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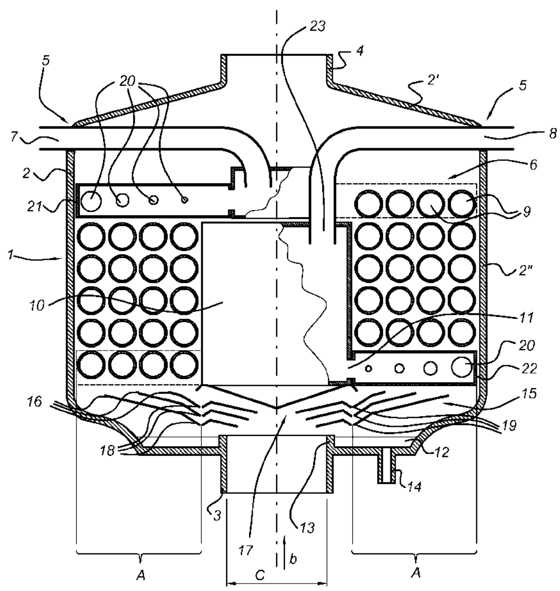
Remarks:
In accordance with Article 14(2), second sentence EPC the applicant has filed a text with which it is intended to bring the translation into conformity with the original text of the application.

(54) Condensing heating appliance with flue gas vent fitting with heat exchanger

(57) The invention relates to an assembly comprising a condensing heating appliance provided with a burner, a heating appliance heat exchanger, and a waste gas outlet, and further comprising a flue gas vent fitting (1) connected up to the waste gas outlet, the said flue gas vent fitting comprising a thermally insulating housing (2) provided with a flue gas inlet connecting end (3) and a flue gas outlet connecting end (4) positioned substantially opposite each other, and a heat exchanger (6) in the housing (2) and concentrically around the connecting line of the connecting ends (3,4), wherein the heat exchanger (6) is provided with parallel-connected, mutually concentric heat exchange elements (9).

Fig 1



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Description

Background of the invention

[0001] The invention relates to an assembly comprising a condensing heating appliance provided with a burner and a heating appliance heat exchanger.

[0002] The recovery of thermal energy from flue gas or waste gas with the aid of a heat exchanger is commonly known per se. Within the literature, various applications are known wherein a water heater or a boiler is provided with a heat exchanger in or around a flue.

[0003] For instance, US 4.175.518 describes a hot water boiler provided with a flue. The flue is interrupted by means of a flared housing in which a heat exchanger coil is fitted. Water from the boiler circulates through this heat exchanger coil. Since water from the boiler is circulated through the heat exchanger, heated or preheated water will generally be recirculated, whereby the heat extraction capacity of the heat exchanger will be limited. In addition, pumping capacity will be necessary for the circulation of the water. Moreover, the heat exchanger is provided with a set of diffuser plates at the inlet and outlet, so that the resistance of this device will be considerable. The system according to this document also recirculates the hot, already heated water without it being tapped. As a result, energy loss occurs.

[0004] GB 2.116.299 describes a boiler provided with a heat exchanger in the flue. Here water from a cold water storage tank is fed in counterflow through a heat exchanger present in the flue, so that this cold storage water is heated as it is fed back to the storage tank. In addition, a further cladding is fitted around the flue, whereby further heat is recovered. Air from a building is fed along the flue and fed back into the building. Since a water supply of cold water from a large storage vessel is recirculated along the heat exchanger, the effect will ultimately be limited.

[0005] US 3.916.991 describes a gas furnace provided with a flue in which a heat exchanger is fitted. In this embodiment, a flue is provided with an inner pipe which over a portion of its length is perforated. In addition, a coiled heat exchange duct is wound around this inner pipe. An insulated outer pipe is then fitted around this whole. The water which is circulated through the heat exchanger then surrenders its heat again via a secondary radiator, for example in order to heat a room within a building. Such a device demands a pump with considerable capacity. In addition, the resistance of such a device, as a result of the perforated pipe, is considerable. Furthermore, through the use of first and second heat exchangers, the efficiency of the device is limited.

[0006] WO 2005/106331 describes a heat recovery system for a waste gas flow. Here, a flue according to the document is surrounded by a water space. In addition, a heat exchange coil is fitted around the waste gas pipe. Fitted around the water space is an insulating outer jacket. The document is unclear about the exact working of the device, in particular the interaction between the water space and the heat exchange coil remains unclear.

[0007] US 7.360.507 describes an energy saving device which is coupled or connected to a standard gas boiler. Here, a helical heat exchange line is fitted around a flue, whereby feed water is preheated by means of waste gas. A hot water tank of a boiler is here surrounded by a cladding. Between the hot water tank and the cladding is an air space and this is connected to a vent pipe. The document makes clear that this vent pipe is not the waste gas pipe. Hot air which escapes from the device via the vent pipe is led through a pipe surrounded by a heat exchanger. Thermal energy is hence recovered from air which escapes from the boiler device and which, according to the description, is not the waste gas of the heating burner.

[0008] WO 2006/059215 describes a device for the recovery of waste gas heat of a domestic boiler. Here, a flue is provided with a heat exchanger mounted therein, and the flue is provided with a further cladding, combustion air for the boiler being fed between these two claddings.

[0009] US 4.893.672 describes a heat exchanger having a series of helical tubes in a housing which is provided with an outlet standing at right angles to an inlet. An application of this heat exchanger is not discussed. The heat exchanger with helical tubes is arranged such that not only does a liquid follow a helical path through the helical tubes, but also the medium which exchanges the heat therewith, since the helical tubes mutually connect. As a result of its design, the device has a relatively high resistance.

[0010] WO 2006/051266 describes a heat exchanger for a boiler. The heat exchanger has a housing having a heat exchanger in a receptacle for condensation water of waste gases. This heat exchanger thus absorbs heat from the condensation water, which reabsorbs heat from the waste gases. The efficiency of the heat exchanger is hereby limited, however.

[0011] US 2008/282996 or WO 08/138128 describes a heat exchanger for extracting heat from waste gases. A bundle of tubes is fitted as a coil around a flow duct. The flow duct has a closure and outflow openings for the closure and transversely to the longitudinal direction of the duct. Waste gas must then change flow direction twice, whereupon it is fed in counterflow along the tubes so as to eventually flow back in again past the closure via further inflow apertures which open the duct transversely to the longitudinal direction of the duct. Here too, there is the issue of a considerable flow resistance, so that, particularly at low flow velocities or a relatively low temperature, the heat recovery will be small.

