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

(11) EP 2 369 285 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
19.08.2020 Bulletin 2020/34

(51) Int Cl.:
F28D 1/047 *(2006.01)* ***F28D 1/053*** *(2006.01)*
F28F 1/12 *(2006.01)* ***F28F 13/14*** *(2006.01)*

(21) Application number: **11002335.5**

(22) Date of filing: **22.03.2011**

(54) **Heat exchanger**

Wärmetauscher

Échangeur de chaleur

(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

(30) Priority: **24.03.2010 CN 201010132946**

(43) Date of publication of application:
28.09.2011 Bulletin 2011/39

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Printed by Jouve, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The present disclosure generally relates to a heat exchanger according to the preamble of claim 1, more particularly, to a heat exchanger having a substantially inverted V-shape.

[0002] Such a heat exchanger is known from US 2005/0241812 A1.

BACKGROUND

[0003] The heat exchanger is widely used in various fields, such as air conditioners. A conventional heat exchanger generally has a flat rectangular shape of so called parallel flow type. In some application situations, the heat exchanger should be bent into a substantially inverted V-shape, thus the heat exchanger is divided into first and second heat exchanger portions which are located at two sides (i.e., the refrigerant inflow side and the refrigerant outflow side) of the bending portion respectively. Accordingly, each fin is divided into a first fin portion in the first heat exchanger portion and a second fin portion in the second heat exchanger portion, and the first and second fin portions have identical structure and design.

[0004] In use, the inlet air flows upward from a lower side of the heat exchanger, exchanges heat with the refrigerant in the tubes when passing through the heat exchanger, and then flows out from an upper side of the heat exchanger as the outlet air. The temperature of the refrigerant is changed along the flow direction in the heat exchanger. For example, if the heat exchanger is used as an evaporator, the temperature of the refrigerant increases along the flow direction. Since the structure of the first and second fin portions at two sides of the bending portion are identical and the temperatures of the refrigerant at two sides of the bending portion are different, the temperatures of the outlet air at two sides of the bending portion are different. In other words, the capacity on the refrigerant inflow side is higher than that on the refrigerant outflow side, so that the temperature of the outlet air on the refrigerant outflow side is higher than that of the outlet air on the refrigerant inflow side. The difference of the temperature of the outlet air at two sides of the bending portion may affect the heat exchange performance. For example, when the heat exchanger is used in an air conditioner, the difference of the temperature of the outlet air on the two sides of the bending portion may affect the comfortableness. Similarly, when the heat exchanger is used as a condenser, the temperatures of the outlet air at two sides of the bending portion are also different, thus affecting the heat exchange performance.

[0005] WO 2005/075918 A1 shows a partially structured heat exchanger laminae. The heat exchanger has a second header connected to an outlet line and a plurality of tubes spaced apart from each other and each connected to the second header in further communication therewith. Furthermore, a plurality of fins are disclosed each disposed between adjacent tubes.

[0006] The laminae have a first portion in which they are not smooth, preferably corrugated, and a portion, in which they are smooth. However, there is nothing disclosed about a bent portion between these two portions of the laminae. As far as can be seen in the drawing and in the description, the bent portions of the tubes are located within either the corrugated portion of the laminae or the smooth portions of the laminae.

[0007] US 2004/0168456 A1 discloses an evaporator for medium temperature refrigerated merchandiser having a tube which is guided in a serpentine-like form. Fins are disposed in contact with the tubes. The density of the fin in an air entry side of the heat exchanger is larger than the density at an air outlet side. This is achieved by arranging additional short fins at the entry side.

SUMMARY

[0008] The present disclosure is directed to a heat exchanger bent into a substantially inverted V-shape, in which the capacities at two sides of a bending portion are substantially identical, thus improving the heat exchange performance.

[0009] According to an embodiment of the present disclosure, there is provided a heat exchanger according to claim 1.

[0010] With the heat exchanger according to the embodiment of the present disclosure, because the heat transfer coefficient of the second heat exchanger portion is greater than that of the first heat exchanger portion, the capacity of the second heat exchanger portion may be substantially identical with that of the first heat exchanger portion, so that the temperature of the outlet air passing through the second heat exchanger portion may be substantially identical with that of the outlet air passing through the first heat exchanger portion, thus improving the heat exchange performance. For example, when the heat exchanger is used in the air conditioner, the comfortableness is improved.

[0011] According to the invention, each fin is divided into a first fin portion in the first heat exchanger portion and a second fin portion in the second heat exchanger portion, and a heat transfer coefficient of the second fin portions is greater than that of the first fin portions.

[0012] According to the invention, each of the first and second fin portions is formed with louvers, in which a louver angle of the louvers in each second fin portion is greater than that of the louvers in each first fin portion and/or. each of the first and second fin portions is formed with louvers, in which a louver length of the louvers in each second fin portion is greater than that of the louvers in each first fin portion.

[0013] In some embodiments, each of the first and second fin portions has a substantially corrugated shape, and a fin pitch of each second fin portion is smaller than that of each first fin portion.

[0014] According to embodiments of the present disclosure, by forming louvers in the first and second fin portions respectively and causing at least one of the louver angle, the louver length and fin pitch of the first pin portion not identical to a corresponding one of the second fin portions, the heat transfer coefficient of the first fin portion may be smaller than that of the second fin portion, so that the temperature of the outlet air passing through the second heat exchanger portion may be substantially identical with that of the outlet air passing through the first heat exchanger portion, thus improving the heat exchange performance and decreasing the cost.

[0015] In some embodiments, the heat exchanger further comprises a third header and a fourth header, wherein the first header and the third header are connected and communicated via the first tube portions, and the second header and the fourth header are connected and communicated via the second tube portions; in which the third header and the fourth header are connected and communicated via a connection pipe; and in which the bent portion is formed by bending the connection pipe.

