possibilities to increase the heat exchange surface. In order to cope with these limitations, one would need to increase the size of the heat exchanger which is perceived negative as well and may in view of the constrictions of the combustion chamber even not be possible.

[0009] Accordingly, the invention suggests the implementation of a second chamber rather than a tubing and to, thereby, enable an increased heat exchange surface without increasing the size of the heat exchanger and providing for a sufficient heat exchange efficiency in a combined heat exchanger. Thereby, it is practically possible to combine the two heat exchangers of two different heat sources, particularly a fuel (gas, oil, etc.) fired boiler and a heat pump in one heat exchanger and particularly a cast body of such a heat exchanger.

[0010] In this context, the present invention suggests a heat exchanger comprising the features of claim 1 as well as a heating comprising such a heat exchanger as defined in claim 11. Preferred embodiments of the invention may be found in the dependent claims, the following description as well as the drawings.

[0011] An aspect of the present invention suggests a heat exchanger comprising a first chamber and a second chamber separated by a fluid channel (or fluid path/fluid passage) to be flown through by a working fluid. The working fluid is preferably water of a hydronic heating system with the purpose of heating a building. The water may certainly include additives as common in the art. Yet, other working fluids are conceivable as well. The first chamber and the second chamber are physically (not thermally) isolated from each other meaning that the chambers do not fluidly communicate and may be independently flown through by a fluid. In particular, the first chamber is configured to be flown through by a heat transfer medium for heat transfer with the working fluid flowing through the fluid channel. The heat transfer medium may preferably be combustion gas. The second chamber is configured to be flown through by a refrigerant for heat transfer with the working fluid flowing through the fluid channel. In this context, heat may be released to the working fluid flowing through the fluid channel by means of either the heat transfer medium, the refrigerant or both. As far as heat transfer of the refrigerant is concerned, latent heat is released by phase change of the refrigerant flowing through the second chamber from vapor to liquid. By integrating the refrigerant circuit for heat

transfer with the working fluid into the heat exchanger of the first heat source but using a chamber, the heat exchanging efficiency may be increased, as a larger heat exchanger surface may be obtained easily without the need of increasing the entire heat exchanger as such. In particular, a refrigerant chamber (second chamber) is preferred as compared to a refrigerant loop made from tubes as one is not limited by the bending characteristics of the tube and its diameter. Thus, a cost effective combined heat exchanger may be obtained without impairing the heat exchange efficiency as compared to two single heat exchangers for the heat transfer medium, on the one hand, and the refrigerant, on the other hand.

[0012] As will be known, the temperature difference between the refrigerant and the working fluid may be not as high as the temperature difference between the heat transfer medium (particularly a combustion gas) and the working fluid. In order to enable a sufficient heat transfer from the refrigerant to the working fluid, it is preferred to configure the fluid channel from a first and second fluid channel both being integrated into the heat exchanger between the first and second chamber and to be flown through by the working fluid. The first and second fluid channel may be flown through by the working fluid in parallel or in series. Thereby, if the heating of the transfer medium is to be achieved at least partly by the release of latent heat from the refrigerant to the working fluid, the working fluid can be flown through both the first and second fluid channel, thereby increasing the heat transfer surface and thereby obtaining sufficient heat transfer. This idea may as well be integrated into a heat exchanger not having a second chamber but integrating a refrigerant loop as mentioned above.

[0013] Additionally or alternatively, it may be conceived to increase the heat exchanger surface of the first fluid channel as compared to the second fluid channel. In this case, working fluid may be flown through either both, the first and second fluid channel as previously indicated or if the heat transfer surface of the first fluid channel is sufficiently large, the working fluid may also be flown only through the first fluid channel to obtain the sufficient heat transfer from the refrigerant to the working fluid in case heat transfer is to be obtained by the refrigerant only.

[0014] According to a preferred embodiment of the present invention, the first and second fluid channels are formed by tubes, preferably by U-shaped bending of the tubes parallel to the heat exchange surfaces of the first and second chamber. This particularly enables preferred embedding of the first and second fluid channel into a single piece body defining the first and second chamber as described in more detail below. If the heat exchange surface of the first fluid channel is to be increased as compared to the second fluid channel, it may be preferred to decrease the diameter of the tube of the first fluid channel as compared to the second fluid channel. Thereby sharper bents of the tube may be obtained and thereby the heat exchange surface may be increased easily with-

out the need to increase the heat exchanger as such.

[0015] Particularly, in a case in which the heat transfer surface of the first fluid channel is larger than that of the second fluid channel, it is preferred to dispose the first fluid channel closer to the second chamber than to the first chamber as compared to the second fluid channel. In other words, in this case, it is preferred that the first chamber, the second fluid channel, the first fluid channel and the second chamber are arranged in that order. Thereby the first fluid channel closer to the second chamber has a larger heat transfer surface and sufficient heat transfer is ensured.

