HEAT EXCHANGER FOR A MOTOR VEHICLE

Inventors: Aurelie Bellenfant, Roeze sur Sarthe (FR); Alain Pourmarin, La Suze sur Sarthe (FR); Fabienne Bedon, Le Mans (FR); Eric Goyet, Arnage (FR); Jean Christophe Prevost, Ligron (FR); Virginie Vincent, Le Mans (FR)

Assignee: VALEO SYSTEMS THEMIDIQUES, Le Mesnil Saint Denis (FR)

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ABSTRACT
A heat exchanger comprises: a plurality of tubes for the circulation of a coolant which are arranged as a core bundle of tubes having a width in a longitudinal direction, a depth in a transverse direction, and a height in a vertical direction; a first header and a second header into which the tubes of the core bundle open; and a first partition arranged respectively in the first and second headers. The first partition respectively divides the first header and the second header, at least partially, into a first compartment and a second compartment which are adjacent in the transverse direction. The heat exchanger further comprises at least one second partition dividing the first compartment and the second compartment of the first header into a first chamber, a fourth chamber, and at least one return compartment which is adjacent, in the longitudinal direction, to the first and fourth chambers.
Figure 1
HEAT EXCHANGER FOR A MOTOR VEHICLE

[0001] The invention relates to a heat exchanger and, more particularly, to a condenser, of a heating, ventilation and/or air-conditioning installation for the interior of a motor vehicle.

[0002] A conventional design of such a condenser is known, for example, from EP 1 223 391 A1 and comprises a core bundle of tubes, through each of which there are formed one or more canals through which a coolant can circulate. The tubes are aligned in a single row, and their ends are housed in common headers, which provide mutual fluidic communication between the canals of various tubes.

[0003] The coolant enters the condenser in the gaseous phase and, as it gradually passes through the canals of the various tubes, exchanges heat with the air passing externally through the condenser, causing progressive condensation to the liquid phase.

[0004] However, such a condenser of conventional design is of relatively large size. The size essentially corresponds to the “height” of the condenser which, by convention, corresponds to the height of the tubes used, plus the height of the headers, and the width of the condenser which, by convention, corresponds to the distance between the end tubes of the bundle.

[0005] It should however be understood that the use of the terms “height” and “width” does not in any way create a precedent as to how the condenser is laid out on board the vehicle, it being possible for the layout to be such that the tubes are generally laid vertically, horizontally, or at any angle, the vehicle being considered generally to be horizontal.

[0006] In certain applications, however, it is inconceivable to position the condenser along the front face of the vehicle. This is the case in particular when the condenser is to be made to operate as an internal condenser. The internal condenser has therefore to be housed actually within a housing of a heating, ventilation and/or air-conditioning installation, especially located near the vehicle interior. The available volume in which to house the internal condenser is therefore greatly reduced, to the point that the width of the condenser has, in certain configurations, to be reduced, notably by a factor of four.

[0007] It is also known practice, from document EP 1 460 364 A1, to create a core bundle that has two rows of tubes. For each row of tubes, one of the ends of the tubes is housed in a header, while the opposite end is connected in fluidic communication with one or more tubes of the other row. This fluidic connection may be achieved either by the use of an additional header common to the two rows of tubes or by bending over the tubular elements in each instance so as to create two tubes, which ultimately belong to different rows.

[0008] Now, for a set size, bending over the tubes appreciably reduces the “useful height” of the core bundle, which means the height of the tube available for exchanging heat. Part of the height of the tubes is therefore “sacrificed” to the bending. Moreover, the use of a return header entails additional components, which increase the cost and complexity of the condenser.

[0009] According to another embodiment taught by document EP 0 414 433, it is known practice to create a condenser in two parts, respectively comprising a core bundle with a single row of tubes and two headers into which the tubes open. The headers are placed in mutual fluidic communication by one or more connecting pipes.

