(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 995 542 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.11.2008 Bulletin 2008/48

(21) Application number: **08156712.5**

(22) Date of filing: **22.05.2008**

(51) Int Cl.:
F28D 7/10 *(2006.01)* ***F28F 1/08*** *(2006.01)*
F28F 9/26 *(2006.01)*

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

(30) Priority: **24.05.2007 IT UD20070087**

(71) Applicant: **Emiflex SpA**
20039 Varedo (MI) (IT)

(72) Inventors:
- **Lai, Giovanni**
  20039, Varedo (MI) (IT)
- **Destro, Bruno**
  20093, Cologno Monzese (MI) (IT)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(54) **Heat exchange device**

(57) Heat exchange device (10) comprising a first tubular pipe (11) having inside it a first cylindrical cavity (12) in which a first fluid flows, and a second tubular pipe (16) in which a second fluid flows which in turn exchanges heat with the first fluid. The second tubular pipe (16) is disposed coaxial inside the first cylindrical cavity (12) of the first tubular pipe (11), creating with the first tubular pipe (11) a first annular interstice (17) for the passage of the first fluid. The device (10) is advantageously associated with a source of heating and the second tubular pipe (16) comprises inside it a second cylindrical through cavity (19), which defines another passage for the first fluid, so as to allow it to flow both outside the second tubular pipe (16), through the first annular interstice (17), and also inside the second tubular pipe (16), through the second cylindrical cavity (19).

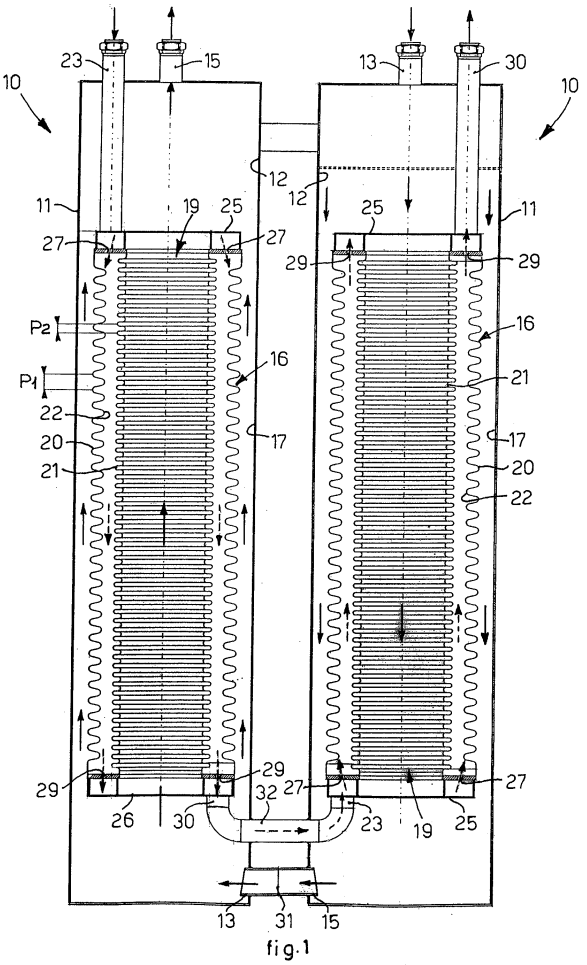

fig.1

EP 1 995 542 A2

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a heat exchange device installable in a heating plant provided with a heating source, in which, by means of heat exchange through convection, the variation in temperature of a determinate fluid, for example water, intended for a user, is induced. In particular, the device according to the present invention is of the type advantageously but not exclusively able to be associated with a boiler, for the production of domestic hot water.

BACKGROUND OF THE INVENTION

[0002] Heat exchange devices are known, able to allow the heat exchange between a first fluid, for example domestic water to be heated, and a second fluid, for example arriving from a heating source, such as a boiler or other.