[0016] According to a further embodiment of the present invention, it may be conceived to use the heat exchanger for heat transfer with the working fluid or another working fluid for heating domestic hot water (tap water). To integrate this additional function into the heat exchanger, it may be preferred that the heat exchanger comprises a third fluid channel between the first and second chamber and to be flown through by the or another working fluid. "The working fluid" means the same working fluid that is also flown through the first and second fluid channel in case the domestic hot water circuit is integrated into the space heating circuit. "Another working fluid" means separate circuits. The other working fluid may be water as well. As the domestic hot water is generally heated by the fuel fired heat source, it is preferred to locate the third fluid channel closer to the first chamber than the first fluid channel. In cases of a first and second fluid channel, it may be conceived to dispose the third and second fluid channel so that parallel tube sections intermesh, i.e. reside substantially in a common plane. Thereby, the entire thickness of the heat exchanger may be decreased and the major portions of third fluid channel may be disposed close to the heat transfer surface of the first chamber.

[0017] In order to further increase the heat transfer surface of the second chamber, it may be beneficial that the second chamber has fins at a wall (bottom or back wall) facing the fluid channel. Preferably these fins may be integral part of the single piece body described below.

[0018] According to one embodiment, the second chamber is closed by a cover attached preferably to the single piece body described below and the fins define the flow path of the refrigerant within the chamber. That is, the chamber is defined by a top wall and a bottom wall as well as opposite side walls, preferably integrally formed within the preferably single piece body of the heat exchanger, the chamber being open at one side opposite to a back wall (bottom) having the fins. This open portion of the chamber is closed by the cover. Thus, a flow path within the chamber may be defined by the fins. This flow path may be a meander as achieved by bending tubes, but it may also be a different flow path depending on the requirements and circumstances of heat transfer.

[0019] As previously indicated, it is preferred that the first chamber is a combustion chamber. According to one embodiment, it is preferred that a burner is disposed in-

side the combustion chamber. For this purpose, the combustion chamber may have an accommodation space for receiving the burner. In this context, the skilled person is referred to WO 2010/002255 A1 disclosing such configuration.

[0020] According to another embodiment of the present invention, the heat exchanger comprises a single piece body defining the first and second chamber and embedding the fluid channel (the first and/or second) and/or the third fluid channel (if present). Preferably, the single piece body is made from die cast or sand cast aluminum, preferably die cast in a high pressure casting process. The tubes of the first to third fluid channel are preferably made from copper or stainless steel and are embedded within the single piece body during the casting process as inserts. This configuration enables ease of manufacture and, therefore, production of a less expensive heat exchanger. Preferably the fins of the second chamber are part of the single piece body and, therefore, obtained in the casting process as well. The body may further have a frame-like shape with two open sides of the first and second chamber, which are both closed by a respective cover as previously mentioned.

[0021] Beside the heat exchanger, the present invention also suggests a heating comprising such a heat exchanger. The heating further comprises a space heating circuit for space heating and a heat pump comprising a refrigerant circuit. The space heating circuit may include a heat emitting section, that is radiators, floor heating loops or the like to transmit heat from the working fluid to the space requiring heating. The space heating circuit is connected to the fluid channel (the first and second fluid channel if both present). The heat pump of the heating may be any kind of heat pump such as an air heat pump, a geothermal heat pump or the like. The heat pump comprises a refrigerant circuit, preferably comprising a compressor an expansion means, a heat exchanger for heat exchange with the heat source, that is air, geothermal energy, etc. and evaporation of the refrigerant. This refrigerant circuit is connected to the second chamber for heat transfer from the refrigerant to the working fluid and, thereby, condensation of the refrigerant within the second chamber.

[0022] As previously mentioned, if there is provided a first and second fluid channel, it is preferred to connect this first and second fluid channel to the space heating circuit and to control the heating as a hybrid heating having a hybrid mode operating both the heat pump and the burner and flow working fluid through the first and second fluid channel. The control is further configured to operate in a boiler only mode operating the burner only and flowing the working fluid through the second fluid channel only and to in a heat pump only mode operate the heat pump only and flow the working fluid either through only the first fluid channel or preferably through both the first and second fluid channel.

[0023] According to an even further embodiment, it is preferred to integrate a domestic hot water circuit into

the heating for heating domestic hot water. This domestic hot water circuit is connected to the third fluid channel. In this instance, the control is configured to flow fluid through the third fluid channel if a demand for domestic hot water exists and to operate either the boiler only or in the hybrid mode.

[0024] Additional features and advantages of the present invention will be apparent from the following description of preferred embodiments.

Brief Description of the Drawings

[0025] The preferred embodiments of the present invention will be described in view of the accompanying drawings, in which:

Figure 1 shows a perspective view of a heat exchanger of the present invention with an opened second chamber;

Figure 2 shows a perspective view of the heat exchanger in Figure 1 with the body of the heat exchanger being partly broken away to show the first to third fluid channel;

Figure 3 shows a perspective view of the heat exchanger shown in Figures 1 and 2 with attached cover;

Figure 4 shows a perspective cross-sectional view of the heat exchanger along line 5-5 in Figure 3;

Figure 5 shows a perspective view of a heat exchanger according to a second embodiment of the present invention with an opened second chamber having a different fin structure.

Embodiments of the Present Invention

[0026] In the drawings, the same reference numerals denote the same or similar elements and a repeated explanation of these elements is generally omitted.

[0027] The heat exchanger shown in Figure 3 comprises a housing comprising a frame-like body 10 and two covers 11 of which only one is visible.

