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(54) Condenser/Evaporator

(57) A condenser/evaporator for production plants of hot sanitary water and heat pump conditioning; the condenser/evaporator has a tank (11) provided with a heat exchanging wall (11A); and at least one pipe (100), which is wound about the tank (11), is arranged in contact with the heat exchanging wall (11A), presents a cross-section (150) having a concave area (150C) of predetermined radius (R1) and with the concavity facing the heat exchanging wall (11A), and is dimensioned to allow the deformation of the concave area (150C), when a fluid at operating pressure runs through the pipe (100), so that the concave area (150C) assumes a complementary shape to the heat exchanging wall (11A) and the pipe (100) adheres to the heat exchanging wall (11A) along the deformed concave area (150C).

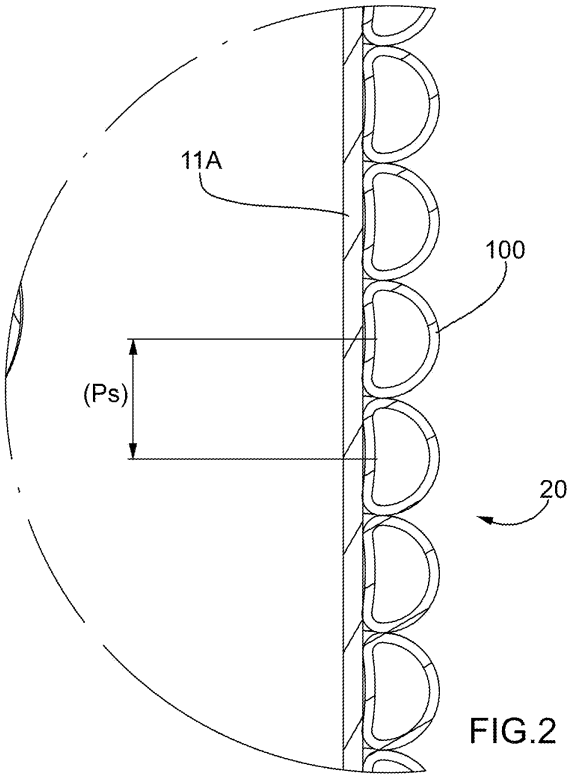

FIG.2

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Description

[0001] The present invention relates to a condenser/evaporator for production plants of hot sanitary water/heat pump conditioning comprising a tank provided with a heat exchanging wall; and at least one pipe wound about the tank and arranged in contact with the heat exchanging wall.

[0002] As known, a type of condenser/evaporator used in such production plants of sanitary and/or cold water comprises the tank, adapted to contain a certain quantity of water, which must be heated or cooled by the pipe wound about the tank and through which a gas passes, e.g. R134A type gas.

[0003] To allow an efficient heat exchange between the water contained in the tank and the gas which flows through the pipe, the pipe is preferably made of aluminium or copper, i.e. materials which have a good heat transmission coefficient and which are easily cold-deformable. Secondly, the pipe must be shaped so as to maximize the contact surface with the tank so as to favour the heat exchange.

[0004] Documents FR 2,549,214, EP 336,751, and W02004/085927 show condensers/evaporators or heat exchangers having the features described in the preamble of claim 1. Each of the pipes shown in these documents has a flat face arranged directly in contact with the heat exchanging wall of the tank or through the interposition of conductive adhesive paste.

[0005] Pipes with flat faces have allowed the increase of heat exchange with respect to circular cross-section pipes but nevertheless require relatively thick walls and/or accurate fixing of the entire flat face to avoid that the flat face deforms when a fluid at operating pressure runs through the pipe and markedly reduces the contact surface between the pipe and the heat exchanging wall.

[0006] The main object of the present invention is to provide a condenser/evaporator for production plants of hot sanitary water and heat pump conditioning which allows the production of high heat exchange in a simple and cost-effective manner.

[0007] According to the present invention, a condenser/evaporator is provided for production plants of hot sanitary water and conditioning; the condenser/evaporator comprising a tank provided with a heat exchanging wall; and at least one pipe wound about the tank and arranged in contact with the heat exchanging wall; the condenser/evaporator being characterized in that the pipe presents a cross-section having a concave area of predetermined radius and with the concavity facing the heat exchanging wall; the pipe being dimensioned to deform at the concave area, when a fluid at operating pressure runs through the pipe, so that the concave area assumes a complementary shape to the heat exchanging wall and the pipe adheres to the heat exchanging wall along the deformed concave area.