[0003] According to the specific flow rates of fluid to be heated, the heating variation and the power of the heat source, different types of heat exchangers are known in the state of the art.

[0004] In particular, heat exchange devices are known in which a second tubular pipe is disposed inside a first cylindrical cavity of a first tubular pipe, so as to define with the latter an interstice for the passage of the fluid to be heated, and thus effect the desired heat exchange.

[0005] In known heat exchange devices the heat exchange occurs only through an external surface of the second tubular pipe, thus limiting the quantity of heat exchange possible.

[0006] This disadvantage entails a substantially reduced yield of the heat exchange effected, and high heat dissipation, and therefore a waste of energy.

[0007] A prior art heat exchanger device for the cooling of gas and oil of a motor of a vehicle is disclosed in EP-A-1.388.720. The device comprises two coaxial tubular pipes, wherein only the inner pipe has an external corrugated surface for increasing the thermal exchange between the two fluids.

[0008] Purpose of the present invention is to achieve a heat exchange device which allows, in a simple and economic manner, to improve the heat exchange effected, reducing to a minimum the possible heat dissipations and the bulk of the device itself.

[0009] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0010] The present invention is set forth and characterized in the independent claim, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0011] A heat exchange device according to the present invention comprises at least a first tubular pipe having inside it a cylindrical cavity in which a first fluid to be heated flows and at least a second tubular pipe in which a second heated fluid flows.

[0012] The device is advantageously associated with a heating boiler, or other heating source, and is applied for the production of domestic hot water.

[0013] In accordance with the above purpose, the second tubular pipe is disposed coaxial and inside the first cylindrical cavity of the first tubular pipe, so as to define with the first pipe a first annular interstice for the first fluid to pass through.

[0014] The second tubular pipe comprises inside it a second cylindrical through cavity able to define another passage for the first fluid, so as to allow the latter to flow both outside the second tubular pipe, through the first annular interstice, and also inside the second tubular pipe, through the second cylindrical cavity.

[0015] In this way, the heat exchange between the first fluid and the second fluid occurs substantially both inside and outside the second tubular pipe, substantially doubling the yield of the heat exchange effected and reducing to a minimum the possible heat dissipation and the bulk of the heat exchanger itself.

[0016] In a preferential form of embodiment, the second tubular pipe comprises a first external tubular element which defines with the first cylindrical cavity of the first tubular pipe said first annular interstice, and a second tubular element disposed coaxial and inside the first tubular element, which defines the second cylindrical cavity of the second tubular pipe. The first tubular element and the second tubular element are separated from each other so as to define a second annular interstice which allows the second heated fluid to pass.

[0017] According to a feature of the present invention, the first tubular element and the second tubular element have respective corrugated surfaces in contact with the first fluid and the second fluid. The corrugated surfaces allow to increase the usable surface of heat exchange between the two fluids and induce the fluids themselves to an advantageous turbulent motion.

[0018] The corrugations of both the first and the second tubular elements lay on planes substantially parallel each other and substantially transversal to the direction of motion of the first and second fluids. In other words, the corrugated surfaces of the two coaxial tubular elements develop as parallel waves, contrary to a spiral or helicoidal way typical of the prior art corrugated pipes. The transversal development of the corrugations of both the surfaces of contact with the fluids allows to create a slow movement of the fluids, contrary to the helicoidal development.

[0019] According to a variant, the first tubular element and the second tubular element are reciprocally connected at the ends by means of respective inlet and outlet flanges provided with relative inlet and outlet apertures.

Advantageously, at least the inlet apertures have a desired orientation able to impart to the second fluid a desired direction of inlet inside the second annular interstice, and hence a desired direction of impact against the first and second tubular element, improving the heat exchange.