[0016] In some embodiments, the heat exchanger is formed by bending a single heat exchanger of parallel flow type.

[0017] In some embodiments, no fins are disposed in the bent portion.

[0018] According to embodiments of the present disclosure, the heat exchanger is bent into an invented V-shape, the bent heat exchanger may be formed by bending a single complete parallel flow type heat exchanger such as a flat plate heat exchanger in which both tubes and fins are bent. Further, in a middle portion of the flat plate heat exchanger, no fins are disposed in the middle portion to be bent, that is, only tubes are bent. Therefore, the heat exchanger is easy to bend and the bending of the heat exchanger will not disadvantageously affect the heat exchange performance.

[0019] Alternatively, the bent heat exchanger may be formed by two separate flat plate heat exchangers, in which the two flat plate heat exchanger are connected in series for example by a connection pipe communicating the outlet header of one flat plate heat exchanger with the inlet header of the other flat plate heat exchanger, and the two flat plate heat exchanger form an angle larger than zero and less than 180 degree for example by bending the connection pipe. Therefore, the bent heat exchanger is easier to manufacture and high in applicability.

[0020] The above summary of the present disclosure is not intended to describe each disclosed embodiment or every implementation of the present disclosure. The Figures and the detailed description which follow more particularly exemplify illustrative embodiments.

[0021] Additional aspects and advantages of the embodiments of the present disclosure will be given in part in the following descriptions, become apparent in part from the following descriptions, or be learned from the practice of the embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] These and other aspects and advantages of the disclosure will become apparent and more readily appreciated from the following descriptions taken in conjunction with the drawings in which:

Fig. 1 is a schematic view of the heat exchanger bent into an inverted V-shape according to an embodiment of the present disclosure;

Fig. 2 is a schematic view of the heat exchanger bent into an inverted V-shape according to another embodiment of the present disclosure;

Fig. 3 is a schematic view of the heat exchanger bent into an inverted V-shape according to still another embodiment of the present disclosure;

Fig. 4 is a schematic view of a fin of the heat exchanger according to an embodiment of the present disclosure;

Fig. 5 is a schematic view of the first fin portion in the first heat exchanger portion according to an embodiment of the present disclosure;

Fig. 6 is a schematic view of the second fin portion in the second heat exchanger portion according to an embodiment of the present disclosure;

Fig. 7 is a sectional view of the fin taken along line C-C of Fig. 4, showing the louver angle in the fin of the heat exchanger;

Fig. 8 is a sectional view of the first fin portion taken along line C1-C1 of Fig. 5, showing the louver angle of the louvers in each first fin portion;

Fig. 9 is a sectional view of the second fin portion taken along line C2-C2 of Fig. 6, showing the louver angle of the louvers in each second fin portion;

Fig. 10 is a schematic view of the second fin portion in the second heat exchanger portion of the heat exchanger according to an embodiment of the present disclosure, showing the fin pitch in each second fin portion; and

Fig. 11 is a schematic view of the first fin portion in the first heat exchanger portion of the heat exchanger according to an embodiment of the present disclosure, showing the fin pitch in each first fin portion.

DETAILED DESCRIPTION

[0023] Reference will be made in detail to embodiments of the present disclosure. The embodiments described herein with reference to the accompany drawings are explanatory and illustrative, which are used to generally understand the present disclosure. The embodiments shall not be construed to limit the present disclosure. The same or similar elements and the elements having same or similar functions are denoted by like reference numerals throughout the descriptions.

[0024] It is to be understood that phraseology and terminology used herein with reference to device or element orientation (such as, for example, terms like "longitudinal", "lateral", "front", "rear", "right", "left", "lower", "upper", "horizontal", "vertical", "above", "below", "up", "top", "bottom" as well as derivative thereof such as "horizontally", "downwardly", "upwardly", etc.) are only used to simplify description of the present invention, and do not alone indicate or imply that the device or element referred to must have or operated in a particular orientation. In addition, terms such as "first" and "second" are used herein for purposes of description and are not intended to indicate or imply relative importance or significance.

[0025] Unless specified or limited otherwise, the terms "connected," and "coupled" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings.

[0026] The heat exchanger according to an embodiment of the present disclosure will be described in detail with reference to the drawings.

[0027] In the embodiments described below, as an example, the heat exchanger is used as an evaporator in an air conditioner. It will be appreciated that the heat exchanger according to embodiments of the present disclosure is not limited to this, for example, the heat exchanger may be also used as a condenser, and may be also used in other equipments such as a refrigerator.

[0028] Now, the heat exchanger according to an embodiment of the present disclosure will be described with reference to Fig. 1. As shown in Fig. 1, the heat exchanger comprises a first header 1, a second header 2, a plurality of tubes 3 such as flat tubes, and a plurality of fins 4.

[0029] The tubes 3 are arranged and spaced apart from each other in a direction parallel to the axial direction of the first and second headers 1 and 2. Two ends of each tube 3 are connected to the first header 1 and second header 2 respectively in fluid communication with the first header 1 and second header 2. The plurality of fins 4 are each disposed between adjacent tubes 3, and the fins 4 and the tubes 3 form the core of the heat exchanger.

[0030] As described above, the heat exchanger may be used as the evaporator in an air conditioner, for example, the first header 1 is used as an inlet header, the second header 2 is used as an outlet header, the refrigerant flows from the first header 1 to the second header 2 in the tubes 3, and the temperature of the refrigerant is increased from the first header 1 to the second header 2 in the tubes 3.

[0031] As shown in Fig. 1, the heat exchanger is formed by bending a single heat exchanger of parallel flow type between the inlet header 1 and the outlet header 2 into a substantially inverted V-shape. In other words, the heat exchanger has a bent portion between the first header 1 and second header 2.