[0028] The body 10 is a single piece body preferably an aluminum body manufactured in a high pressure die cast process. The body 10 as best visible from Figure 4 has a circumferential side 12 with a top wall, a bottom wall and opposite side walls defining a combustion chamber 13 (as a first chamber). The combustion chamber 13 has a gas exhaust 14 for exhausting combustion gas along the arrow GE (Gas Exhaust). The combustion chamber may have a plurality of not shown fins arranged within the combustion chamber 13 for increasing the heat exchange surface. The fins are connected to a bottom (back wall) 16 of the combustion chamber 13. Figure 4 omits the cover of the combustion chamber 13 but with

the cover 11 attached to the combustion chamber 13, the chamber forms a sealed space within the body 12 with the exception of an inlet for the combustion gas to the burner (not shown) and the gas exhaust GE. In order to dispose the burner within the combustion chamber 13, the fins may be tapered towards one end forming an accommodation space (not shown) for accommodating the not shown burner. In use, the burner will be directed so that the combustion gas flows from the accommodation space along the fins towards the gas exhaust GE.

[0029] The refrigerant chamber 20 (as second chamber) is provided on an opposite side of the combustion chamber 13 relative to the bottom 16. At this side, the body 10 has as well as circumferential side 21 defining the top wall, bottom wall and opposite side walls of the refrigerant chamber 20 and a bottom (back wall) 22 separating the refrigerant chamber 20 from the combustion chamber 13. The bottom 22 is provided with a plurality of fins 23 protruding integrally with the body 10 from the bottom 22 of the refrigerant chamber 20. The height of the fins 23 is preferably at least the same as that of the circumferential side 21 so that with the cover 11 attached, the fin 23 define the flow path of the refrigerant within the refrigerant chamber 20. In the embodiment shown in Figure 1 to 4, a refrigerant inlet RI is disposed at the top left-hand side in Figure 1 and the fins do not extend along the entire width between the opposite side walls of the circumferential side 21. Rather the fins 23 are somewhat shorter and alternately connected to one side wall and to the opposite side wall (the left side wall and the right side wall in the drawings). Thereby and as indicated by the arrows in Figure 1, the refrigerant may flow in a loop (maender) from the top left corner of the refrigerant chamber 20 towards the lower left corner where the refrigerant leaves the refrigerant chamber at the refrigerant outlet RO.

[0030] Moreover, the heat exchanger of the present embodiment comprises three water loops 24 (first fluid channel), 25 (second fluid channel) together forming the fluid channel and 26 (third fluid channel). All three loops 24 to 26 are formed by copper or stainless steel tubes being bent to a loop (maender) with their largest two-dimensional extension parallel to the bottom 16 and 22 of the combustion chamber 13 and the refrigerant chamber 20, respectively. Each loop consists of straight portions 27 with two straight portions being connected by a bent portion 28 being U-shaped. All three water loops (first to third fluid channels) are embedded in the die cast aluminum body 10. In this context, the water loop 24 (first fluid channel) is located closest to the bottom 22 as compared to the second and third water loop (fluid channel) 25 and 26.

[0031] The bottom 22 of the refrigerant chamber 20 is formed in a wave shape with portions being convex toward the refrigerant chamber 20 corresponding to the diameter of the tube 24 and with portions concave relative to the refrigerant chamber 20 formed inbetween. The fins 23 are relatively positioned at the apex of the concave

portions and also in the concave portions.

[0032] The second and third water loop (fluid channel) are arranged with their straight portions 27 intermeshing, that is the center points as seen in cross-sections of the straight portions of the loops 25 and 26 lie within a common plane (see Figure 4). For this purpose, the bent portions 28 of the third loop do not only provide for a bent in one plane but also for a bent in a different plane so that the bents 28 are disposed around a portion of the second water loop 25 as best visible from Figure 2.

[0033] The first and second water loops 24 and 25 are respectively connected at their water inlets WE1 and WE2 to a return line (not shown) of a space heating circuit of a heating. Both these loops 24 and 25 are each connected at their water outlets WO1 and WO2 to a supply line of the space heating circuit. In this context, the loops 24 and 25 may be connected in series or in parallel.

[0034] Moreover, the third water loop 26 is connected at its water inlet WE3 to a return line of a domestic hot water circuit and with its water outlet to a supply line of a domestic hot water circuit. The water introduced via a return line into the third water loop 26 at the connection WE3 is heated and supplied via the connection WO3 for heating water in a domestic hot water container and then again returned to the connection WE3.

[0035] The sole difference between the first embodiment shown in Figures 1 to 4 and the embodiment in Figure 5 is the configuration of the fins 23 of the refrigerant chamber 20. In this example, the fins 23 extend longitudinally along the side walls of the circumferential side 21, that is from the top wall to the bottom wall (in the first embodiment, the fins extend perpendicular thereto from the one side wall towardly the opposite side wall). The refrigerant chamber 20 in regard of the configuration of the fins is separated along a diagonal line 30 in Figure 5. In a portion on a lower side of the diagonal line 30, the fins have the same height over their entire longitudinal length. In another portion on the upper side of the diagonal line 30, the fins 23 are formed like a castle wall with merlons 31 and crenels 32 inbetween the merlons 31. Whereas a refrigerant flow in the portion with the merlons and the crenels is possible in a direction from the top to the bottom wall (in the drawings a vertical direction) and a direction perpendicular thereto via the crenels (in the drawings a horizontal direction), a refrigerant flow in the other portion with the fins having a continuous same height over their longitudinal length is only possible in a vertical direction.