[0012] US 2005/133202 describes a heat exchanger for a gas turbine, which is provided with a housing having an inlet and outlet in line. A tube part provided with a butterfly valve is fitted in line with the inlet and outlet in the housing, with the bottom side and top side each at a distance from the inlet and outlet respectively. Wound helically around the tube is a number of tubes. By means of the butterfly valve, the quantity of waste gas through the tube part and along the tubes can be partially regulated. The tube part is provided to, under full load, lead the over-hot waste gas around the heat exchanger. In case of use for a high-efficiency combi boiler, such a facility is unnecessary.

[0013] US 4449571 describes a heat exchanger wherein the flow direction of waste gas reverses. Placed on top of the outer housing is a "dome", the function of which is unclear. The description talks about condensation, apparently of water flowing out of the heat exchange elements, but also about boilover protection and air separators. In case of use in, for example, a high-efficiency combi boiler, wherein the waste gases have a limited temperature, such a use appears unnecessary. This heat exchanger, too, further has a relatively large pressure drop.

[0014] JP-59-147993 describes a heat exchanger provided with a housing containing a pipe winding around a water drum. The helical tube emerges in the water drum. The pressure drop over the heat exchanger will once again be relatively large.

[0015] The energy content of flue gases of, in particular, a modulating high-efficiency combi boiler is still considerable, however, despite the fact that this temperature is normally lower than 90°C. On the one hand because in tapping operation, that is to say the draw-off of normally domestic hot water, the CH (central heating) return temperatures lie normally above 60°C, whereby the temperature of the flue gases or waste gases still lies well above the condensation point and about 11% of the originally supplied energy can still be present in the flue gases. On the other hand, the boiler, even in CH operation, will in many cases fail to reach the desired "low" temperature, simply because the connected outlets or emitters are not designed for this purpose and/or because the boiler, with associated control system, is incapable of delivering the demanded low quantity of energy. In both cases, the supply and return temperature is higher than desired and the flue gases still contain a considerable quantity of sensible heat and condensation heat. There is hence a need for an improved recovery of heat from flue gases or waste gases.

Summary of the invention

[0016] The object of the invention is to provide an improved heat recovery from waste gases.

[0017] A further or supplementary object of the invention is to provide an improved heat recovery from waste gases of a heating installation.

[0018] A further or supplementary object of the invention is to provide an improved heat recovery from waste gases of a heating installation which is insertable in flues of, for example, high-efficiency combi boilers.

[0019] A further or supplementary object of the invention is to provide an improved tapping output of, for example, high-efficiency combi boilers.

[0020] To this end, the invention provides an assembly comprising a condensing heating appliance provided with a burner, a heating appliance heat exchanger arranged to exchange at least a part of the heat of the combustion gases with a liquid flowing through the heating appliance heat exchanger, and a waste gas outlet, and further comprising a flue gas vent fitting connected up to the waste gas outlet, the said flue gas vent fitting comprising a thermally insulating housing provided with a flue gas inlet connecting end and a flue gas outlet connecting end positioned substantially opposite each other, in one embodiment in line with each other, and a heat exchanger in the housing and concentrically around the connecting line of the connecting ends, which heat exchanger is arranged to be, during operation, in heat-exchanging contact with the flue gas of the heating appliance and is provided with a heat exchanger inlet and a heat exchanger outlet, wherein the heat exchanger is provided with parallel-connected, mutually concentric heat exchange elements.

[0021] As already indicated above, in the case of condensing heating appliances, such as, for example, high-efficiency combi boilers, the efficiency is often already very high, certainly in the usual operating modes. In practice, however, a considerable heat loss through the waste gases is nevertheless evident. As a result of the low pressure drop over the flue gas vent fitting according to the invention, and by virtue of the fact that the flue gas vent fitting is suitable for efficiently recovering residual heat from varying flows of flue gas, the device according to the invention is especially suitable for use on existing installations ("retrofit"), as well as on existing designs of installations, so that the output thereof increases.

[0022] A not insignificant problem with known principles and methods of preliminary heat recovery from flue gases, which problem will certainly arise if it is wished to apply such heat recovery retrospectively (in the case of pre-installed boilers), is the increased pressure drop on the flue gas side, which can ensure that boilers are no longer able to function at full capacity. An excessive rise in resistance on the water side can ensure that the surrendered hot water capacity can no longer be recovered and occasional partial blockages in the heat exchanger as a result of the large quantities of condensation water which is formed can ensure a widely varying combustion quality. In addition, the widely varying flue gas flow in volume terms (modem boilers are modulating and consequently give rise to widely varying flue gas flows) can ensure that the specially fitted heat exchanger is used optimally for only a limited part of the time. These problems do not apply just to retrofit application, but also to newly produced boilers. In order to overcome the increased resistance on the flue gas side, a stronger fan can, of course, be chosen, but this will give rise to increased electricity consumption on the part of the boiler, whilst an excessive increase in resistance on the sanitary fitting side remains a problem also for newly produced boilers. The device according to the invention makes a flue-gas-side resistance of less than 20 Pa possible.

[0023] A heating appliance in which the outlined problems especially arise is a condensing heater provided with a burner, a heat exchanger for delivering at least a part of the heat of the combustion gases to a liquid, and a waste gas outlet. In such an appliance, a part of the heat is recovered from the combustion gases or waste gases by condensation of the water vapour in these gases. To this end, the liquid to be heated is pre-heated by first bringing this into heat-exchanging contact with the waste gases. The waste gas outlet is then after this in heat-exchanging contact. The water vapour is formed by combustion of the hydrogen component in gases or liquids to be burnt, generally hydrocarbons. As set out above, the full condensation heat is not normally recovered. The temperature of the waste gases of such a heating appliance is generally lower than about 90°C. In high-efficiency combi boilers, in particular, the waste gases will generally have a temperature below 65°C.

[0024] One particular version of such a heating appliance is a so-called "condensing boiler" or "high efficiency condensing boiler". In this, not only is a liquid (normally water) for a central heating system heated, which liquid is reused, for example, to heat a building, but also domestic water too is heated. The flue gas fitting of the invention is useful, in particular, on a high-efficiency combi boiler for domestic use. A high-efficiency combi boiler normally has a housing comprising a burner, a heat exchanger in order to bring a fluid, normally water, into heat-exchanging contact with the hot waste gases of the burner, and a waste gas outlet, which guides the waste gases outside the housing. In some arrangements, inflowing air for the burner is pre-heated by bringing it into contact with outflowing waste gases. In a high-efficiency combi boiler, domestic water is also heated, normally by means of a further domestic water heat exchanger. A high-efficiency combi boiler normally has a control device which is operatively connected to a pump for the fluid, a pump for the domestic water, a supply of air and fuel to the burner. The control device is designed to mutually regulate these parts, so that the waste gas temperature remains relatively low, yet sufficient heating capacity is nevertheless delivered. In addition, further temperature meters or temperature sensors are normally provided, which are operatively connected to the control device and which record the temperature of the outflowing fluid and the outflowing domestic water. Temperature probes can even be provided, which relay the inflow temperatures thereof to the control device.