[0032] The refrigerant flows from the first header 1 to the second header 2, the temperature of the refrigerant increases from the first header 1 to the second header 2 in the tubes 3, and a length direction of a folding line of the bent portion is consistent with a width direction (the direction perpendicular to the paper in Fig.1) of the core of the heat exchanger. The heat exchanger is divided by the bent portion into first heat exchanger portion 100 and second heat exchanger portion 200 which are located at the right side and the left side in Fig. 1 (a refrigerant inflow side and a refrigerant outflow side, i.e.,) of the bent portion respectively. In this embodiment, since the heat exchanger is formed by bending a signal complete heat exchanger of parallel flow type, each fin 4 is divided into a first fin portion 4a in the first heat exchanger portion 100 and a second fin portion 4b in the second heat exchanger portion 200, and each tube 3 is divided into a first tube portion 3a in the first heat exchanger portion 100 and a second tube portion 3b in the second heat exchanger portion 200.

[0033] The second fin portion 4b is disposed between adjacent second tube portions 3b and the first fin portion 4a is disposed between adjacent first tube portions 3a.

[0034] According to the embodiment of the present disclosure, a heat transfer coefficient of the second heat exchanger portion 200 is greater than that of the first heat exchanger portion 100. Therefore, the capacity of the second heat exchanger portion 200 is substantially identical with that of the first heat exchanger portion 100, so that the temperature t2 of the outlet air A2 at the left side in Fig. 1 may be substantially identical with the temperature t1 of the outlet air A1 at the right side in Fig 1, thus improving the heat exchange performance, and thereby, for example, improving the comfortableness of an air conditioner.

[0035] More particularly, as shown in Fig. 1, the inlet air A having a temperature of t flows upward from a lower side of the heat exchanger, exchanges heat with the refrigerants in the first tube portion 3a and the second tube portion 3b respectively when passing through the first heat exchanger portion 100 and the second heat exchanger portion 200, and then flows out from the upper sides of the first heat exchanger portion 100 and the second heat exchanger portion 200, in which the outlet air A1 flowing out from the upper side of the first heat exchanger portion 100 has a temperature of t1 and the outlet air A2 flowing out from the upper side of the second heat exchanger portion 200 has a temperature of t2.

[0036] The capacity of the first heat exchanger portion 100 may be calculated by the following formula:

$$Q1 = c.m.\Delta t = c.m\ (t\text{-}t1)$$

in which c is the specific heat of air, m is the air flow rate, t is the temperature of the inlet air A, and t1 is the temperature of the outlet air A1 at the right side in Fig. 1.

[0037] Similarly, the capacity of the second heat exchanger portion 200 may be calculated by the following formula:

$$Q2 = c.m.\Delta t = c.m\ (t\text{-}t2)$$

in which c is the specific heat of air, m is the air flow rate, t is the temperature of the inlet air A, and t2 is the temperature of the outlet air A2 at the left side in Fig. 1.

[0038] It is known from the above that the temperature t2 of the outlet air A2 may be substantially identical with the temperature t1 of the right outlet air A1 if Q1 is equal to Q2.

[0039] As described above, the temperature of the refrigerant increases from the right side of the heat exchanger to the left side thereof, as shown in Fig. 1, the refrigerant flows in a direction denoted by an arrow B1 in the first heat exchanger portion 100 and flows in a direction denoted by an arrow B2 in the second heat exchanger portion 200. Therefore, if the structure and the design of the first fin portion 4a are identical with those of the second fin portion 4b, Q1 will be greater than Q2.

[0040] According to embodiments of the present disclosure, the heat transfer coefficient of the second heat exchanger portion 200 is increased, thus increasing the capacity of the second heat exchanger portion 200, so that Q1 may be substantially equal to Q2. Therefore, the temperature t2 of the outlet air A2 may be identical with the temperature t1 of the outlet air A1, thus improving the heat exchange performance.

[0041] As described above, in the embodiment shown in Fig. 1, the heat exchanger is formed by bending a single heat exchanger of parallel flow type, that is, the heat exchanger is formed by bending the core of a heat exchanger of parallel flow type. In an embodiment of the present disclosure, the first heat exchanger portion 100 and the second heat exchanger portion 200 are symmetrical with respect to the folding line.

[0042] In some embodiments, the heat transfer coefficient of the second fin portions 4b is greater than that of the first fin portions 4a, that is, the capacity of the second heat exchanger portion 200 is increased by increasing the heat transfer coefficient of the second fin portions 4b.

[0043] Fig. 2 is a schematic view of the inverted V-shaped heat exchanger according to another embodiment of the present disclosure. In the embodiment shown in Fig. 2, the heat exchanger is formed by bending a single heat exchanger of parallel flow type, in which no fins are disposed between adjacent tubes 3 in the bent portion so as to facilitate the bending of the heat exchanger. The heat transfer coefficient of the second fin portions 4b is greater than that of the first fin portions 4a, so that the temperature t2 of the outlet air A2 may be substantially equal to the temperature t1 of the outlet air A1, thus improving the heat exchange performance. According to the embodiment shown in Fig. 2, because there are no fins in the bent portion, the heat exchanger is much easier to bend without influencing the heat exchange performance.

[0044] Fig. 3 is a schematic view of the inverted V-shaped heat exchanger according to still another embodiment of the present disclosure. As shown in Fig. 3, the first heat exchanger portion 100 is a single complete heat exchanger and the second heat exchanger portion 200 is also a single complete heat exchanger. In this embodiment, the heat exchanger further comprises a third header 5a (i.e., an outlet header of the first heat exchanger portion 100) and a fourth header 5b (i.e., an inlet header of the second heat exchanger portion 200). The first header 1 and the third header 5a are connected and communicated by the plurality of first tube portions 3a, and each first fin portion 4a is disposed between adjacent first tube portions 3a. The second header 2 and the fourth header 5b are connected and communicated by the plurality of second tube portions 3b, and each second fin portion 4b is disposed between adjacent second tube portions 3b. The third header 5a and the fourth header 5b are connected and communicated by a connection pipe 6. The bent portion is formed by bending the connection pipe 6. In some embodiments of the present disclosure, the first heat exchanger portion 100 and the second heat exchanger portion 200 are symmetrical. In other words, the inverted V-shaped heat exchanger in Fig. 3 is formed by two separate heat exchangers of parallel flow type such as flat plate heat exchanger.