[0036] In the following, the function of the heat exchanger and particularly its implementation into a heating is explained in more detail. In particular, the heat exchanger is preferably included in a hybrid heating using a fuel fired boiler as one heat source and heat pump, preferably an air heat pump as a second heat source. Depending on the outer circumstances and particularly for improved efficiency, the heating is capable of operating in a hybrid mode, a boiler only mode and a heat pump only mode if space heating is required. Similar may also

apply if domestic hot water is required even though a domestic hot water demand is generally satisfied by the fuel fired heat source. For details in regard of a hybrid heating, the skilled person is referred to EP 2 462 591 B1 incorporated in its entirety by reference.

[0037] Depending on the efficiency as for example described in EP 2 462 591 B1, the heating may be operated in a hybrid mode. In the hybrid mode, both the boiler, that is the burner and the heat pump are operated so that heat exchange is possible from both heat sources to the working fluid (water). In this instance, water is flown through the first and second loop 24 and 25 and heat is transferred from the combustion gas within the combustion chamber 13 and from the refrigerant within the refrigerant chamber 20 to the water flowing in the water loops 24 and 25, whereby the water is heated to the required flow temperature and then distributed to the heat emitting sections of the space heating circuit for satisfying the respective demand. If for efficiency reasons, the space heating is operated in the heat pump only mode, it is preferred to flow the water through the first and second water loop 24 and 25 as well to have an increased heat exchange surface and enable efficient heat transfer from the refrigerant within the refrigerant chamber 20 to the water in the loops 24 and 25 and thereby heat the water to the required flow temperature of the space heating. If for efficiency reasons, the heating is operated in the boiler only mode, heat is only transferred from the combustion gas in the combustion chamber 13 to the water flowing in the loop first water 24. In this instance, no water is flowing through the second water loop 25 as the heat exchanger surface of the first water loop 24 is sufficient in view of the heat that may be transferred from the combustion chamber, i.e. the combustion gas.

[0038] Finally, if domestic hot water is required, water is (also) flown through the third water loop 26 and thereby, depending on the mode in which the heating is actually operated, heated by either the combustion gas in the combustion chamber 13 and/or the refrigerant within the refrigerant chamber 20. If such demand exists and the heat provided by the heat pump, i.e. the refrigerant is not sufficient to satisfy the domestic hot water demand and the demand of space heating, it is conceivable to additionally operate the burner to increase the capacity and satisfy both demands. Alternatively, it may also be conceivable to stop water flowing through the first and second water loops 24 and 25 in order to sufficiently heat the water in the third water loop 26 and satisfy the domestic hot water demand. This, however, may lead to a little discomfort in space heating as this demand may thus not be satisfied for a period of time.

[0039] The heat exchanger of the present invention enables to combine heat exchangers generally used separately for different heat sources in one heat exchanger. To ensure sufficient heat transfer efficiency, this is achieved by configuring a refrigerant chamber opposite to another heat source (combustion) chamber. In addition, it is very efficient to produce (preferably in a die

casting process) the heat exchanger with the two chambers from the single piece body embedding the water loops inbetween the two chambers. Thereby, a heat exchanger with a small number of parts and a simple manufacturing process may be obtained. At the same time, the heat transmission from the refrigerant to the water within the loops can be enhanced because of the close contact of the materials. Even further, by providing two water loops for the same destination (space heating), it may be possible to increase the heat exchange surface for exchanging heat with the refrigerant by condensation of the refrigerant within the refrigerant chamber without increasing complexity of the heat exchanger and/or impairing the manufacturing process.

Claims

1. A heat exchanger comprising: a first chamber (13) and a second chamber (20) separated by a fluid channel (24,25) to be flown through by a working fluid, wherein the first chamber (13) is configured to be flown through by a heat transfer medium for heat transfer with the working fluid flowing through the fluid channel (24,25) and the second chamber (20) is configured to be flown through by a refrigerant for heat transfer with the fluid flowing through the fluid channel (24).
2. The heat exchanger according to claim 1, wherein the fluid channel comprises a first fluid channel (24) and a second fluid channel (25) between the first (13) and second chamber (20) and to be flown through by the working fluid, a heat exchange surface of the first fluid channel (24) being preferably larger than a heat exchange surface of the second fluid channel (25).
3. The heat exchanger according to claim 2, wherein the first (24) and second (25) fluid channels are formed by tubes and the diameter of the tube of the first fluid channel (24) preferably is smaller than the diameter of the tube of the second fluid channel (25).
4. The heat exchanger according to claim 2 or 3, wherein the first chamber (13), the second fluid channel (25), the first fluid channel (24) and the second chamber (20) are arranged in that order.
5. The heat exchanger according to any one of claims 2 to 4, further comprising a third fluid channel (26) between the first (13) and second (20) chamber and to be flown through by the working fluid or another working fluid.
6. The heat exchanger according to claim 5, wherein the third fluid channel (26) is located closer to the first chamber (13) than the first fluid channel (24).