[0020] According to another form of embodiment of the present invention, each heat exchange device comprises connection means, able to allow reciprocal connection to an analogous heat exchange device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic view of a lateral section of a heat exchange device according to the present invention;
- fig. 2 shows a variant of the heat exchange device in fig. 1.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0022] A heat exchange device 10 according to the present invention is shown in its entirety in fig. 1. In this case, an application is shown in which two analogous heat exchange devices 10 are provided, connected in series. For a more practical description, we shall only describe the heat exchange device 10 shown on the right in fig. 1. The numerical references to equivalent components are also shown on the heat exchanger 10 illustrated on the left.

[0023] In particular, the heat exchanger 10 according to the present invention comprises a first pipe 11 having axially a first cylindrical cavity 12, inside which cold domestic water to be heated is able to be introduced, under pressure, through a feed collector 13; the direction of flow of the water is indicated by the arrows in continuous line. Once it has passed through the first pipe, the cold water is conveyed into a relative outlet collector 15.

[0024] The heat exchanger 10 also comprises a second pipe 16 disposed substantially coaxial and inside the first cylindrical cavity 12 of the first pipe 11, so as to define with the latter a first annular interstice 17 through which the domestic water to be heated flows.

[0025] The second pipe 16 is also shaped so as to define inside it a second cylindrical cavity 19, inside which the water to be heated is free to flow in through manner.

[0026] The second pipe 16 consists of an external tube 20 distanced from an internal surface of the first pipe 11, to define the first annular interstice 17, and an internal tube 21, disposed coaxial and inside the external pipe 20 and defining the second cylindrical cavity 19.

[0027] In particular, the external tube 20 and the internal tube 21 are distanced from each other so as to define a second annular interstice 22, into which hot water is introduced, under pressure, through a relative feed collector 23; the direction of flow of the hot water is indicated by the arrows shown with a line of dashes.

[0028] In this way, the hot water flowing inside the second annular interstice 22 effects a double heat exchange with the cold water flowing both inside the first annular interstice 17 and also inside the second cylindrical cavity 19.

[0029] Advantageously, the hot water flowing inside the second annular interstice 22 flows in a discordant direction to that of the cold water flowing inside both the first annular interstice 17 and the second cylindrical cavity 19.

[0030] Moreover, both the external tube 20 and the internal tube 21 are corrugated on the outside, the corrugations being substantially transversal to the direction of motion of the fluids, so as to increase the usable surface of heat exchange and influence the flow of the hot water the water to be heated, determining a turbulent motion. By doing this, there is a slow motion of the liquids and therefore an increase in the yield of heat exchange effected both in the first annular interstice 17 and also in the second cylindrical cavity 19.

[0031] Advantageously, the corrugation of the external tube 20 has a first pitch P1, greater than a second pitch P2 of the corrugation of the internal tube 21.

[0032] This variation in pitch of the corrugation of the two tubes 20 and 21 is chosen as a function of the flow rate of water flowing in the relative first annular interstice 17 and second cylindrical cavity 19, the heat exchange to be effected and/or other parameters.

[0033] The external tube 20 and the internal tube 21 are interconnected at the ends and kept reciprocally distanced by means of two flanges, respectively an inlet flange 25 and an outlet flange 26.

[0034] Moreover, the inlet flange 25 comprises a plurality of inlet holes 27 made through and angularly distanced from each other, to allow the hot water to enter inside the second annular interstice 22.

[0035] In particular, the inlet holes 27 are orientated in such a manner as to induce the hot water to flow inside the second annular interstice 22, directly contacting the internal part of the external tube 20, thus further improving the conditions of heat exchange.

[0036] The outlet flange 26 also comprises relative outlet holes 29 made through and angularly distanced from each other, to allow the hot water to exit from the second annular interstice 22, towards a relative outlet collector 30.

[0037] In the form of embodiment shown in fig. 1, the outlet collectors 15 and 20, respectively of the cold water heated by the heat exchange device 10 on the right, and the hot water from the heat exchange device 10 on the left, are directly connected to the respective feed collectors 13 and 23 of the respective adjacent heat exchange device 10, so that the cold water to be heated and the

hot water effect two cycles of heat exchange.