[0025] Another problem concerns the evacuation of the condensation water. For some boilers, it is problematic when the said condensation water is drained back to the boiler via the flue gas vent, because the condensation water then re-evaporates and the recovered condensation heat is negated by the evaporation energy which is extracted there. And then there is still the problem of the physical applicability of the heat recovery unit on the flue gas side.

[0026] In one embodiment, the flue gas vent fitting is further provided between the flue gas inlet connecting end and the heat exchanger with a concentric flow distributor, in one embodiment provided with mutually concentric flow distributor elements arranged to distribute flue gas over the concentric heat exchange elements, in a further embodiment the flow distributor comprises a plurality of concentrically placed cones, arranged to distribute the supplied flue gases over the heat exchange elements, including during part-load operation, in proportion to the heat-exchanging area of the individual concentric heat exchange elements.

[0027] A good heat exchange can hence take place, even if the supply of waste gases varies.

[0028] In one embodiment of the flue gas vent fitting, the flow resistance of the concentric heat exchange elements for a through-flowing liquid is less in the outward direction. In one embodiment, the heat exchanger is provided on the water side with flow restrictions, which distribute the supplied water flow over the heat exchange elements in proportion to the heat-exchanging area of the individual concentric heat exchange elements.

[0029] The heat-absorbing capacity over the area of the heat exchanger is hence able to be adjusted; in one embodiment, through the adjustment of the flow resistance, the heat-absorbing capacity per unit of area for successive concentric heat exchange elements is substantially equal.

[0030] In one embodiment, the flue gas vent fitting is further provided with a storage vessel for heat exchange fluid, mounted on the connecting line of the flue gas inlet connecting end and the flue gas outlet connecting end and in fluid connection with the heat exchanger outlet. In one embodiment thereof, the diameter of the storage vessel is greater than or equal to the diameter of the flue gas inlet connecting end. The storage vessel increases the heat-absorbing capacity of the flue gas vent fitting. By fitting the heat exchanger concentrically around the storage vessel and, moreover, choosing the diameter of the storage vessel greater than the flue gas inlet and flue gas outlet, it is possible to prevent the return flow of condensation water via the inlet of the flue gas vent fitting. In one embodiment, the storage vessel is circular-cylindrical.

[0031] Alternatively or additionally, the invention relates to a flue gas vent fitting with heat recovery function, comprising a thermally insulating housing, which is provided with a flue gas supply end and a flue gas evacuation end and in which a concentric heat exchanger is provided, wherein in the flue a course to a concentric annular passage is installed, and wherein the heat exchanger comprises concentric heat exchange elements, the smallest of which has an inner diameter which is greater than or equal to the diameter of the flue gas supply end.

[0032] Alternatively or additionally, the invention relates to a flue gas vent fitting comprising a thermally insulating housing provided with a flue gas inlet connecting end and a flue gas outlet connecting end positioned substantially opposite each other, in one embodiment in line with each other, and a heat exchanger in the housing and concentrically around the connecting line of the connecting ends, which heat exchanger is arranged to be, during operation, in heat-exchanging contact with the flue gas and is provided with a heat exchanger inlet and a heat exchanger outlet, wherein the heat exchanger is provided with parallel-connected, concentric heat exchange elements.

[0033] The below-stated embodiments can be combined with this aspect of the invention or above-stated aspects.

[0034] In one embodiment, the heat exchanger comprises a multi-spiral heat exchanger with ribbed tubes. A larger heat-exchanging area is hereby formed.

[0035] In one embodiment, the heat exchanger comprises a spiral plate exchanger containing vertical ribs or helical fitted ribs, which enlarge the heat-recovering area and improve the heat transfer and condensate evacuation.

[0036] In one embodiment, the heat exchanger comprises concentric cylinders containing, in use, vertical ribs or helical ribs which enlarge the heat recovery area and improve the heat transfer and condensate evacuation.

[0037] In one embodiment, the heat exchange elements, on their outer side, are provided with a hydrophobic coating for the rapid evacuation of water droplets.

[0038] In one embodiment, the flue-gas side passage which is left after the installation of the concentric heat exchanger, in particular the sum of the spaces between the different concentric heat exchanger segments, is here dimensioned, in terms of number and mutual spacing, such that the flue-gas-side resistance is thus adapted to the desired heat recovery efficiency. In particular, the passage can be chosen such that the flue-gas-side resistance is less than 20 Pa.

[0039] In one embodiment, the flue-gas-side passage which is left after the installation of the concentric heat exchanger, in particular the sum of the spaces between the different concentric heat exchanger segments, is here dimensioned, in terms of number and mutual spacing, such that a minimal flue-gas-side basic resistance is thereby realized, which, by means of a flow restriction to be placed on top of the concentric exchanger, is increased to the maximally permissible flue-gas-side resistance in order that the maximum recovery efficiency can be realized for each application. In particular, the passage can be chosen such that the flue-gas-side resistance is less than 20 Pa.

[0040] In one embodiment, the concentric heat exchanger is provided on the inflow side with a flue gas distributor, comprising in one embodiment a plurality of concentrically placed cones, arranged to distribute the supplied flue gases over the heat exchanger. including during part-load operation, in proportion to the heat-exchanging area of the individual concentric heat exchanger segments.

[0041] In one embodiment, the heat exchanger is provided on the water side with flow restrictions, which distribute the supplied water flow over the heat exchanger in proportion to the heat-exchanging area of the individual concentric heat exchanger segments.

[0042] In one embodiment, the flue gas heat exchange fitting comprises in the centre of the heat exchanger a water-holding container, in particular in the form of a cylinder, and having a diameter which is at least equal to the diameter of the flue gas supply end.

[0043] In one embodiment, the flue gas distributor is provided with condensation water collection and evacuation facilities for the separate evacuation of condensation water, in vertical application and the prevention of backflow of the condensation water into the flue gas supply end.

[0044] In one embodiment, the housing is provided with one or more condensate-collecting spaces having an evacuation facility coupled thereto, so that condensation water, both in the vertical and horizontal position of the product, can be collected and evacuated outside the housing.