The heat transfer coefficient of the second fin portions 4b is greater than that of the first fin portions 4a, so that the temperature t2 of the outlet air A2 may be substantially equal to the temperature t1 of the outlet air A1, thus improving the heat exchange performance. According to the embodiment shown in Fig. 3, because the bent portion is formed by bending the connection pipe 6, the heat exchanger is much easier to manufacture without influencing the heat exchange performance.

[0045] Fig. 4 and Fig. 7 show a fin 4 of the heat exchanger according to embodiments of the present disclosure. As shown in Fig. 4 and Fig. 7, each fin 4 is comprised of a series of corrugations, each of which, in turn, is comprised of a pair of adjacent fin walls 42, joined at a crest 43. Each fin wall 42 is formed with a plurality of louvers 41, each louver 41 may be formed by cutting and bending a certain portion of the fin wall 42 so as to form a vane 411 and an opening 412. The louver angle indicated at *a* is the angle of each vane 411 inclined relative to the general plane of the fin wall 42 of the fin 4. The fin pitch indicated at "FP" is a spacing (a distance in the up and down direction in Fig. 4) between two adjacent crests 43. Louver length is indicated at Lh.

[0046] Accordingly, as shown in Figs. 5-6, 8-11, for convenience of description, the fin wall, the crest and the louver of the first fin portion 4a are indicated at 42a, 43a, and 41a respectively, and the fin wall, the crest and the louver of the second fin portion 4b are indicated at 42b, 43b, and 41b respectively. Further, the vane and the opening of the first fin portion 4a are indicated at 411a and 412a respectively and the vane and the opening of the second fin portion 4b are indicated at 411b and 412b respectively. In addition, the fin pitches of the first fin portion 4a and second fin portion 4b are indicated at FP1 and FP2 respectively.

[0047] As shown in Figs. 5-6 and 10-11, in some embodiments of the present disclosure, in order to make the heat transfer coefficient of the second fin portions 4b greater than that of the first fin portions 4a, the fin pitch FP2 of each second fin portion 4b is smaller than the fin pitch FP1 of each first fin portion 4a.

[0048] In some embodiments of the present disclosure, as shown in Figs. 5-6 and 8-9, in order to make the heat transfer coefficient of the second fin portions 4b greater than that of the first fin portions 4a, the louver angle *a2* of each second fin portion 4b is greater than the louver angle *a1* of each first fin portion 4a.

[0049] In some embodiments of the present disclosure, as shown in Figs. 5-6, in order to make the heat transfer coefficient of the second fin portion 4b greater than that of the first fin portion 4a, the louver length Lh2 of each second fin portion 4b is greater than the louver length Lh1 of each first fin portion 4a.

[0050] With the above embodiments, by causing at least one of the louver angle, the louver length and fin pitch of the first pin portion not identical to a corresponding one of the second fin portions, the heat transfer coefficient of the second heat exchanger portion is increased. It will be appreciated that the present disclosure is not limited to this.

[0051] With the inverted V-shaped heat exchanger according to embodiments of the present disclosure, since the heat transfer coefficient of the second fin portions is different from that of the first fin portions, the capacity of the second heat exchanger portion may be substantially identical with that of the first heat exchanger portion, so that the temperature of the outlet air at the left side may be substantially identical with that of the outlet air at the right side. In other words, the heat transfer coefficient of the second fin portions located at a side where the temperature of the refrigerant is higher is greater than that of the first fin portion located at another side where the temperature of the refrigerant is lower, thus improving the heat exchange performance such as the comfortableness of an air conditioner.

[0052] Reference throughout this specification to "an embodiment", "some embodiments", "one embodiment", "an example", "a specific examples", or "some examples" means that a particular feature, structure, material, or characteristic described in connection with the embodiment or example is included in at least one embodiment or example of the disclosure. Thus, the appearances of the phrases such as "in some embodiments", "in one embodiment", "in an embodiment", "an example", "a specific example", or "some examples" in various places throughout this specification are not necessarily referring to the same embodiment or example of the disclosure. Furthermore, the particular features, structures, materials, or characteristics may be combined in any suitable manner in one or more embodiments or examples.

[0053] Although explanatory embodiments have been shown and described, it would be appreciated by those skilled in the art that changes, alternatives, and modifications all falling into the scope of the claims and their equivalents may be made in the embodiments.

Claims

1. A heat exchanger, comprising:

a first header (1);
a second header (2);
and
a plurality of fins (4) each disposed between adjacent tubes (3), wherein
the heat exchanger has a bent portion between the first and second headers (1, 2) such that the heat exchanger is divided into first (100) and second heat exchanger portions (200) which are located at two sides of the bent portion, respectively, and
wherein a heat transfer coefficient of the second heat exchanger portion (200) is greater than that of the first heat exchanger portion (100), wherein each fin (4) is divided into a first fin portion (4a) in the first heat exchanger portion (100) and a second fin portion (4b) in the second heat exchanger portion (200), and a heat transfer coefficient of the second fin portions (4b) is greater than that of the first fin portions (4a), **characterized in that** the heat exchanger comprises a plurality of tubes (3) spaced apart from each other and each connected between the first and second headers (1, 2) in fluid communication therewith; wherein
each of the first and second fin portions (4a, 4b) is formed with louvers, in which a louver angle of the louvers in each second fin portion is greater than that of the louvers in each first fin portion, and/or
each of the first and second fin portions is formed with louvers (41), in which a louver length (Lh) of the louvers (41) in each second fin portion (4b) is greater than that of the louvers in each first fin portion (4a).