[0008] By virtue of the present invention, it is possible to use pipes with relatively thin walls and it is not necessary to perform an accurate fixing of the portion of the pipe used for heat exchange. Consequently, the present invention determines a substantial saving of material and assembly time, and guarantees a high heat exchange.

[0009] For a better understanding of the present invention, a preferred embodiment thereof will now be described, by way of non-limiting example and with reference to the accompanying drawings, in which:

- figure 1 is a perspective view, with parts removed for clarity, of a condenser for plants for the production of hot sanitary water by heat pump in accordance with the present invention;
- figure 2 is a cross-section view, on an enlarged scale and with parts removed for clarity, of a detail of figure 1; and
- figure 3 is a cross-section view, on a further enlarged scale and with parts removed for clarity, of a detail of figure 2.

[0010] In figure 1, numeral 10 indicates, as a whole, a condenser for a plant for the production of hot sanitary water by heat pump (not illustrated in its entirety). Condenser 10 comprises a tank 11 containing a liquid, in particular water, to be heated. For example, the water at room temperature enters the tank 11 in a direction indicated by the arrow (F1) and exits cold in a direction indicated by the arrow (F2). Tank 11 has a substantially cylindrical heat exchanging wall 11A. Condenser 10 comprises a pipe 100 wound about the tank 11 and arranged in contact with the heat exchanging wall 11A. Pipe 100 is wound in turns in order to create a coil 20 comprising a plurality of spirals. Coil 20 has a gas inlet 21 and an outlet 22 for the same gas. In use, a gas flows through coil 20, for example R134A.

[0011] As shown in greater detail in figure 3, pipe 100 has a cross-section 150, which presents a substantially semicircular-shaped first portion 150A, and a squashed-shaped second portion 150B substantially defined by a concave area 150C with external concavity of predetermined radius (R1). The concavity of concave area 150C is not to be confused with the concavity determined by the helical winding of pipe 100 about tank 11 (figure 2) as the concavity determined by the helical winding of pipe 100 does not affect the shape of the cross-section of pipe 100.

[0012] According to what is better illustrated in figure 2, concave area 150C (figure 3) of pipe 100 faces heat exchanging wall 11A of tank 11. In rest conditions, a substantially closed space is formed between pipe 100 and heat exchanging wall 11A. In other words, in rest conditions concave area 150C (figure 2) is arranged in contact with heat exchanging wall 11A solely at opposite ends of concave area 150C. When a fluid at operating pressure passes through pipe 100, concave area 150C deforms so as to assume a complementary shape and to allow pipe 100 to adhere to the heat exchanging wall 11A. Pipe 100 is not shown in the operating configuration in the

accompanying figures.

[0013] Pipe 100 is made of metal material and preferably of copper or aluminium or an alloy containing at least one of copper or aluminium.

[0014] With reference to figure 3, pipe 100 has a first overall dimension (D1) parallel to heat exchanging wall 11A (Figure 2) and a second overall dimension perpendicular to heat exchanging wall 11A. Preferably, between the second overall dimension (D2) and the first overall dimension (D1) of cross-section 150 there is the following relation: (D2)/(D1) = 0.5 - 0.8.

[0015] Preferably, between the radius (R1) of the concavity and the first overall dimension (D1) there is the following relation: (R1) ≤ 1.5 - 2.5 (D1),

[0016] In fact, the radius (R1) of the concavity must not be too small or otherwise the concavity would be too pronounced and section 150 would not deform in the appropriate manner, but nor should it be too large, as otherwise there would be the same problems which present themselves with the use of flat faces. In other words, in the latter case, section 150 would deform in such a way that the contact between the two heat exchanging surfaces would substantially act as a generator.

[0017] Pipe 100 is made from a circular cross-section cylindrical pipe of diameter (Φ). The shape of section 150 is obtained, for example, from an aluminium circular section pipe of initial diameter (Φ) = 10 mm which is deformed by means of a cold roll-forming operation.