[0045] In one embodiment, the condensation water drain comprises a first discharge opening in liquid connection with the flue gas inlet connecting end, a second discharge opening in liquid connection outside the housing, and a shut-off valve by which the condensation water drain can be brought adjustably into liquid connection with the flue gas inlet connecting end and with the second discharge opening. In one specific embodiment, the condensation water drain comprises a duct having the first discharge opening, and the second discharge opening can be terminated upstream of the first discharge opening in the duct, which second discharge opening interrupts the duct. The condensation evacuation can hence be adapted to any desired use and appliance.

[0046] In one embodiment, the flue gas vent fitting is directly coupled to a plate heat exchanger in the thermally insulating housing for heat transfer between central heating water and sanitary domestic water in the thermally insulating housing.

[0047] In one embodiment, the flue gas vent fitting is further provided with an air feed duct, which is likewise fitted concentrically around the housing and which in one embodiment is provided at top and bottom with circular connecting ends.

[0048] In one embodiment, the flue gas vent fitting is further provided with rapid couplings with integrated shut-off valve, or slide couplings, so that the unit can be quickly and easily uncoupled from and/or fastened to the flue gas evacuation line.

[0049] In one embodiment, the concentric heat exchanger is directly coupled to a plate heat exchanger or fluid storage vessel, which components in one embodiment are integrated in the thermally insulating housing of the flue-gas vent fitting. An inherently conventional plate heat exchanger, which is used in systems, for example, to exchange heat between domestic water and heating water, can herewith be integrated in the fitting.

[0050] The flue gas vent fitting can be integrated outside an existing installation in a flue or flue. Alternatively, the flue gas vent fitting can be fitted, if so desired, inside a housing of an installation such as a high-efficiency boiler or similar device. The device can here be a retrofit or be integrated in a design of a new installation.

[0051] The invention further relates to a device provided with one or more characterizing measures described in the appended description and/or shown in the appended drawings.

[0052] It will hopefully be clear that the different aspects mentioned in this patent application can be combined and each can separately enter into consideration for a spin-off patent application.

Brief description of the figures

[0053] In the appended figures, an embodiment of a heat recovery fitting is represented, in which:

Figure 1 shows a longitudinal section of an embodiment of a heat recovery fitting with spiral heat exchanger;
Figure 2 shows a perspective view of an embodiment of an alternative heat exchanger for the heat recovery fitting;
Figure 3 shows a longitudinal section of an embodiment of an alternative heat exchanger for the heat recovery fitting;
Figure 4 shows a longitudinal section of an embodiment of another alternative heat exchanger for the heat recovery fitting;
Figure 5 shows an alternative embodiment of a condensation water drain.

Description of embodiments

[0054] Fig. 1 shows an embodiment of a heat recovery fitting 1. The heat recovery fitting 1 is provided with an insulating housing 2, which is provided with a waste gas inlet 3 and an outlet 4 provided substantially opposite the inlet 3. An insulating housing 2 of this type is normally a plastics housing. In particular, according to this embodiment, the inlet and the outlet 4 are here situated in line opposite each other, whereby it is possible to keep the inlet-side counterpressure of the device as small as possible. In particular, in this embodiment it has proved possible to limit the pressure drop over the heat recovery fitting 1 to below 20 Pascal by these and various other measures. In this embodiment, the insulating housing 2 is further provided with connecting passages 5 for connecting up heat-exchanging fluid to the heat exchanger 6 provided in the insulating housing 2.

[0055] The heat exchanger 6 has a flow area A for bringing waste gas from the inlet 3 into heat-exchanging contact and leading it off to the outlet 4. This flow aperture is concentric around a connecting line through the inlet 3 and the outlet 4. The heat exchanger 6 has an inlet 7 and an outlet 8 for a heat-exchanging fluid, in this case water, in particular domestic water, and an outlet 8 for the heat-exchanging fluid.

[0056] In this embodiment, the heat exchanger 6 comprises a series of the concentric heat exchanger elements 9. In this example, four concentric heat exchanger elements 9 are provided. These concentric heat exchanger elements 9 are in one embodiment each fitted concentrically around a previous heat exchanger element 9. It is hereby possible to further minimalize the flow resistance.

[0057] In this embodiment, the heat exchanger 6 is provided in its centre with a reservoir 10 for heat exchanging medium, in this particular case water, such as domestic water, as stated earlier. The heat exchanger elements 9 are fitted concentrically around this storage vessel 10. The storage vessel 10 is provided with an inlet 11 and an outlet 23 for the heat exchanging medium. In order to prevent condensation water from possibly flowing back towards the inlet, the diameter B of the storage vessel 10 is in this embodiment at least equal to the diameter C of the inlet 3. In particular, the diameters of the heat exchanging elements 9 are greater than or maximally equal to the diameter of the inlet 3. As a result, the chance of condensation water flowing back via the inlet is considerably reduced. Moreover, the storage vessel 10 increases the thermal capacity of the heat recovery fitting 1.

[0058] In this embodiment, the housing is provided with a condensation water receiving part 12. In addition, the inlet is provided with a circumferential vertical rim 13, whereby flowback of condensation water collected in the condensation water receiving part 12 back into the inlet is considerably reduced. Moreover, the condensation water receiving part is provided with a condensation water drain 14. Between the inlet 3 and the flow area of the heat exchanger 6, the heat exchange fitting 1 is provided with a flow distributor 15 for distributing oncoming air over the heat exchanger 6. In this embodiment, this flow distributor 15 is a series of, in the direction of flow, successive dish-shaped elements 16. For the volume-related distribution of the inflowing air, the flow distributor dishes or dish-shaped elements are provided with flow holes 17 around a connecting line between the inlet 3 and the outlet 4. Viewed from the direction of flow, the dish-shaped elements are respectively provided with openings or flow holes 17 of diminishing size. As a result of the adaptation of the diameter of the openings, the flow is distributed on a volume basis. Alternatively, a simple flow distributor is a perforated plate between the heat exchanger 6 and the inlet 3. This can have a greater flow resistance, however, than the embodiment of Figure 1.

[0059] The dish-shaped elements 16 are respectively further provided with a concentric condensation water chute 18, which chutes are positioned concentrically around the inlet 3. Hence condensation water flowing down from, for example, the heat exchange elements 9 can be caught by the dish-shaped elements 16 of the flow distributor 15 and will flow towards the chutes 18. By further providing these chute elements 18 with holes 19, the water will collect in the collecting chamber 12 of the housing 2.