2. The heat exchanger according to claim 1, further comprising a third header (5a) and a fourth header (5b),
wherein each tube (3) consists of a first tube portion (3a) and a second tube portion (3b) and the first header (1) and the third header (5a) are connected and communicated via the first tube portions (3a), and the second header (2) and the fourth header (5b) are connected and communicated via the second tube portions (3b);
wherein the third header (5a) and the fourth header (5b) are connected and communicated via a connection pipe (6); and
wherein the bent portion is formed by bending the connection pipe (6).

3. The heat exchanger according to claim 1, **characterized in that** the heat exchanger is formed by bending a single heat exchanger of parallel flow type.

4. The heat exchanger according to claim 3, **characterized in that** no fins (4) are disposed in the bent portion.

5. The heat exchanger according to claim 1, **characterized in that** each of the first and second fin portions (4a, 4b) has a substantially corrugated shape, and a fin pitch (Fp) of each second fin portion (4b) is smaller than that of each first fin portion (4a).

Patentansprüche

1. Ein Wärmetauscher, der aufweist:

   einen ersten Sammler (1);
   einen zweiten Sammler (2);
   und eine Vielzahl von Rippen (4), die jeweils zwischen benachbarten Rohren (3) angeordnet sind, wobei der Wärmetauscher einen gebogenen Abschnitt zwischen dem ersten und dem zweiten Sammler (1, 2) aufweist, so dass der Wärmetauscher in einen ersten (100) und einen zweiten Wärmetauscherabschnitt (200) unterteilt ist, die sich jeweils an zwei Seiten des gebogenen Abschnittes befinden, und
   wobei ein Wärmeübergangskoeffizient des zweiten Wärmetauscherabschnittes (200) größer als der des ersten Wärmetauscherabschnitts (100) ist, wobei jede Rippe (4) in einen ersten Rippenabschnitt (4a) im ersten Wärmetauscherabschnitt (100) und einen zweiten Rippenabschnitt (4b) im zweiten Wärmetauscherabschnitt (200) unterteilt ist, und ein Wärmeübertragungskoeffizient der zweiten Rippenabschnitte (4b) größer als der der ersten Rippenabschnitte (4a) ist, **dadurch gekennzeichnet, dass** der Wärmetauscher eine Vielzahl von Rohren (3) umfasst, die voneinander beabstandet sind und jeweils zwischen dem ersten und zweiten Sammler (1, 2) in Fluidverbindung damit verbunden sind, wobei
   jeder der ersten und zweiten Rippenabschnitte (4a, 4b) mit Lamellen ausgebildet ist, bei denen ein Lamellenwinkel der Lamellen in jedem zweiten Rippenabschnitt größer ist als der der Lamellen in jedem ersten Rippenabschnitt und/oder
   jeder der ersten und zweiten Rippenabschnitte mit Lamellen (41) ausgebildet ist, bei denen eine Lamellenlänge (Lh) der Lamellen (41) in jedem zweiten Rippenabschnitt (4b) größer als die der Lamellen in den ersten Rippenabschnitten (4a) ist.

2. Wärmetauscher nach Anspruch 1, der weiterhin einen dritten Sammler (5a) und einen vierten Sammler (5b) aufweist,
   wobei jedes Rohr (3) aus einem ersten Rohrabschnitt (3a) und einem zweiten Rohrabschnitt (3b) besteht und der erste Sammler (1) und der dritte Sammler (5a) verbunden sind und über die ersten Rohrabschnitte (3a) in Verbindung stehen und der zweite Sammler (2) und der vierte Sammler (5b) verbunden sind und über die zweiten Rohrabschnitte (3b) in Verbindung stehen;
   wobei der dritte Sammler (5a) und der vierte Sammler (5b) verbunden sind und über ein Verbindungsrohr (6) in Verbindung stehen; und wobei der gebogene Abschnitt durch Biegen des Verbindungsrohrs (6) gebildet ist.

3. Wärmetauscher nach Anspruch 1, **dadurch gekennzeichnet, dass** der Wärmetauscher durch Biegen eines einzelnen Wärmetauschers vom Parallelströmungstyp gebildet ist.

4. Wärmetauscher nach Anspruch 3, **dadurch gekennzeichnet, dass** in dem gebogenen Abschnitt keine Rippen (4) angeordnet sind.

5. Wärmetauscher nach Anspruch 1, **dadurch gekennzeichnet, dass** jeder der ersten und zweiten Rippenabschnitte (4a, 4b) eine im wesentlichen gewellte Form hat und ein Rippenabstand (Fp) jedes zweiten Rippenabschnitts (4b) kleiner als der jedes ersten Rippenabschnitts (4a) ist.