[0018] With this initial diameter value (Φ the preferred values of the first and second overall dimensions are respectively (D1) = 12 mm and (D2) = 8 mm.

[0019] Pipe 100 presents a thickness (Sp) which is correlated to the diameter (Φ). Preferably, between the thickness (Sp) and the diameter there is the following relation: (Sp) = 0.05 - 0.15 (Φ).

[0020] Coil 20 presents a uniform pitch (Ps) of the turn distribution. Preferably, between the pitch (Ps) of the turn distribution and the first overall dimension (D1) there is the following relation: (Ps)/(D1) = 1 - 1.5.

[0021] The advantages of the present invention consist in providing a high heat exchange together with the simplicity of construction and assembly of the condenser.

[0022] Finally, it becomes apparent that modifications, variations, improvements may be made to the described condenser without departing from the scope of the appended claims. In particular, in the present description, specific reference has been made to a condenser, even if the present invention relates to an evaporator, the structure of which is substantially similar and differs solely due to the operating conditions.

Claims

1. A condenser/evaporator for production plants of hot sanitary water and heat pump conditioning; the condenser/evaporator comprising a tank (11) provided with a heat exchanging wall (11A); and at least one pipe (100) wound about the tank (11) and arranged in contact with the heat exchanging wall (11A); the condenser/evaporator (10) being **characterized in that** the pipe (100) presents a cross-section (15) having a concave area (150C) of predetermined radius (R1) and with the concavity facing the heat exchanging wall (11A); the pipe (100) being dimensioned to deform at concave area (150C), when a fluid at operating pressure runs through pipe (100), so that the concave area (150C) assumes a complementary shape to the heat exchanging wall (11A) and the pipe (100) adheres to the heat exchanging wall (11A) along the deformed concave area (150C).

2. A condenser/evaporator as claimed in claim 1, wherein the cross-section (150) of the pipe (100) has a first overall dimension (D1) parallel to the heat exchanging wall (11A); and a second overall dimension (D2) perpendicular to the heat exchanging wall (11A); the ratio between the second (D2) and the first (D1) overall dimension being in a range 0.5 - 0.8.

3. A condenser/evaporator as claimed in claim 2, wherein the ratio between the predetermined radius (R1) and the first overall dimension (D1) is in a range 1.5 - 2.5.

4. A condenser/evaporator as claimed in any one of the preceding claims, wherein the pipe (100) is obtained from a circular-section pipe having a diameter (Φ) and a thickness (Sp); the ratio between the thickness (Sp) and the diameter (Φ) being in a range 0.05 - 0.15.

5. A condenser/evaporator as claimed in any one of the preceding claims, wherein the pipe (100) is wound in a helix about the tank (11) in order to create a coil (20) having a plurality of adjacent spirals.

6. A condenser/evaporator as claimed in claim 5 wherein the coil (20) presents a turn distribution pitch (Ps); the ratio between the turn distribution pitch (Ps) and a first overall dimension (D1) of the section of the pipe (100) in a direction parallel to the heat exchanging wall (11A) is in a range 1 - 1.5.

7. A condenser/evaporator as claimed in any one of the preceding claims, wherein the pipe (100) is made of metal material, preferably copper or aluminium and alloys containing at least one of copper and aluminium.