[0010] This arrangement entails increasing the number of mechanical components, making such a condenser particularly complicated to produce and difficult to do so on an industrial scale.

[0011] Moreover, the connecting pipes increase the width of the condenser and lead to significant pressure drops because of their bore section which narrows in relation to the size of the headers that they connect.

[0012] It is therefore evident that the known heat exchangers are not satisfactory in meeting the needs of a specific application such as an internal condenser.

[0013] The present invention proposes a heat exchanger that exhibits good thermal performance, minimal pressure drops, and dimensions compatible with integration into a housing of a heating, ventilation and/or air-conditioning installation.

[0014] To this end, the present invention proposes a heat exchanger comprising:

[0015] a plurality of tubes arranged in a core bundle of tubes which has a width in a longitudinal direction, a depth in a transverse direction and a height in a vertical direction and allows for a circulation of a coolant;

[0016] a first header and a second header into which the tubes of the core bundle of tubes open;

[0017] a first partition arranged respectively in the first header and in the second header, and

[0018] the first partition respectively dividing the first header and the second header, at least partially, into a first compartment and a second compartment which are adjacent in the transverse direction.

[0019] More specifically, the heat exchanger comprises at least one second partition dividing the first compartment and the second compartment of the first header into a first chamber, a fourth chamber and at least one return compartment which is adjacent, in the longitudinal direction, to the first chamber and to the fourth chamber.

[0020] Advantageously, the plurality of tubes is arranged in a first row and in a second row such that:

[0021] some of the tubes of the first row open into the first chamber of the first header and into the first compartment of the second header,

[0022] some of the tubes of the second row open into the fourth chamber of the first header and into the second compartment of the second header, and

[0023] some of the tubes of the first row and of the second row open into the return compartment of the first header.

[0024] According to the present invention, the heat exchanger is connected to a coolant circuit circuit by a first pipe and a second pipe opening respectively into the first chamber and the fourth chamber of the first header.

[0025] According to an alternative form of embodiment, the first partition divides the return compartment into a second chamber and a third chamber.

[0026] Advantageously, the first partition is a dividing partition separating the second chamber from the third chamber and pierced with at least one through-passage.

[0027] In the context of the present invention, the heat exchanger comprises at least one baseplate and at least one cover, which are assembled one with the other to form the first header and/or the second header.
To complement this, the first partition is formed by a projection of the cover and/or of the baseplate toward the baseplate and/or the cover and in contact with the baseplate and/or with the cover.

Alternatively, the second partition comprises an additional partitioning element interposed between the baseplate and the cover.

In this alternative, the additional partitioning element is configured to conform in terms of shape to the first header and/or the second header.

In addition, the cover is formed of a pressed metal plate defining at least one first longitudinal cavity and one second longitudinal cavity.

According to this embodiment, the first partition is formed of a non-pressed region of the metal plate. To complement this, the second partition is formed of a non-pressed region of the metal plate.

Finally, the pressed metal plate that forms the cover comprises at least one transverse cavity delimited by two second partitions forming the return compartment.

The proposed heat exchanger comprises two rows of tubes, organized into two layers of tubes and, in particular, four passes. This optimizes the thermal performance of the heat exchanger in relation to a size dictated in particular when the heat exchanger has to be incorporated into a heating, ventilation and/or air conditioning housing.

Advantageously, the first and the second two pass on the one hand, and the third and fourth pass on the other, are connected via tubes of the same row.

The use of two headers, each one common to the tubes of the two rows, reduces the number of heat exchanger components. This arrangement makes the core bundle easier to assemble. This is because the two rows can be assembled at the same time, particularly during the same brazing operation.

Moreover, according to the present invention, the tubes of one row are placed in communication with the tubes of the other row within one of the headers, without additional components.

The cost of such a heat exchanger is therefore reduced and it becomes easier to assemble.

Finally, the communication between the two layers of tubes may be sized in such a way that the bore section of the communication means is greater than or equal to the combined section of the tubes opening into the communication chambers. This avoids the creation of additional pressure drops.