[0060] In order to make the heat exchanger 6 suitable for a modulating boiler, wherein the quantity of waste gas can be regulated in accordance with the desired capacity of a device in which this heat recovery fitting 1 can be used, the concentric heat exchange elements 9 are in this embodiment provided with restrictions 20, whereby the volume flow through each heat exchange element 9 is mutually adapted. In the embodiment, the flow limitations are respectively smaller towards the centre, whereby the flow resistance increases and hence the flow rate decreases. By means of a flow distributing block 21, the heat exchange elements 9 are here connected in parallel with one another. Moreover, the flow restrictions are here provided in the flow distributing block 21. The flow rate in the outermost heat exchange element 9 is greater than in the innermost heat exchange element 9 as a result of the flow restriction 20. The heat-absorbing capacity of each heat exchanging element can hence be adapted in relative terms. As a result, in this embodiment, the heat-absorbing capacity for each concentric heat exchange element end up standing in relation to the area of the heat exchange element. A good heat exchange with all heat exchange elements 9 will hence be achievable even in the event of a lower flow rate of flue gases and/or domestic water. It is clear, after all, that the heat exchanger and flow distributing means are arranged such that, both with a low flow rate of waste gases or flue gases and with a maximal flow rate of waste gases, the heat exchanger 6 and the flow distributing elements are designed such that the waste gases flow along all the heat exchanger elements 9 and there exchange their heat with the heat exchanging fluid.

[0061] At the outlets of the heat exchange elements 9 a collecting block 22 is provided, here once again provided with flow restrictions 20. The collecting block 22 connects up to the inlet 11 of the storage vessel 10. The outlet 23 of the storage vessel 10 is in fluid connection with the outlet 8 of the heat recovery fitting 1.

[0062] The insulating housing 2 is in this embodiment made up of two elements 2' and 2" mountable one upon the other, whereby the housing can be easily divided into two parts. In this way, the heat exchanger 6 can be easily removed from the housing for cleaning, for example. Furthermore, the inlet 3 and the outlet 4 can be provided with connecting parts or connecting means, whereby the heat exchanging fitting 1 can be easily and quickly connected into a flue.

[0063] In one embodiment, the outer housing can be provided with a further enveloping housing (not represented), whereby a channel is formed, limited by and between the housing 2 and an outer housing and along which air can be fed to a boiler. The air can thereby be preheated.

[0064] Figures 2 and 3 show respectively a perspective view and a longitudinal section of an alternative heat exchanger 6 for the heat recovery fitting 1. In this case, a heat exchanger element is provided in spiral or helical arrangement around the connecting line through the inlet 3 and the outlet 4. In particular, the heat exchanger is fitted in spiral arrangement around a core. In the shown embodiment, this core comprises a storage vessel 10, as described above. The circuits of the heat exchanger 6 are mutually connected to the inlet 7, and the circuits are mutually connected in liquid connection to the collecting block 22, which is in liquid connection with the inlet 11 of the storage vessel 10. Hence each circuit forms a heat exchanger element 9 and these are parallel-connected.

[0065] In Figure 4 is shown an alternative heat exchanger 6 around a storage vessel 10, as described above. The heat exchange elements 9 are connected in mutually parallel arrangement by means of a flow distributing block 21 and a collecting block 22. The heat exchanger comprises fluid ducts in liquid connection with the flow distributing block 21 and the collecting block 22. Running along and parallel to these fluid ducts are ducts for the waste gas. The fluid ducts can run parallel to the longitudinal axis of the storage vessel 10, or slightly helically or helicoidally, as in the shown embodiment.

[0066] In Figure 5, an alternative embodiment of a condensation water drain part for, for example, an embodiment of the flue gas vent fitting of Figure 1 is represented. In this case, the condensation water receiving part 12 is provided with a concentric chute below condensation water chutes 18, in particular below the holes 19 therein, of the flow distributor 15. The concentric chute has a slope in the direction of the condensation water drain 14. The concentric chute is here provided with an outflow opening in line with, in operation above, the condensation water drain 14. The condensation water drain 14 can be provided with a shut-off valve 30, such as the represented screw cap with cap nut. The condensation water drain can further comprise a drainage chute, which forms a channel, as a component part of the condensation water drain 14, towards the inlet 3. When the shut-off valve 30 is installed, the condensation water then runs via the drainage chute and the inlet 3 out of the heat exchanger fitting 1. If the shut-off valve 30 is removed, a discharge opening is formed outside the housing. The drainage chute has further downstream a discharge opening into the inlet 3.

[0067] It will hopefully be clear that the above description is included to illustrate the working of preferred embodiments of the invention, and not to limit the scope of the invention. Based on the above account, a number of variations which fall under the spirit and the scope of the present invention will be evident to a person skilled in the art.

Claims

1. Assembly comprising a condensing heating appliance provided with a burner, a heating appliance heat exchanger arranged to exchange at least a part of the heat of the combustion gases with a liquid flowing through the heating appliance heat exchanger, and a waste gas outlet, and further comprising a flue gas vent fitting connected up to the waste gas outlet, the said flue gas vent fitting comprising a thermally insulating housing provided with a flue gas inlet connecting end and a flue gas outlet connecting end positioned substantially opposite each other, in one embodiment in line with each other, and a heat exchanger in the housing and concentrically around the connecting line of the connecting ends and which is arranged to be, during operation, in heat-exchanging contact with the flue gas of the heating appliance and which is provided with a heat exchanger inlet and a heat exchanger outlet, wherein the heat exchanger is provided with parallel-connected, mutually concentric heat exchange elements.

2. Assembly according to Claim 1, wherein the flue gas vent fitting is further provided between the flue gas inlet connecting end and the heat exchanger with a concentric flow distributor provided with mutually concentric flow distributor elements arranged to distribute flue gas over the concentric heat exchange elements, in one embodiment the flow distributor comprises a plurality of concentrically placed cones, arranged to distribute the supplied flue gases over the parallel, concentric heat exchange elements, including during part-load operation, in proportion to the heat-exchanging area of the individual concentric heat exchange elements.

3. Assembly according to one of the preceding claims, wherein the flow resistance of the concentric heat exchange elements for a liquid flowing through the heat exchanger elements is less in the outward direction, wherein in one embodiment the heat exchanger is provided on the water side with flow restrictions, which distribute the supplied water flow over the heat exchange elements in proportion to the heat-exchanging area of the individual concentric heat exchange elements.

4. Assembly according to one of the preceding claims, wherein the flue gas vent fitting is further provided with a storage vessel for heat exchange fluid, mounted on the connecting line of the flue gas inlet connecting end and the flue gas outlet connecting end and in fluid connection with the heat exchanger outlet, in one embodiment the diameter of the storage vessel is greater than or equal to the diameter of the flue gas inlet connecting end, and wherein in one embodiment in the centre of the heat exchanger is placed a water-holding container, in particular in the form of a cylinder, and having a diameter which is at least equal to the diameter of the flue gas supply end.