7. The heat exchanger according to any one of the preceding claims, wherein the second chamber (20) has fins (23) at a wall facing the fluid channel (24, 25).
8. The heat exchanger according to claim 7, wherein the second chamber (20) is closed by a cover (11) and the fins (23) define the flow path of the refrigerant within the second chamber (20). 5
9. The heat exchanger according to any one of the preceding claims, wherein the first chamber (13) is a combustion chamber and preferably a burner is disposed inside the combustion chamber (13). 10
10. The heat exchanger according to any one of the preceding claims, further comprising a single piece body (10) defining the first (13) and second (20) chamber and embedding the fluid channel (24,25) and/or third fluid channel (26). 15
11. A heating unit comprising: a heat exchanger according to any one of the preceding claims; a space heating circuit for space heating connected to the fluid channel (24,25) and a heat pump comprising a refrigerant circuit connected to the second chamber (20). 20
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12. The heating according to claim 11, wherein the heat exchanger has the features of claim 2, wherein the space heating circuit is connected to the first fluid channel (24) and to the second fluid channel (25). 30
13. The heating according to claim 12, wherein the heat exchanger has the features of claim 9 and the heating further comprises a control configured to in a hybrid mode operate both the heat pump and the burner and flow working fluid through the first (24) and second (25) fluid channel, to in a boiler only mode operate the burner only and flow the working fluid through the first fluid channel (24) only and to in a heat pump only mode operate the heat pump only and flow the working fluid through the first (24) and/or second (25) fluid channel. 35
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14. The heating according to any one of claims 11 to 13, wherein the heat exchanger has the features of claim 5 and the heating further comprises a domestic hot water circuit for heating domestic hot water connected to the third fluid channel (26). 45
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15. The heating according to claims 13 and 14, wherein the control is configured to flow fluid through the third fluid channel (26) if a demand for domestic hot water exists and to preferably operate in either the boiler only or in the hybrid mode. 55