[0038] In particular, the connections between the outlet collectors 15, 30 and the feed collectors 13 and 23 are made by means of relative connection pipes 31 and 32.

[0039] In the form of embodiment shown in fig. 2, the two heat exchange devices 10 are disposed substantially one above the other, with the first pipes 11, in this case in the form of a tank, connected with each other by means of a relative connection pipe 31.

[0040] In this case, the two second pipes 16, on the contrary, are separated from each other so as to define two distinct heating circuits for the cold water circulating in the first pipes 11. In the solution shown, the feed collector 13 and the outlet collector 15 for the water are not visible.

[0041] It is clear, however, that modifications and/or additions of parts may be made to the heat exchange device 10 as described heretofore, without departing from the field and scope of the present invention.

[0042] For example, it comes within the field of the present invention to provide that each heat exchange device provides, inside its first pipe 11, two or more second pipes 16, connected with each other, or independent.

[0043] It is also clear that, although the present invention has been described with reference to specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of heat exchange device, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Heat exchange device for the production of domestic water, comprising at least a first tubular pipe (11) having inside it a first cylindrical cavity (12) in which a first fluid is able to flow, and at least a second tubular pipe (16) in which a second fluid is able to flow, able in turn to exchange heat with said first fluid, and in which said second tubular pipe (16) is disposed coaxial and inside said first cylindrical cavity (12) of said first tubular pipe (11), so as to define with said first tubular pipe (11) a first annular interstice (17) for the passage of said first fluid, said device being advantageously associated with a source of heating, wherein said second tubular pipe (16) comprises inside it a second cylindrical through cavity (19), able to define another passage for said first fluid, so as to allow said first fluid to flow both outside said second tubular pipe (16), through said first annular interstice (17), and also inside said second tubular pipe (16), through said second cylindrical cavity (19), said second tubular pipe (16) comprising a first external tubular element (20) able to define with said first cylindrical cavity (12) of said first tubular pipe (11) said first annular interstice (17), and a second tubular element (21) disposed coaxial and inside said first tubular element (20), and able to define said second annular interstice (19) of said second tubular pipe (16), wherein said first tubular element (20) and said second tubular element (21) are disposed distanced from each other so as to define a second annular interstice (22) able to allow said second fluid to pass, **characterized in that** said first tubular element (20) and said second tubular element (21) have respective corrugated surfaces in contact with said first fluid and with said second fluid, the corrugations of said first tubular element (20) and of said second tubular element (21) laying on planes substantially parallel each other and substantially perpendicular to the direction of motion of said first and second fluids.

2. Heat exchange device as in claim 1, **characterized in that** the corrugations of said first tubular element (20) have a first pitch (P1) greater than a second pitch (P2) of said second tubular element (21).

3. Heat exchange device as in claim 1 or 2, **characterized in that** said first tubular element (20) and said second tubular element (21) are reciprocally connected at the ends by means of an inlet flange (25) provided with relative inlet apertures (27), and an outlet flange (26) provided with relative outlet apertures (29).

4. Heat exchange device as in claim 3, **characterized in that** at least said inlet apertures (27) have a desired orientation able to impart to said second fluid a desired direction of inlet inside said second annular interstice (22).

5. Heat exchange device as in any claim hereinbefore, **characterized in that** it comprises connection means (13, 15, 23, 30, 31, 32) able to allow its reciprocal connection to an analogous heat exchange device (10).