What is more, the communication means are distributed over the entire length of the partitioning between the communication chambers, at several locations. This then improves the distribution of the rows of tubes and, therefore, the efficiency of the heat exchanger, the distribution of heat across the heat exchanger and the internal pressure drops experienced by the moving fluid.

Other features and advantages of the invention will become apparent from examining the description which follows with reference to the attached drawings, given by way of nonlimiting examples, which may serve to supplement the understanding of the present invention and the description of how it is embodied but may also, as appropriate, contribute to defining the invention, and in which:

FIG. 1 depicts a heat exchanger according to a first embodiment of the invention, in the assembled state, viewed in perspective.

FIG. 2 depicts a heat exchanger of FIG. 1, in an exploded perspective view.

FIG. 3 depicts a detail of the heat exchanger of FIG. 1, showing a first header, in an exploded perspective view.

FIG. 4 depicts a detail of the heat exchanger of FIG. 1, showing a second header, in an exploded perspective view.

FIG. 5 is similar to FIG. 1, showing one path of the coolant through the heat exchanger.

FIG. 6 is detail VI of FIG. 5.

FIG. 7 depicts a heat exchanger according to a second embodiment of the invention, in a view similar to FIG. 1.

FIG. 8 depicts the heat exchanger of FIG. 7 in a view similar to FIG. 2.

FIG. 9 depicts a first header for the heat exchanger according to FIG. 7, in a view similar to FIG. 3.

FIG. 10 depicts a second header for the heat exchanger according to FIG. 7, in a view similar to FIG. 4, and

FIG. 11 depicts the heat exchanger according to FIG. 7 in a view similar to FIG. 5.

Reference is made first of all to FIGS. 1 to 4, which at least partially depict a heat exchanger 1, or first heat exchanger 1, particularly intended for use as a condenser, particularly as an internal condenser to be incorporated into a motor vehicle heating, ventilation and/or air conditioning housing. FIGS. 1 and 2 depict the heat exchanger 1 according to a first embodiment of the invention, respectively in the assembled state and in an exploded perspective view. More particularly, FIGS. 3 and 4 depict a detail of the heat exchanger 1, respectively showing a first header and a second header, in an exploded and perspective view.

The heat exchanger 1 comprises a core bundle 3 of tubes made up of a plurality of tubes 5 suited to the circulation of a fluid, particularly a coolant flowing through an air conditioning loop of a heating, ventilation and/or air conditioning installation for the interior of a motor vehicle.

The heat exchanger 1 extends over a width “L” in a first direction “x” referred to as the longitudinal direction, and over a depth “P” in a second direction “y” referred to as the transverse direction, and over a height “H” in a third direction “z” referred to as the vertical direction.

According to the present invention, the heat exchanger 1 is arranged in such a way that the tubes 5 are distributed as a first row 7A and a second row 7B. For preference, the first row 7A and the second row 7B are mutually parallel and are arranged one behind the other in the transverse direction.

Thus, the first row 7A is made up of a plurality of tubes arranged parallel to one another in the longitudinal direction. Likewise, the second row 7B is made up of a plurality of tubes 7 arranged parallel to one another in the longitudinal direction.

Each tube 5 extends over a depth “P” in the transverse direction and over a height “H” in the vertical direction. A first end of the tube 5 is housed in a first header 9 and a second end of the tube 5, which is the opposite end to the first end, is housed in a second header 11. The first header 9 and the second header 11 are of elongate shape.

The first header 9 and the second header 11 essentially extend in the longitudinal direction and are arranged with respect to the core bundle 3 of tubes in such a way that the longitudinal direction of the first header 9 and of the second header 11 corresponds to the longitudinal direction of the core bundle 3 of tubes.
The heat exchanger 1 comprises a first pipe 13 and a second pipe 15 for connecting the heat exchanger 1 to a coolant circuit. The first pipe 13 and the second pipe 15 are arranged at a first end of the first header 9 and open into this first header. The first pipe 13 and the second pipe 15 may be arranged differently, notably the first pipe 13 and the second pipe 15 may be arranged at one end of the second header 11 or may be arranged respectively at one end of the first header 9 and at one end of the second header 11.