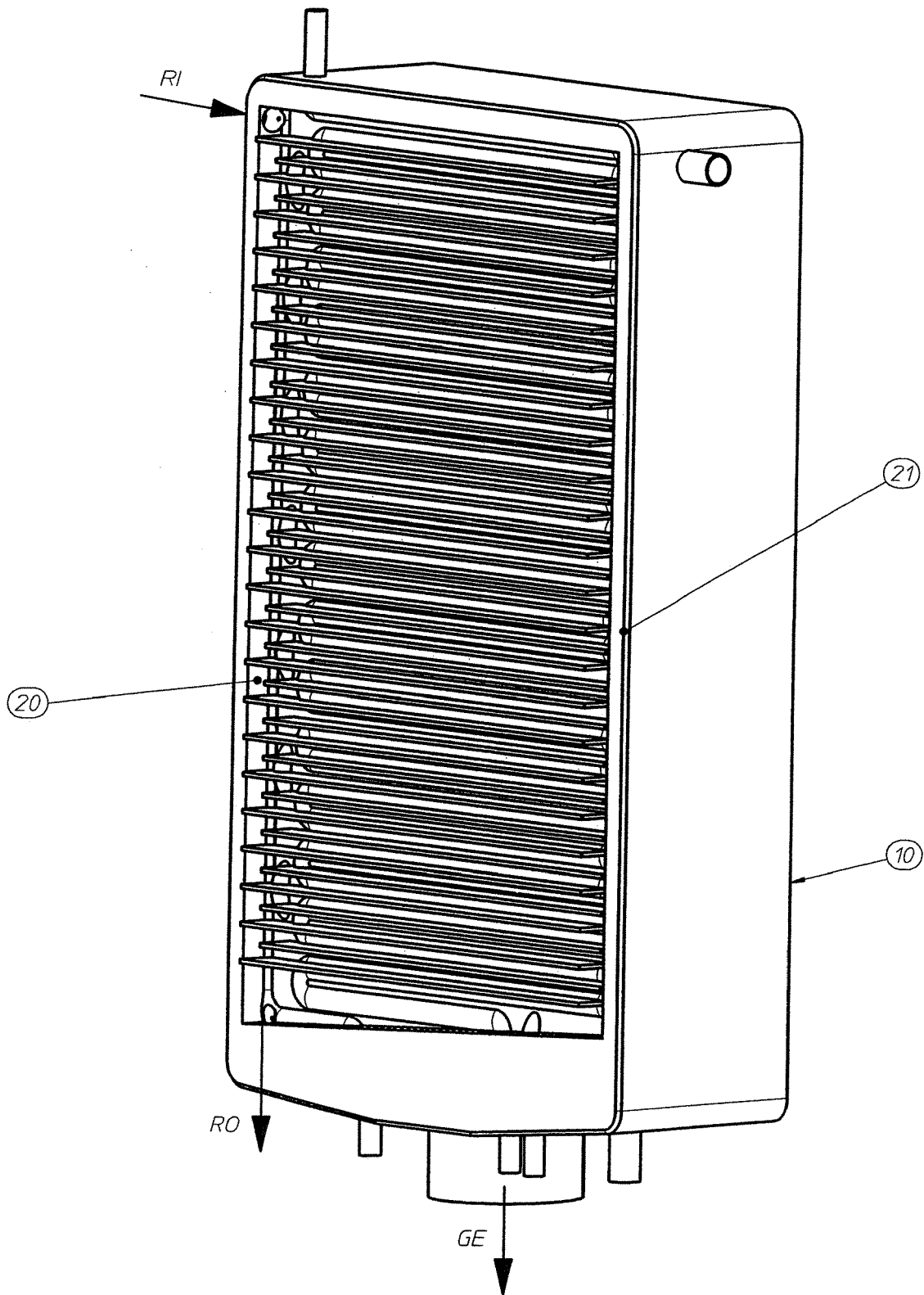


Fig. 1

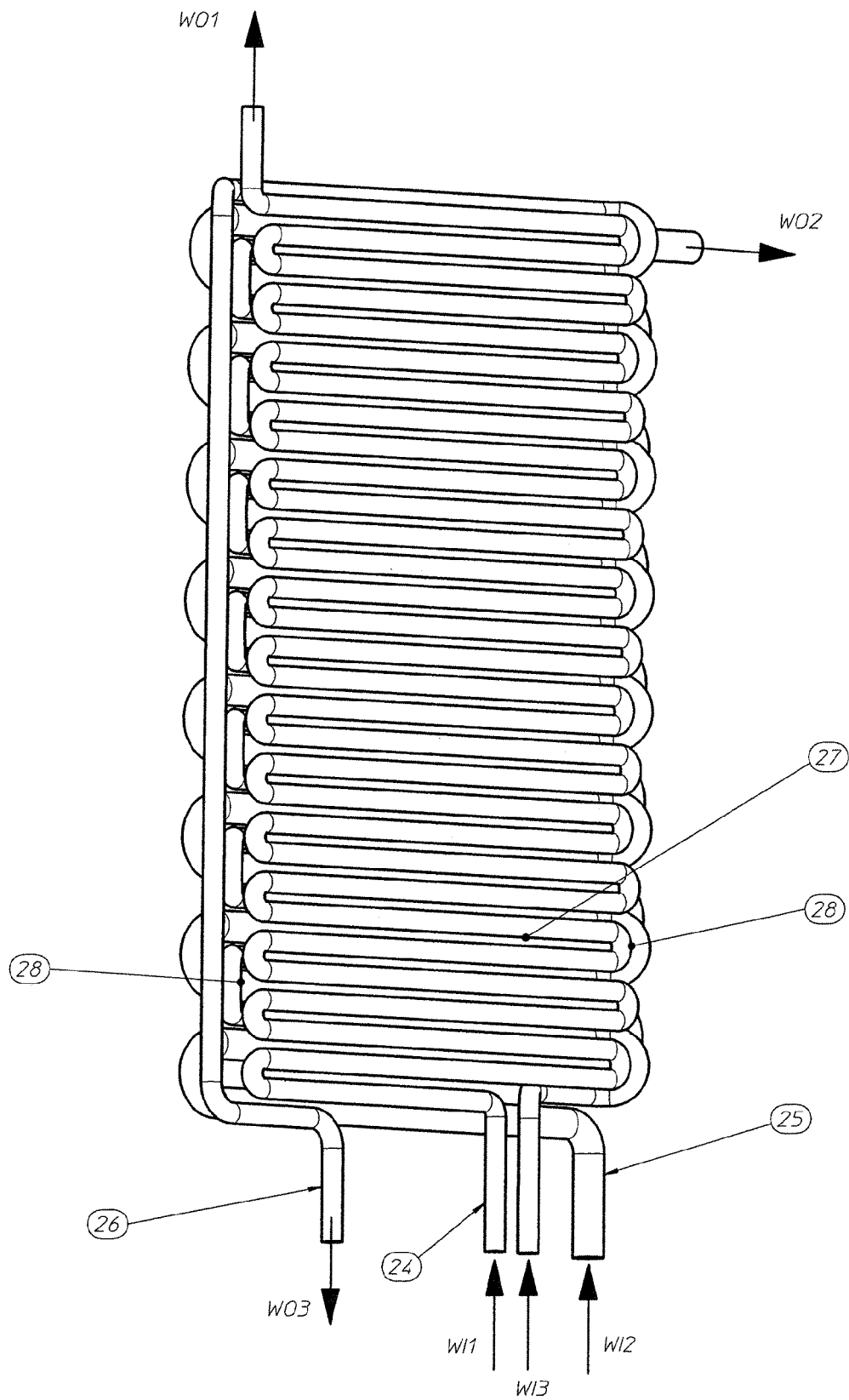


Fig. 2

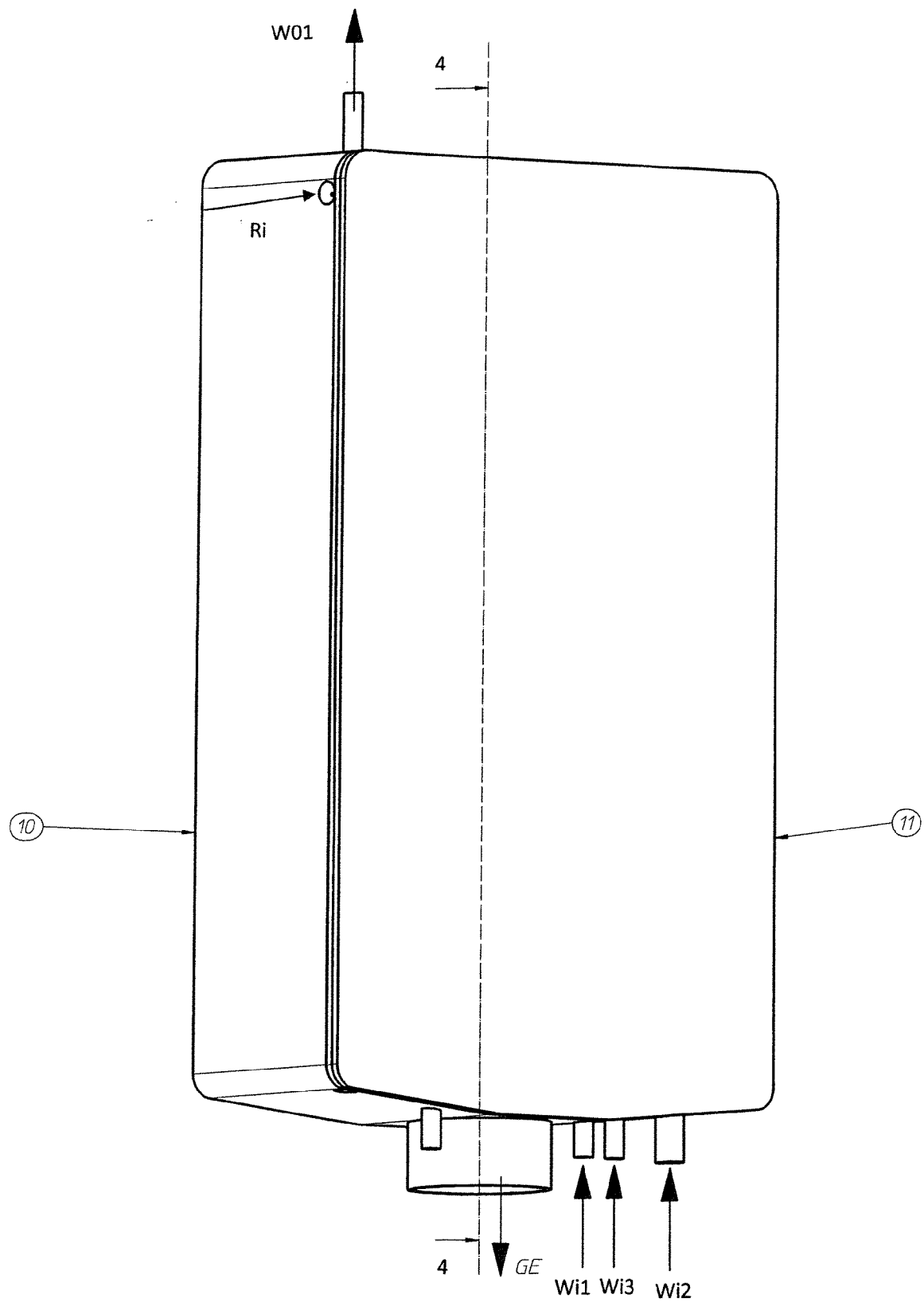


Fig. 3

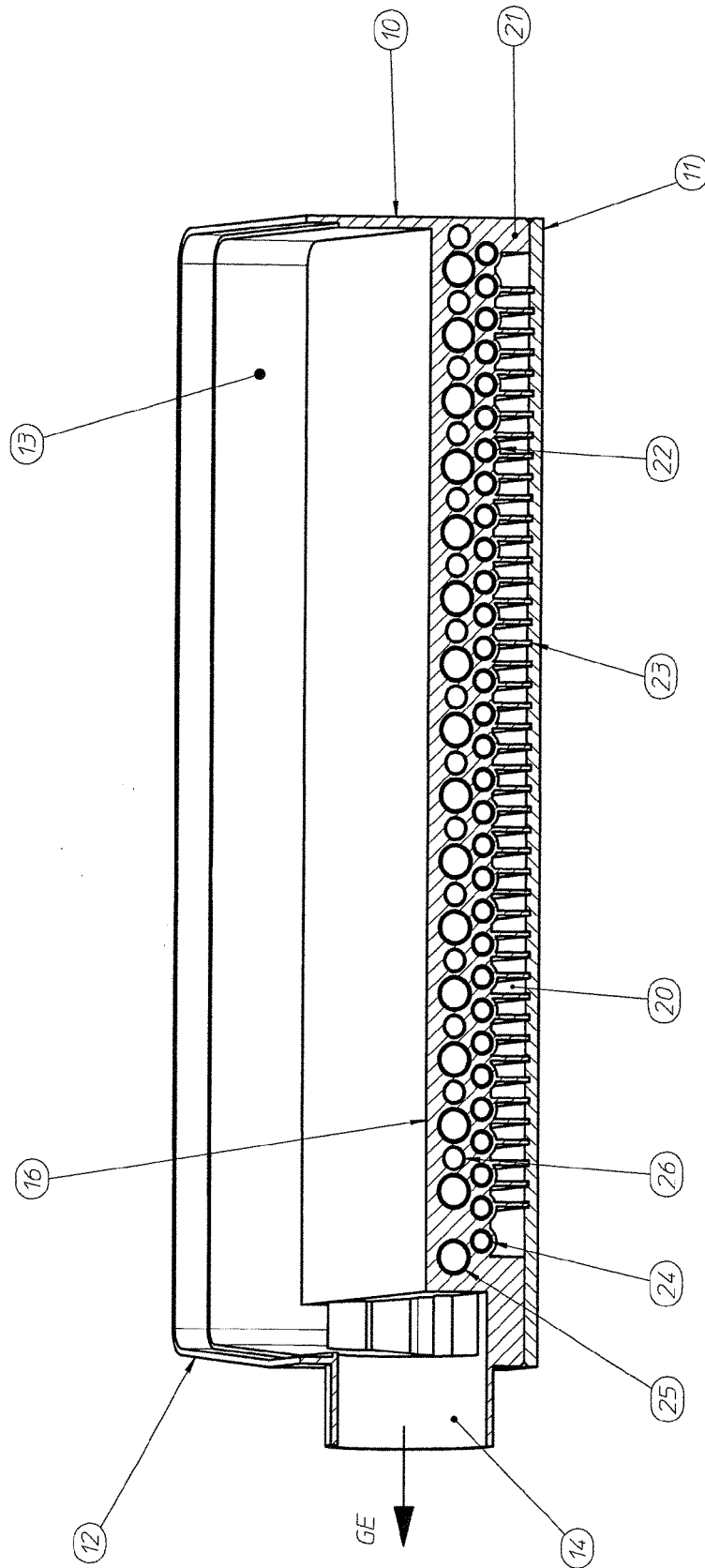


Fig. 4