6. Heat exchange device as in claim 1, **characterized in that** it is able to produce hot water for domestic use.

7. Heat exchange device as in claim 1, **characterized in that** it is associated with a heating boiler.

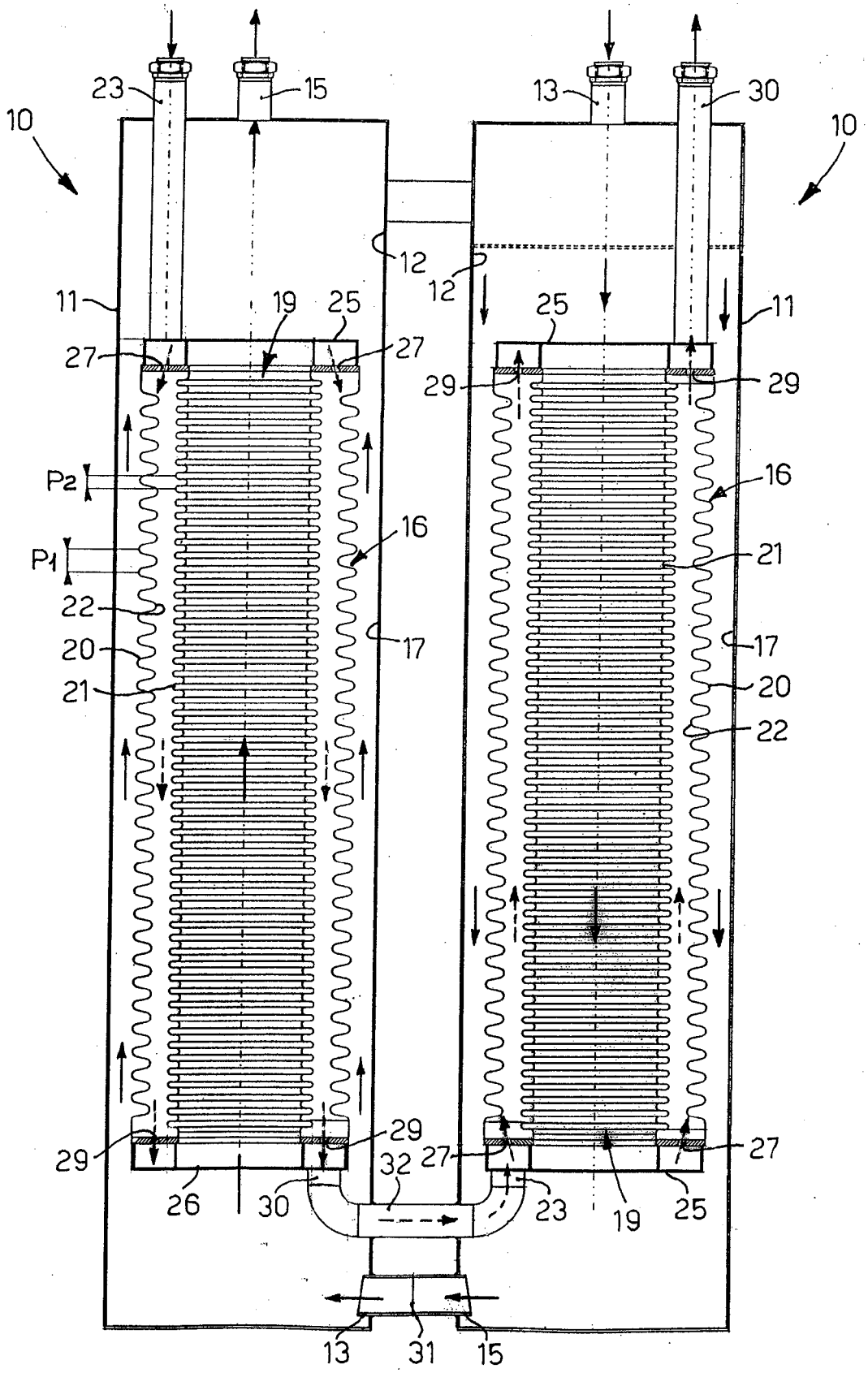
10
23
15
13
30
10
12
12
11
19
25
25
11
27
27
27
29
29
P2
16
16
P1
21
22
17
17
20
21
20
22
29
29
27
27
32
26
30
23
19
25
13
31
15