The first header 9 comprises a profile shaped as a header baseplate 17, or first baseplate 17, and a profile shaped as a header cover 19, or first cover 19. The first baseplate 17 and the first cover 19 are fixed to one another to create an interior volume defining the first header 9.

The first baseplate 17 is pierced with a plurality of first orifices 21. The plurality of first orifices 21 is distributed between two rows so that the first orifices 21 of each of the rows are aligned in the longitudinal direction. The cross section of each first orifice 21 is configured in such a way that it conforms to the contour of the cross section of the tubes 5. In this instance, nonlimitingly, the tubes 5 are in the form of flat tubes.

The first baseplate 17 and the first cover 19 have a cross section configured as two portions of a circle joined together. The first baseplate 17 and the first cover 19 have complementary cross sections which, when joined together, correspond to the cross section of the first header 9. Thus, when the first baseplate 17 and the first cover 19 are assembled with one another the first header 9 is formed in the manner of two cylindrical portions of circular cross section, joined together along a common generatrix.

The first header 9 further comprises a first closure partition 22. The first closure partition 22 is of a shape that corresponds to the cross section of the first header 9. The first closure partition 22 is interposed between the first baseplate 17 and the first cover 19. According to this embodiment of the invention, the first closure partition 22 is positioned at a second end of the first header 9 which is the opposite end to the first end at which the first pipe 13 and the second pipe 15 are arranged.

The first header 9 also comprises a second closure partition 23, of an overall shape similar to the first closure partition 22 and interposed between the first baseplate 17 and the first cover 19, at the first end of the first header 9.

The second closure partition 23 differs from the first closure partition 22 in that it is pierced with two openings suited respectively to accepting the end portions of the first pipe 13 and of the second pipe 15.

Advantageously, the openings in the second closure partition 23 are arranged, respectively, more or less at the center of each of the two circular portions that make up the second closure partition 23.

The first closure partition 22 and the second closure partition 23 are fixed in a fluid tight manner to the first baseplate 17 and to the first cover 19, for example using brazing. According to one particular embodiment of the first embodiment of the invention, the first pipe 13 and the second pipe 15 are attached to a mounting plate 24. The mounting plate 24 comprises a first connection orifice 25 and a second connection orifice 26 which are designed to accept end portions of the first pipe 13 and of the second pipe 15. The mounting plate 24 also has end portions (unreferenced) received in the openings of the second closure partition 23. According to an alternative embodiment, the first pipe 13, the second pipe 15, the mounting plate 24, the first connection orifice 25 and the second connection orifice 26 are made as a one-piece component.

Thus defined, the first header 9 has a closed interior space into which the tubes 5 of the core bundle 3 of tubes open.

In cross section, the first cover 19 has, where the two portions of a circle meet, a first partition 27 produced, in particular, in the form of a projection 27 extending, in the longitudinal direction, toward the first baseplate 17, over the entire length of the first cover 19.

The projection 27 forms a first divider which, in collaboration with the first baseplate 17, divides the interior space of the first header 9 into a first compartment 28 and a second compartment 29 respectively extending in the longitudinal direction over all or part of the length of the first header 9. The first compartment 28 and the second compartment 29 are adjacent to one another in the transverse direction.

A first row of the first orifices 21 of the first baseplate 17 is housed in the first compartment 28, while the second row of first orifices 21 is housed in the second compartment 29.