Revendications

1. Échangeur de chaleur, comprenant :

   une première partie supérieure (1) ;
   une deuxième partie supérieure (2) ;
   et
   une pluralité d'ailettes (4), chacune disposée entre des tubes adjacents (3), l'échangeur de chaleur comportant une section courbée entre les premières et deuxième partie supérieure (1, 2), de sorte que l'échangeur de chaleur est divisé en des première (100) et seconde sections (200) d'échangeur de chaleur qui se trouvent sur deux faces de la section courbée respectivement et
   un coefficient de transfert de chaleur de la seconde section d'échangeur de chaleur (200) étant supérieur à celui de la première section d'échangeur de chaleur (100), chaque ailette (4) étant divisée en une première section d'ailette (4a) dans la première section d'échangeur de chaleur (100) et une seconde section d'ailette (4b) dans la seconde section d'échangeur de chaleur (200), et un coefficient de transfert de

chaleur des secondes sections d'ailette (4b) étant supérieur à celui des premières sections d'ailettes (4a), **caractérisé en ce que** l'échangeur de chaleur comprend une pluralité de tubes (3) espacés les uns des autres et connectés chacun entre les premières et deuxième parties supérieures (1, 2) en communication fluidique avec celles-ci ;

chacune des première et seconde sections d'ailette (4a, 4b) est conformée avec des persiennes, dans lesquelles un angle de persiennes des persiennes est, dans chaque seconde section d'ailette, supérieur à celui des persiennes dans chaque première section d'ailettes, et/ou

chacune des première et seconde sections d'ailette est conformée avec des persiennes (41), dans lesquelles une longueur de persiennes (Lh) des persiennes (41) dans chaque seconde section d'ailette (4b) est supérieure à celle des persiennes dans chaque première section d'ailette (4a).

2. Échangeur de chaleur selon la revendication 1, comprenant en outre une troisième partie supérieure (5a) et une quatrième partie supérieure (5b),

chaque tube (3) étant composé d'une première section de tube (3a) et d'une seconde section de tube (3b) et la première partie supérieure (1) et la troisième partie supérieure (5a) étant connectées et communiquant via les premières sections de tube (3a), et la deuxième partie supérieure (2) et la quatrième partie supérieure (5b) étant connectées et communiquant via les secondes sections de tube (3b) ;

la troisième partie supérieure (5a) et la quatrième partie supérieure (5b) étant connectées et communiquant via un tuyau de connexion (6) ; et

la section courbée étant formée en courbant le tuyau de connexion (6).

3. Échangeur de chaleur selon la revendication 1, **caractérisé en ce que** l'échangeur de chaleur est formé en courbant un seul échangeur de chaleur de type à écoulement parallèle.

4. Échangeur de chaleur selon la revendication 3, **caractérisé en ce qu'**aucune ailette (4) n'est disposée dans la section courbée.

5. Échangeur de chaleur selon la revendication 1, **caractérisé en ce que** chacune des première et seconde sections d'ailettes (4a, 4b) a une forme substantiellement ondulée, et que le pas d'ailette (Fp) de chaque seconde section d'ailette (4b) est inférieur à celui de chaque première section d'ailette (4a).