6. Assembly according to one of the preceding claims, wherein the flue gas vent fitting comprises a thermally insulating housing, which is provided with a flue gas supply end and a flue gas evacuation end and in which the concentric heat exchanger is provided, wherein in the flue a course to a concentric annular passage is installed, and wherein the heat exchanger comprises concentric heat exchange elements, the smallest of which has an inner diameter which is greater than or equal to the diameter of the flue gas supply end.

7. Assembly according to one of the preceding claims, wherein the heat exchanger, on the outer side, is provided with a hydrophobic coating, in one embodiment a PTFE-containing coating, for the rapid evacuation of water droplets.

8. Assembly according to one of the preceding claims, wherein the flue-gas-side passage which is left after the installation of the concentric heat exchanger, in particular the sum of the spaces between the different concentric heat exchanger segments, is dimensioned, in one embodiment in terms of the number and the mutual spacing of the heat exchanger segments, to adapt the flue-gas-side resistance to the desired heat recovery efficiency.

9. Assembly according to one of the preceding claims, wherein the flue-gas-side passage which is left after the installation of the concentric heat exchanger, in particular the sum of the spaces between the different concentric heat exchanger segments, is dimensioned, in terms of number and mutual spacing, such that a minimal flue-gas-side basic resistance is realized, which, by means of a flow restriction to be placed on top of, that is to say downstream of, the concentric heat exchanger, is increased to the maximally permissible flue-gas-side resistance in order that the maximum recovery efficiency can be realized for each application.

10. Assembly according to one of the preceding claims and provided with the flow distributor, wherein the flow distributor is provided with condensation water collection and evacuation facilities for the separate evacuation of condensation water in vertical application and the prevention of backflow of the condensation water into the flue gas supply end.

11. Assembly according to one of the preceding claims, wherein the housing is provided with one or more condensate-collecting holders, in one embodiment in functional connection with the condensation water receiving and evacuation facility of Claim 10, having a condensation water drain connected to the condensate-collecting holder and having a discharge opening outside the housing, so that condensation water, both in the vertical and horizontal position of the product, can be collected and evacuated outside the housing, in one embodiment the housing is provided with one or more condensate-collecting spaces having an evacuation facility coupled thereto, so that condensation water, both in the vertical and horizontal position of the product, can be collected and evacuated outside the housing, in one embodiment the condensation water drain comprises a first discharge opening in liquid connection with the flue gas inlet connecting end, a second discharge opening in liquid connection outside the housing, and a shut-off valve by which the condensation water drain can be brought adjustably into liquid connection with the flue gas inlet connecting end and with the second discharge opening, in one specific embodiment the condensation water drain comprises a duct having the first discharge opening, and the second discharge opening can be terminated upstream of the first discharge opening in the duct, which second discharge opening interrupts the duct.

12. Assembly according to one of the preceding claims, wherein the concentric heat exchanger is directly coupled to a plate heat exchanger or fluid storage vessel, which components in one embodiment are integrated in the thermally insulating housing of the flue-gas vent fitting.

13. Assembly according to one of the preceding claims, wherein the flue gas vent fitting is further provided with an air feed duct, which is likewise fitted concentrically around the housing and which is provided at top and bottom with circular connecting ends.

14. Assembly according to one of the preceding claims, wherein the condensing heating appliance comprises a heating appliance housing provided with the burner and the heating appliance heat exchanger, and the waste gas outlet reaches outside the heating appliance housing, and the flue gas vent fitting, outside the heating appliance housing, is connected up to the waste gas outlet.

15. Flue gas vent fitting, comprising the characterizing measures of Claim 1, wherein in one embodiment the flue gas vent fitting is further provided with rapid couplings with integrated shut-off valve, or slide couplings, so that the housing of the flue gas vent fitting can be quickly and easily uncoupled from or fastened to a waste gas outlet.