The first header box 9 further comprises a second partition 30 produced, in particular, in the form of an additional partitioning element 30. The additional partitioning element 30 is produced in the form of a flat component of a shape similar to the first closure partition 22, interposed between the first baseplate 17 and the first cover 19. The additional partitioning element 30 is arranged in the second direction "y". According to one embodiment, the additional partitioning element 30 occupies a median position with respect to the first and second ends of the first header 9.

According to the embodiment depicted, as an option, the additional partitioning element 30 has a slot through which the projection 27 can pass. As an additional alternative, the projection 27 also has a similar slot intended to collaborate with the slot of the additional partitioning element 30.

The additional partitioning element 30 acts as a dividing partition which divides the first compartment 28 into a first chamber 31 and a second chamber 33. The second chamber 33 is therefore adjacent to the first chamber 31 and the longitudinal direction. According to the embodiment depicted, the first pipe 13 opens into the first chamber 31 of the first compartment 28.

Likewise, the additional partitioning element 30 divides the second compartment 29 into a third chamber 35 and a fourth chamber 37. The third chamber 35 is adjacent to the second chamber 33 in the transverse direction. Moreover, the fourth chamber 37 is adjacent to the third chamber 35 in the longitudinal direction. According to the embodiment depicted, the second pipe 15 opens into the fourth chamber 37.

The first orifices 21 of the first baseplate 17 housed in the first compartment 28 and the second compartment 29 are distributed, more or less evenly, between the first chamber 31 and the second chamber 33 on the one hand, and between the third chamber 35 and the fourth chamber 37 on the other.

According to the present invention, the projection 27 is pierced with at least one through-passage 38, advantageously with a plurality of through-passages 38. The through-passage 38 or the plurality of through-passages 38 opens into the second chamber 33 and into the third chamber 35. The
through-passage 38 or the plurality of through-passages 38 therefore places the second chamber 33 and the third chamber 35 in communication. In one particular embodiment that incorporates a plurality of through-passages 38, the through-passages 38 are evenly distributed over the entire length of the projection 27 separating the second chamber 33 and the third chamber 35. Defined in this way, the second chamber 33 and the third chamber 35 together define a return compartment.

0080] The second header 11 is configured in a similar way to the first header 9. However, the second header 11 comprises structural differences by comparison with the first header 9 and these are:

0081] the additional partitioning element 30 is replaced by a stiffening element 51, produced in the form of a flat component of outline similar to the additional partitioning element 30;

0082] the second closure partition 23 is replaced by a partition element similar to the first closure partition 22; and

0083] the projection 27 of the second header 11 has no through-passage 38 or plurality of through-passages 38.

0084] The stiffening element 51 is pierced with two passages 53. Advantageously, the two passages 53 of the stiffening element 51 are respectively located more or less at the center of each of the two circular portions that make up the stiffening element 51. According to the embodiment depicted, the stiffening element 51 is arranged in the second direction “y” and is in a median position in relation to the first and second stiffening ends of the second header 11.

0085] The stiffening element 51 and the projection 27 of the second header 11 together form a second set of partitions which divides the first compartment 28 of the second header 11 into a first chamber 55 and a second chamber 57. The first chamber 55 and the second chamber 57 are respectively elongate in the longitudinal direction. Thus, the first chamber 55 is therefore adjacent to the second chamber 57 in the longitudinal direction, or first direction “x”.

0086] Likewise, the stiffening element 51 and the projection 27 of the second header 11 divide the second compartment 29 of the second header 11 into a third chamber 59 and a fourth chamber 61. The third chamber 59 and the fourth chamber 61 are respectively elongate in the longitudinal direction. Thus, the third chamber 59 is therefore adjacent to the fourth chamber 61 in the longitudinal direction, or first direction “x”.

0087] Moreover, the third chamber 59 is adjacent to the second chamber 57 in the transverse direction, and the fourth chamber 61 is adjacent to the first chamber 55 in the transverse direction.