fig.1

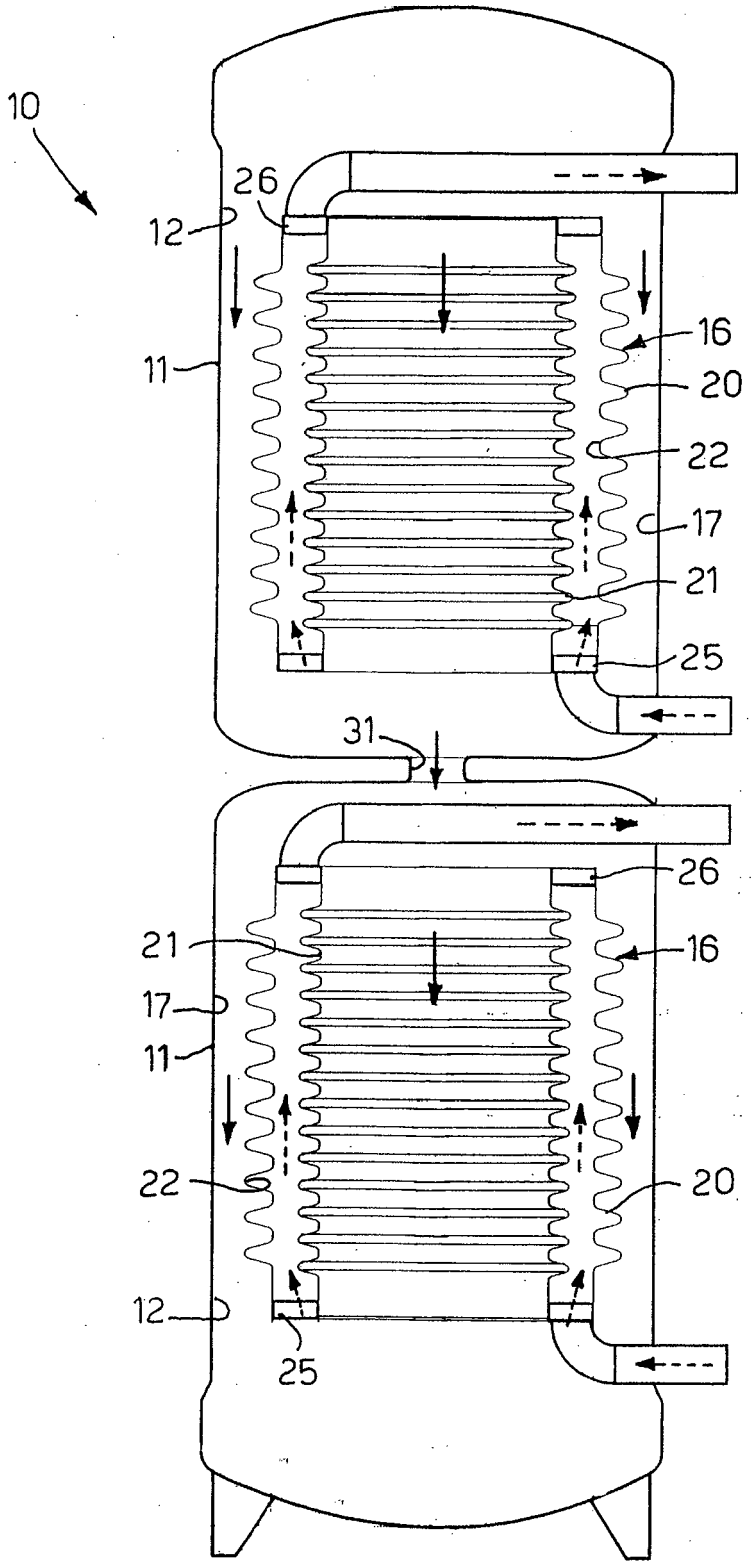

fig. 2

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1388720 A **[0007]**