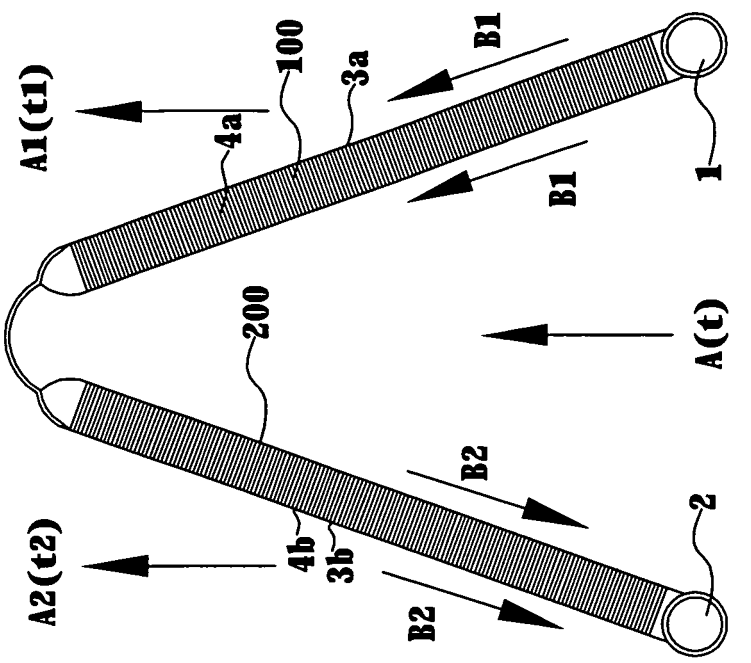

A1(t1)
A2(t2)
A(t)
100
200
3a
4a
4b
3b
B1
B1
B2
B2
1
2

Fig.2

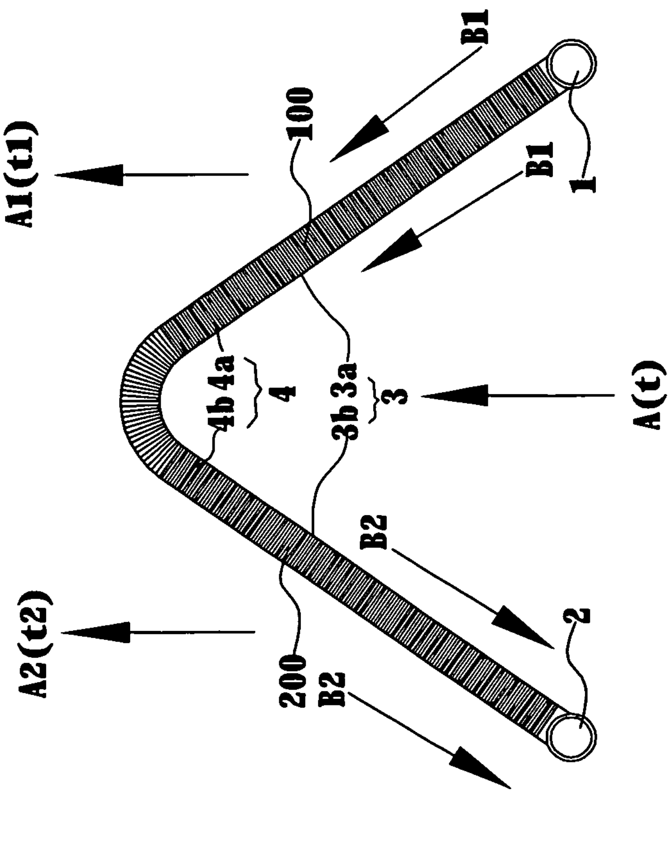
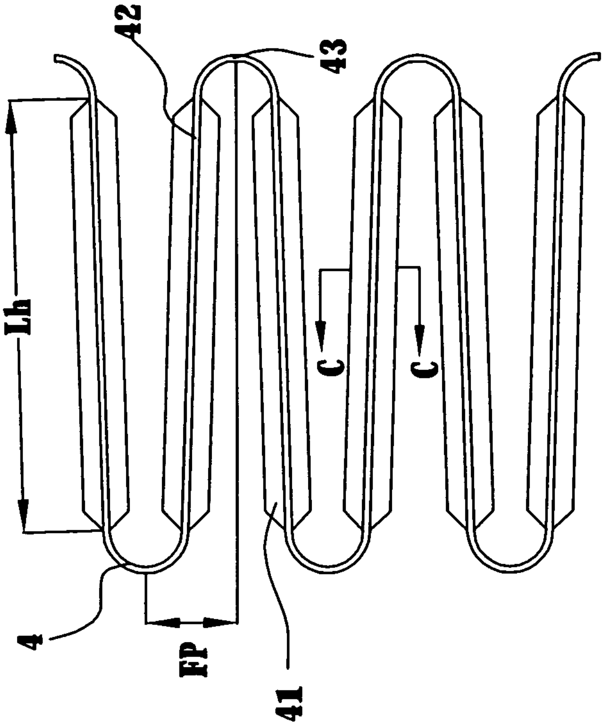
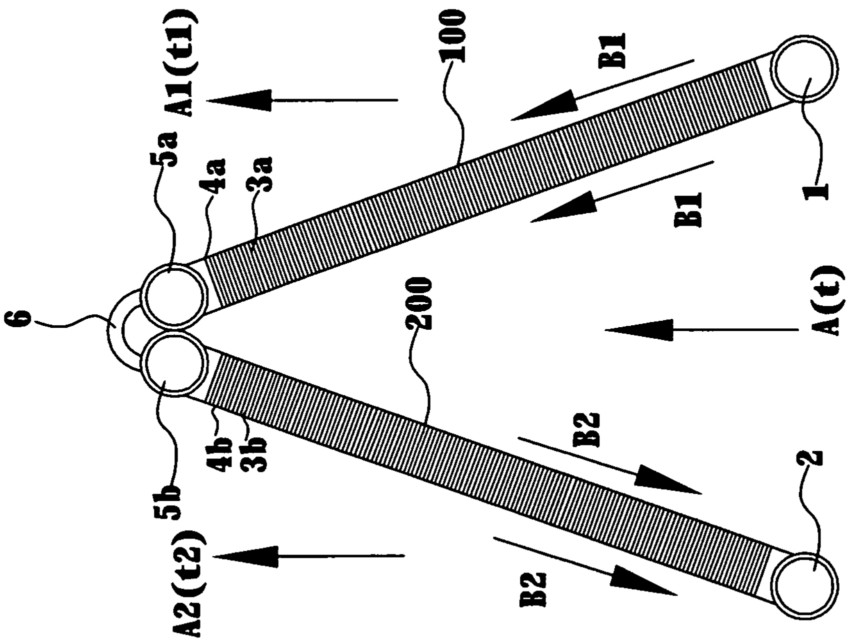

A1(t1)
A2(t2)
A(t)
100
200
4b 4a
4
3b 3a
3
B1
B1
B2
B2
1
2

Fig.1



42
43
Lh
C
C
4
FP
41

Fig.4



6
5a
4a
3a
A1(t1)
100
B1
B1
1
200
A(t)
5b
4b
3b
B2
B2
2
A2(t2)