Fig 1

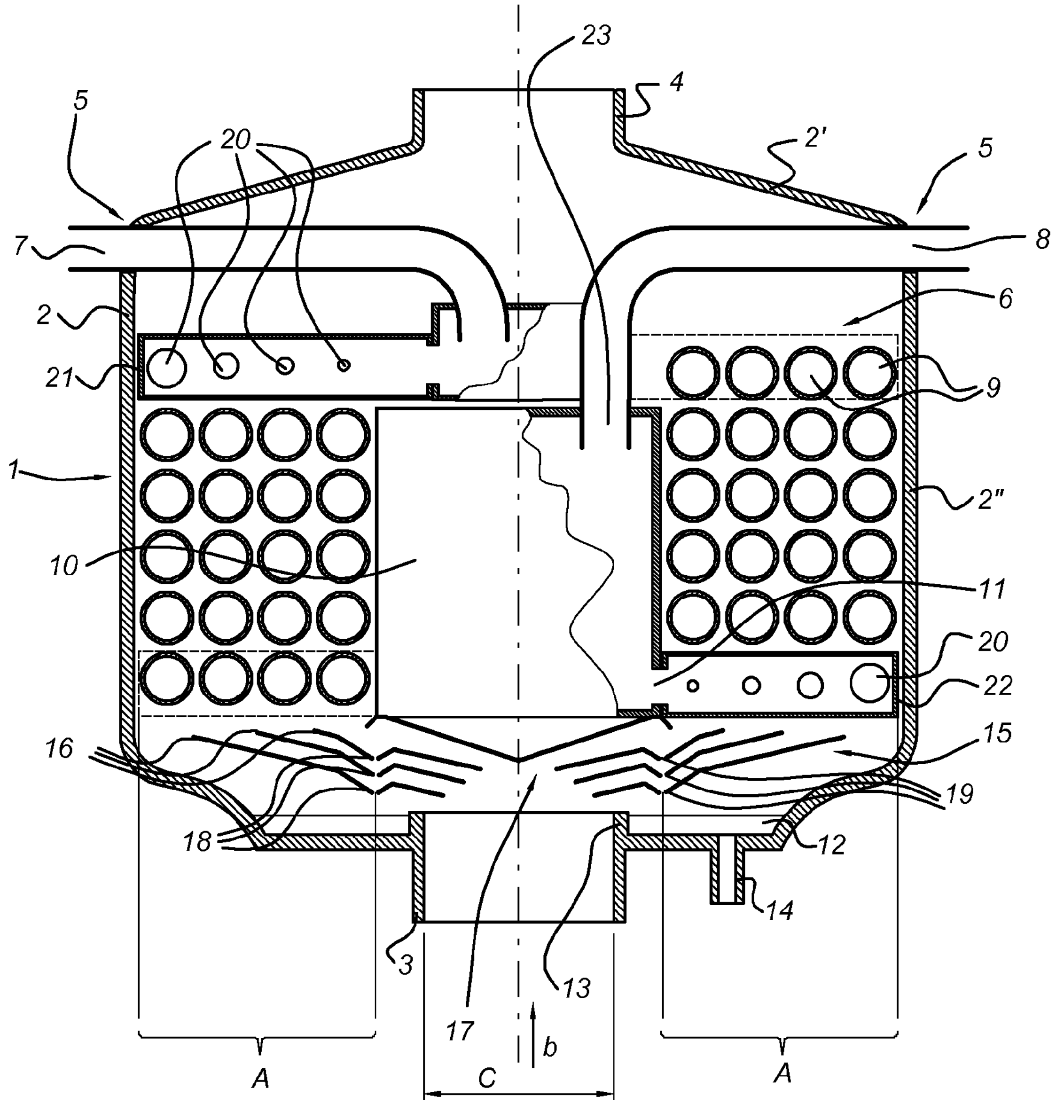


Fig 2

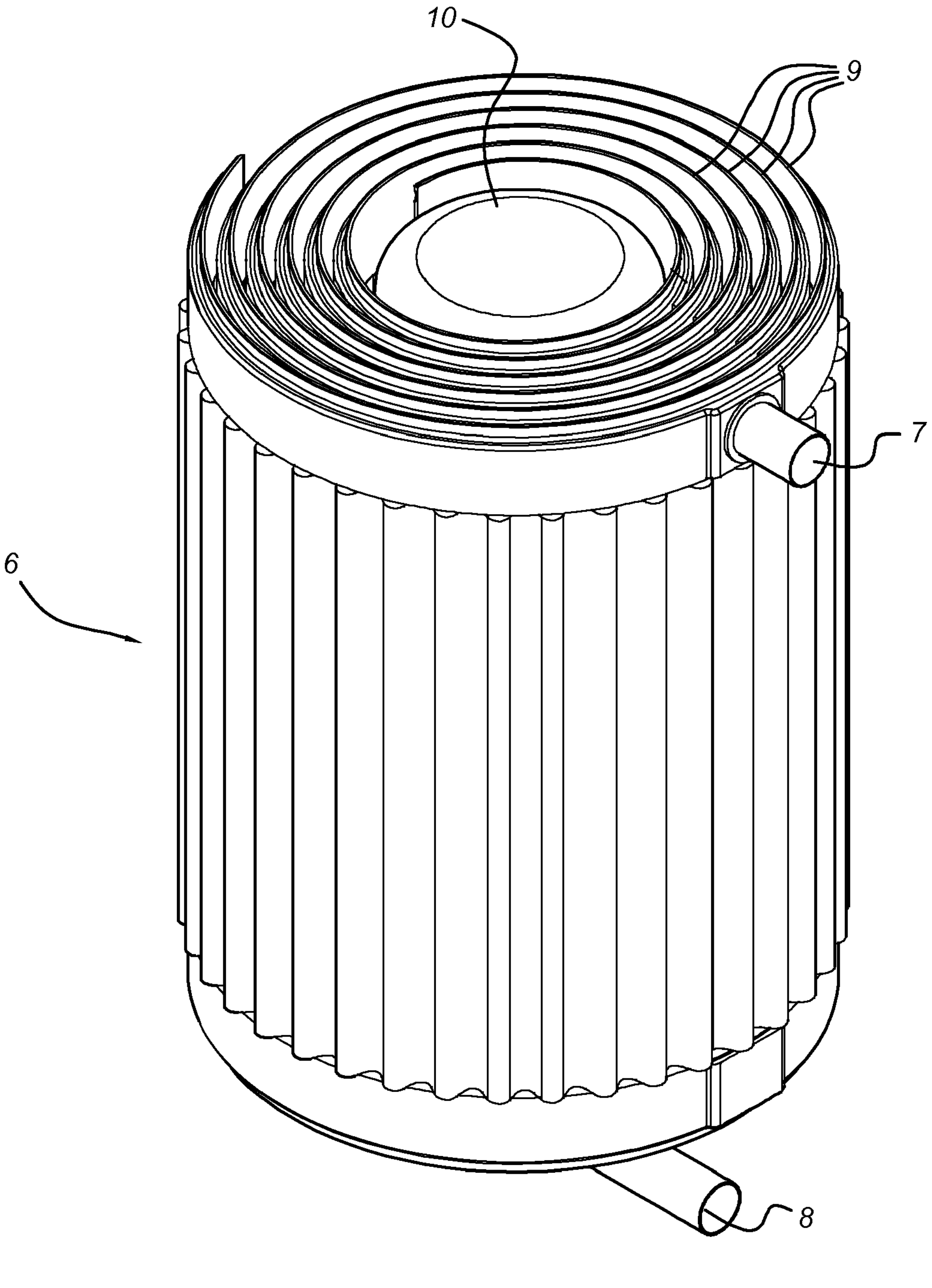


Fig 3

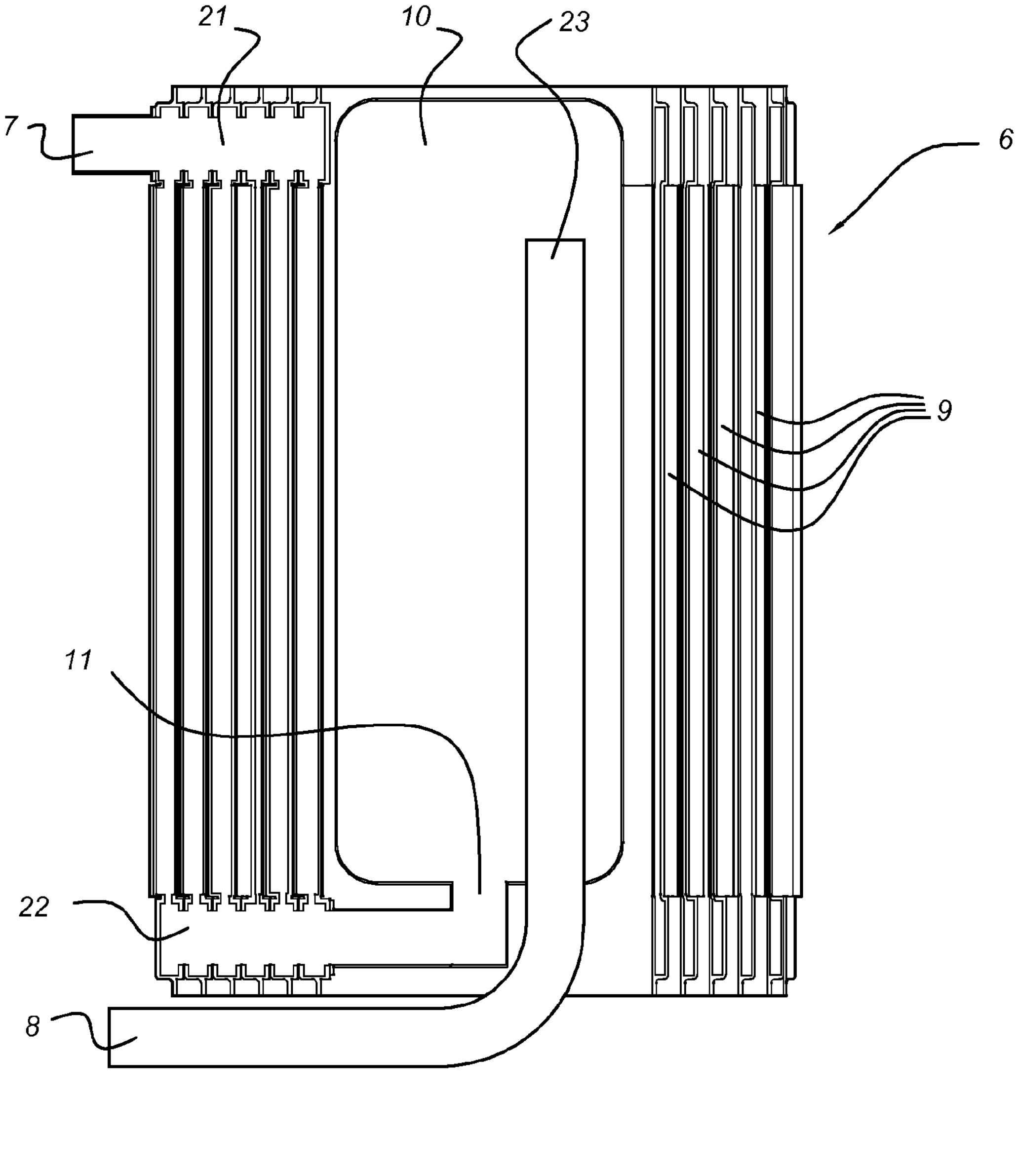


Fig 4

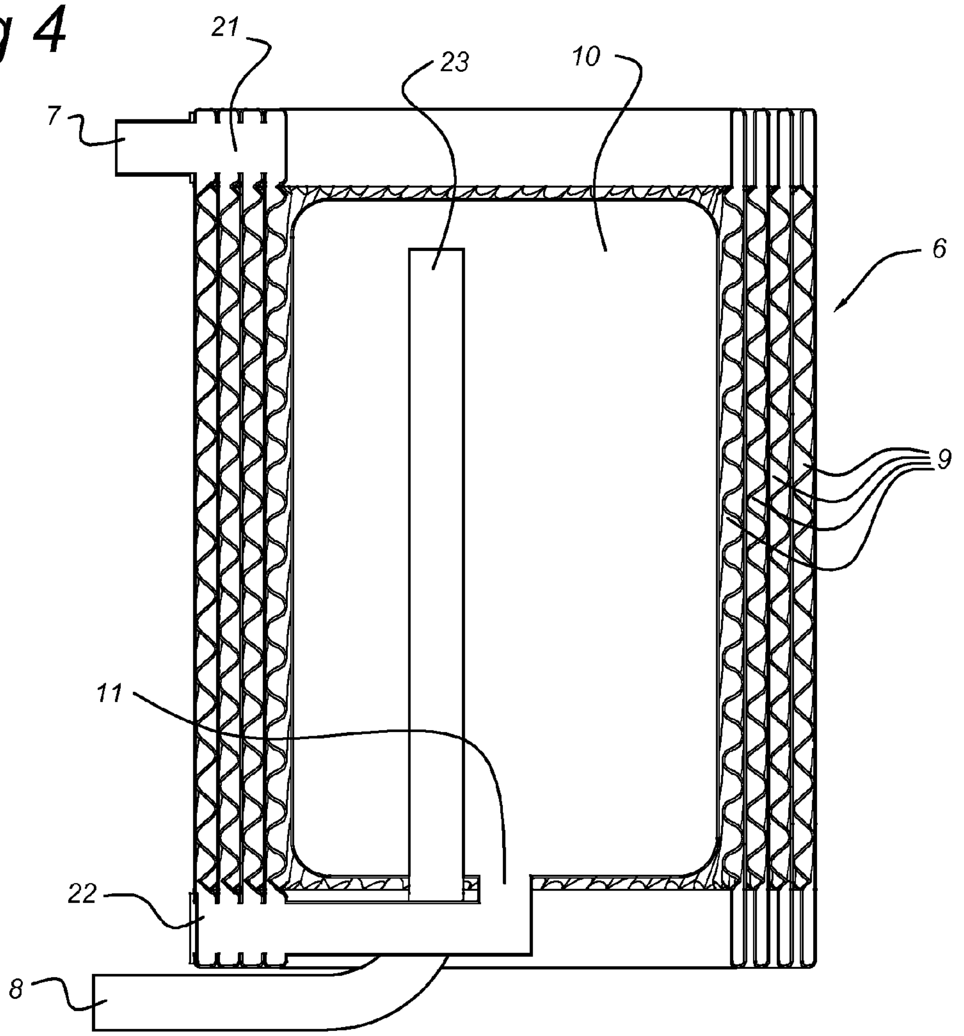
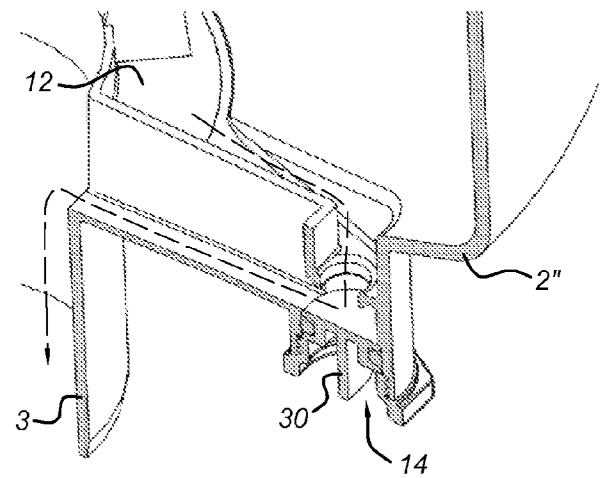


Fig 5



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EUROPEAN SEARCH REPORT

Application Number
EP 10 19 5892

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	5 August 2011	Van Dooren, Marc

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Application Number
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