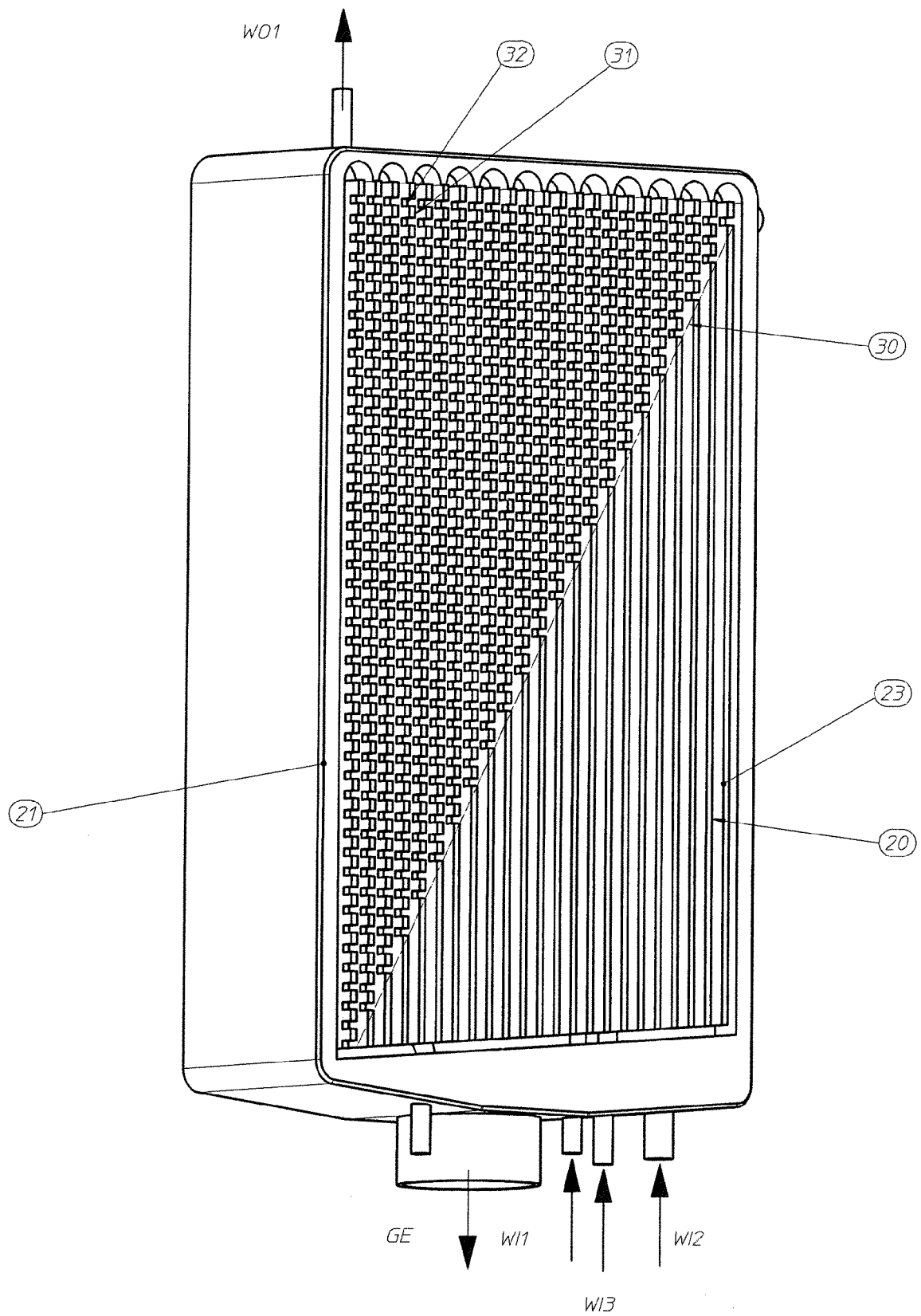


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 14 15 1589

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			F28D F28F F24H F24D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 April 2014	Examiner Vassoille, Bruno
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 14 15 1589

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17-04-2014

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