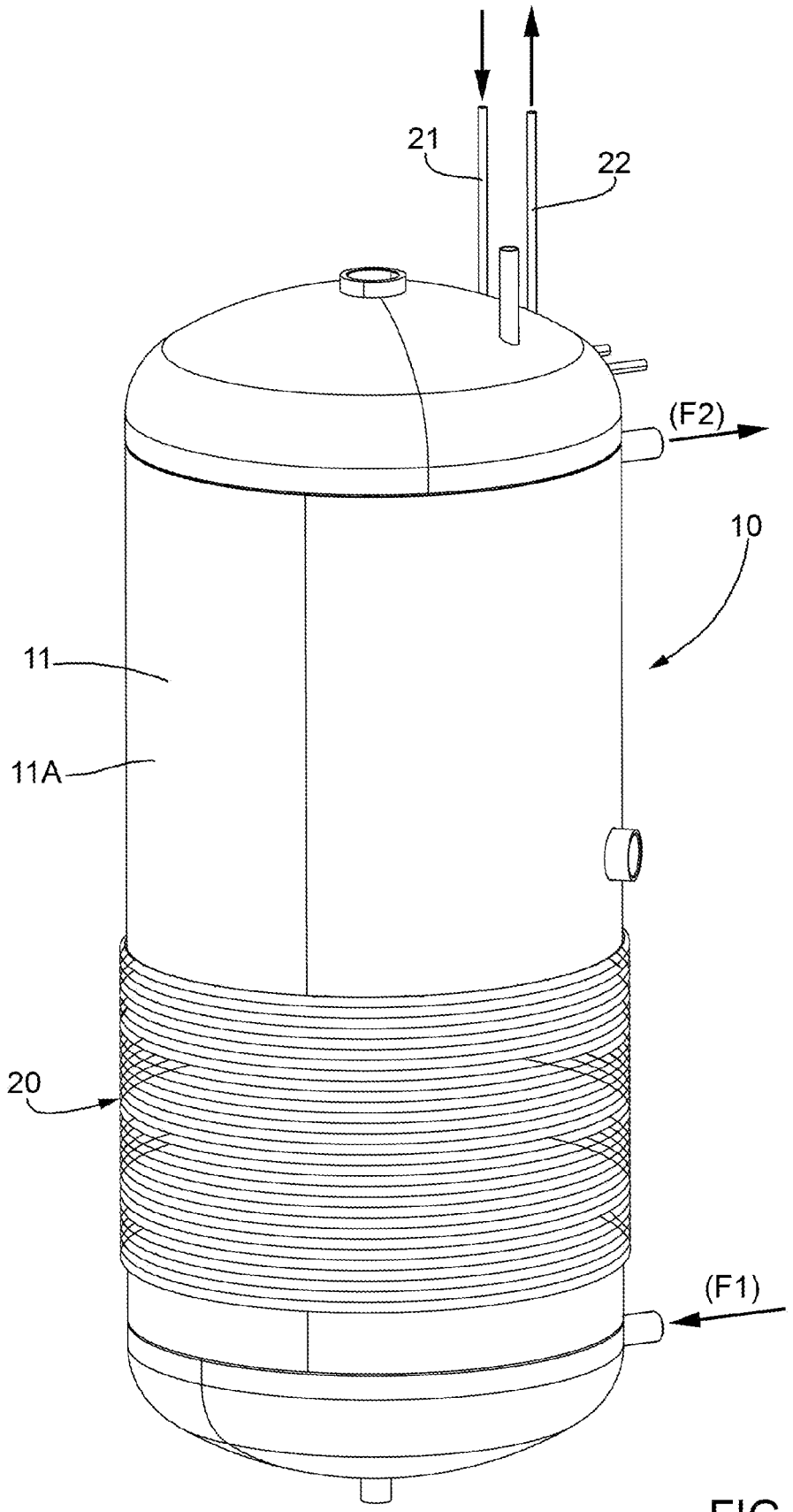

FIG.1

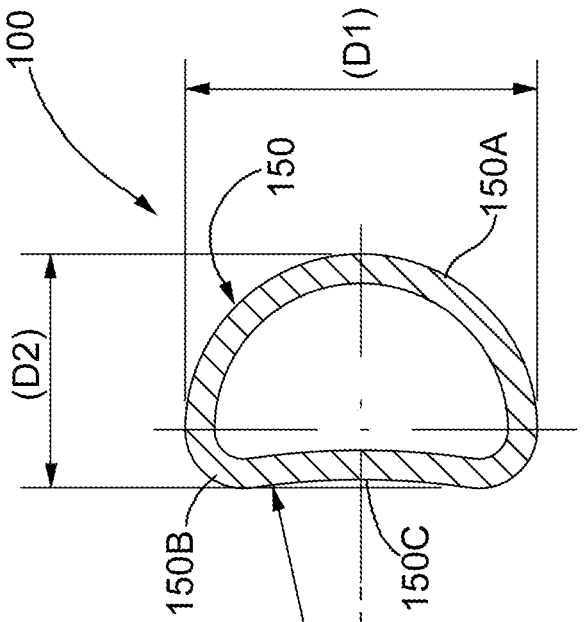

FIG.3

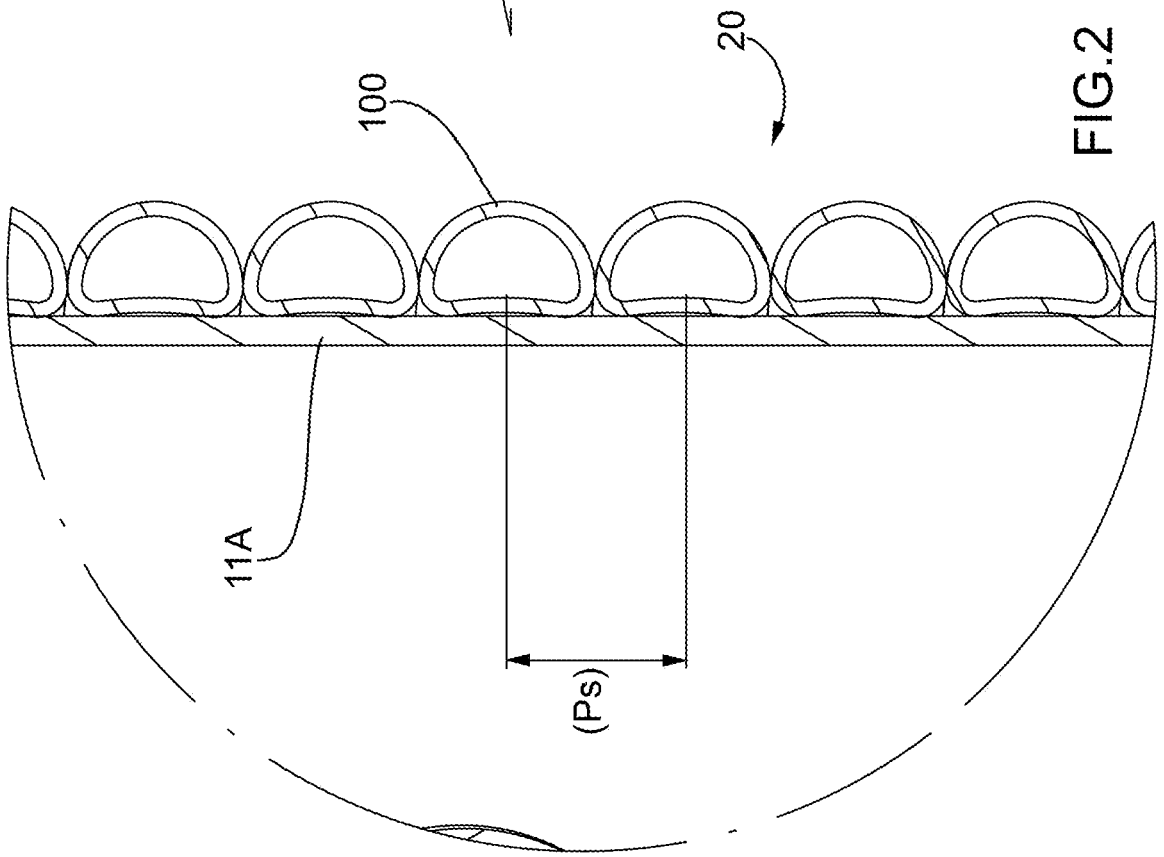

FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 9298

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 2 549 214 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 18 January 1985 (1985-01-18) * page 1, line 11 - page 3, line 8 * -----	1-7	INV. F28D7/02 F24H1/18 F24H1/43
A	WO 2004/085927 A1 (SIDDONS STEVENS DEVELOPMENTS P [AU]; STEVENS RODNEY [AU]) 7 October 2004 (2004-10-07) * figure 5 * -----	1-7	F24H4/04
A	EP 0 336 751 A2 (SIDDONS RAMSET LTD [AU]) 11 October 1989 (1989-10-11) * line 15 - column 4, line 35; figure 1a * -----	1-7	
A	US 2007/209606 A1 (HAMADA TETSUROU [JP] ET AL) 13 September 2007 (2007-09-13) * figure 14 * -----	1-7	

TECHNICAL FIELDS SEARCHED (IPC)

F28D
F24H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 July 2011	Bain, David

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- EP 336751 A **[0004]**
- WO 2004085927 A **[0004]**