Fig.3

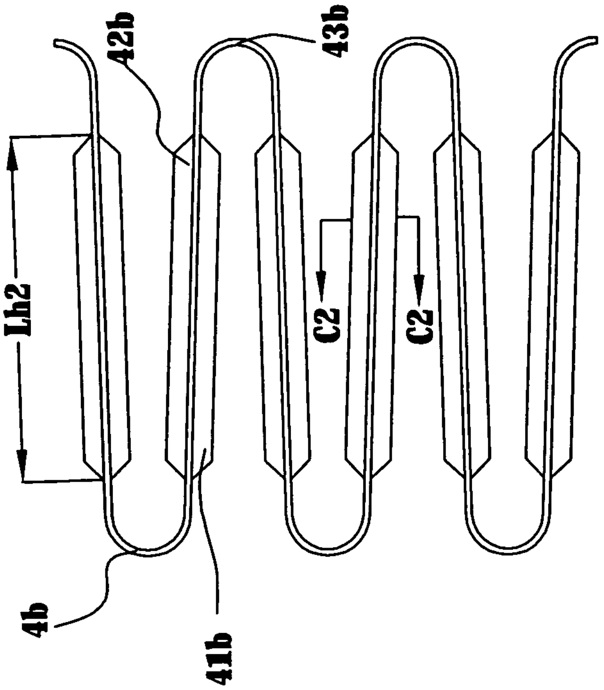


Fig.6

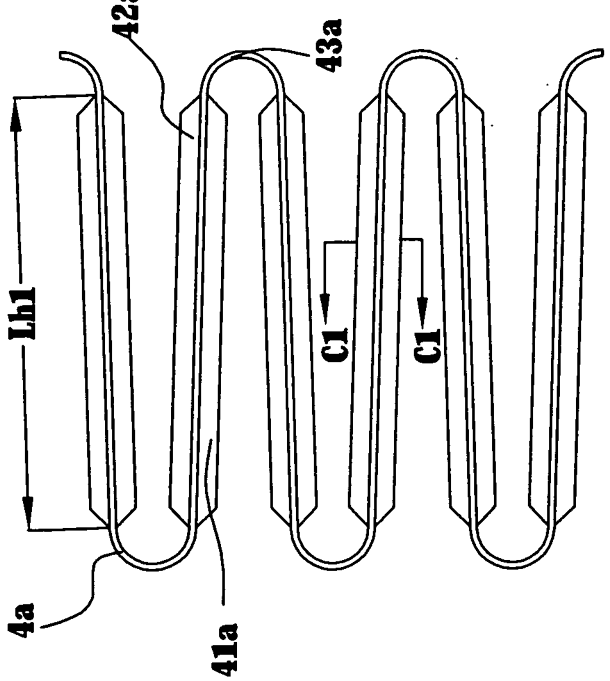


Fig.5

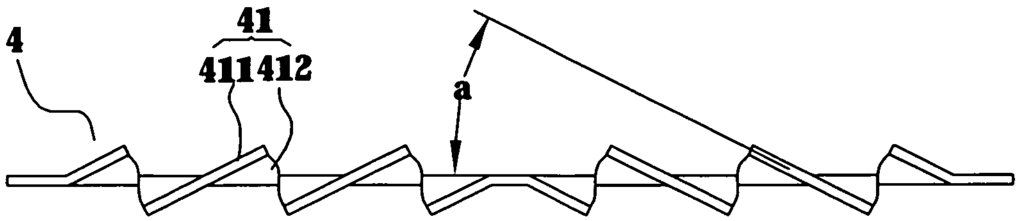


Fig.7

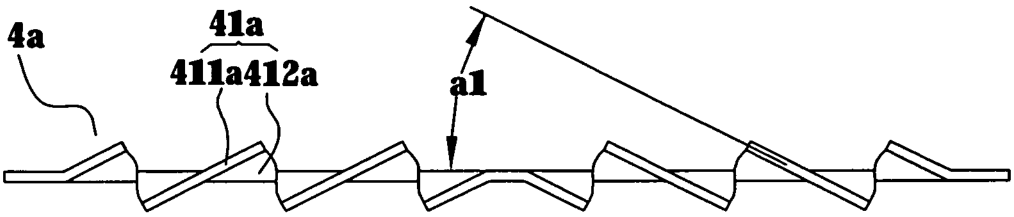


Fig.8

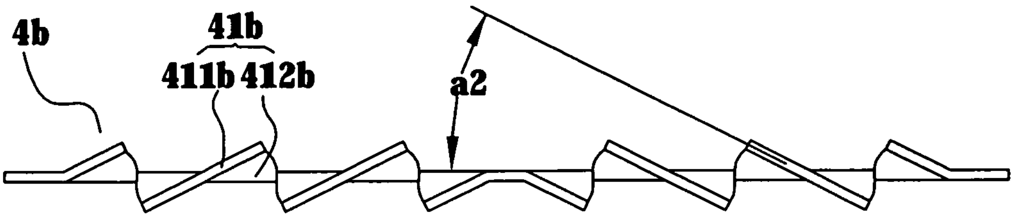


Fig.9

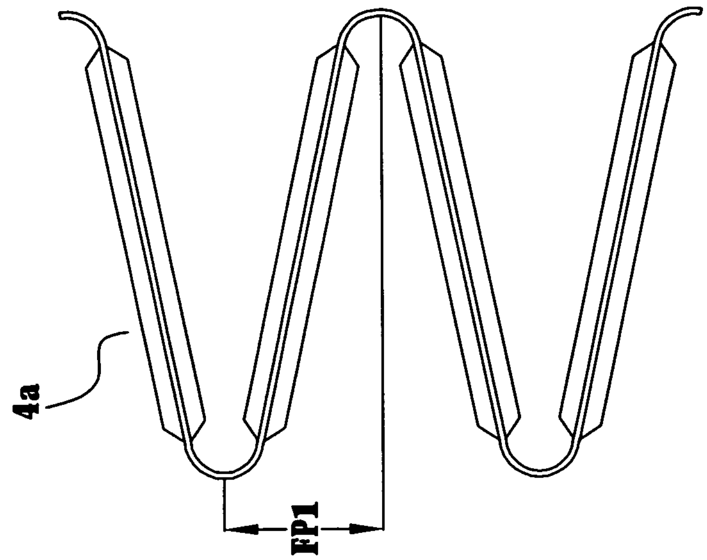


Fig.11

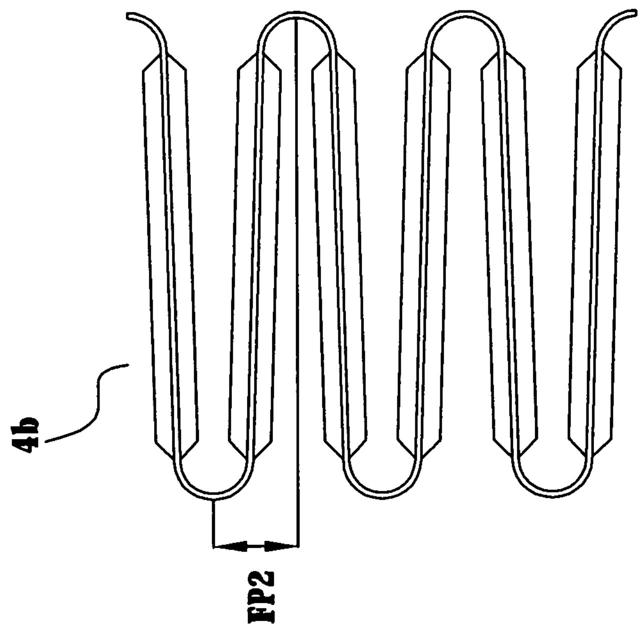


Fig.10

REFERENCES CITED IN THE DESCRIPTION

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- US 20040168456 A1 **[0007]**