0088] The heat exchanger 1 also comprises a plurality of heat exchange fins 63. Each heat exchange fin 63 is positioned between two tubes 5 that are adjacent and belong to the first row 7A and between two tubes 5 belonging to the second row 7B. To facilitate exchange of heat, each heat exchange fin 63 is in contact with the two adjacent tubes 5 between which it is positioned.

0089] As an exception, the heat exchange fins 63 positioned at the ends of the core bundle 3 of tubes are in contact with a tube 5 of the first row 7A, and of the second row 7B and with an end plate 65. In particular, the end plate 65 stiffens the heat exchanger 1 assembly.

0090] According to an alternative form of embodiment that has not been depicted, the heat exchange fin 63 is disposed so as to create a space between the first row 7A and the second row 7B of tubes 5 of the heat exchanger 1.

0091] According to the embodiment depicted, the additional partitioning element 30 and the stiffening element 51 are in a median position in relation to the first and second ends, respectively, of the first header 9 and of the second header 11. Nonetheless, depending on the configurations for the circulation of coolant through the heat exchanger 1, the additional partitioning element 30 and the stiffening element 51 may be positioned in various positions, in relation to the first and second ends, respectively, of the first header 9 and of the second header 11, in the longitudinal direction.

0092] FIG. 5 is similar to FIG. 1 showing one path of the coolant through the heat exchanger 1. FIG. 6 is a detail of FIG. 5.

0093] The coolant enters the first chamber 31 of the first header 9 through the first pipe 13 (arrow 67). It takes the tubes 5 of the first row 7A opening into the first chamber 31 to reach the first chamber 55 of the second header 11 (arrow 69). From the first chamber 55, the coolant passes through the passage 53 of the stiffening element 51 to reach the second chamber 57 of the second header 11 (arrow 71).

0094] Thereafter, the coolant passes through the tubes 5 of the first row 7A to reach the second chamber 33 of the first header 9 (arrow 73).

0095] From the second chamber 33 of the first header 9, the coolant passes through the through-passages 38 to reach the third chamber 35 of the first header 9 (arrow 75).

0096] From the third chamber 35 of the first header 9, the coolant takes the tubes 5 of the second row 7B to reach the third chamber 59 of the second header 11 (arrow 77). From the third chamber 59 of the second header 11, the coolant reaches the fourth chamber 61 of the second header 11 by passing through the passage 53 of the stiffening element 51 (arrow 79).

0097] Finally, coolant takes the tubes 5 of the second row 7B to reach the fourth chamber 37 of the first header 9 (arrow 81) before leaving the heat exchanger 1 via the second pipe 15 (arrow 83).

0098] In the first header 9, the through-passages 38 place the second chamber 33 and the third chamber 35 in fluidic communication.

0099] The bore section of the through-passages 38 is determined in such a way that the pressure drops experienced by the fluid passing through the heat exchanger 1 are minimized. This notably entails the combined bore section of the through-passages 38 being greater than or equal to the combined cross section of the tubes 5 opening into the second chamber 33.

0100] FIG. 7 depicts a heat exchanger 85 according to a second embodiment of the invention, in a view similar to FIG. 1. FIG. 8 depicts the heat exchanger 85 of FIG. 7 in a view similar to FIG. 2.

0101] Moreover, FIGS. 9 and 10 respectively depict a first header and a second header of the heat exchanger 85 according to the second embodiment of the invention, in views similar to FIGS. 3 and 4 respectively.

0102] The heat exchanger 85 differs through the design of a first header 87 and of a second header 89 which are different from the first header 9 and the second header 11 of the heat exchanger 1 according to the first embodiment of the invention.

0103] The other components already detailed in conjunction with the first embodiment of the invention are the same.
They will not be described further in detail. For these, reference may be made to the description given hereinabove.

[0104] The first header 87 of the heat exchanger 85 according to the second embodiment of the invention comprises a profile configured as a header baseplate 91 or second baseplate 91, and a profile configured as a header cover 93, or second cover 93. The second baseplate 91 and the second cover 93 are fixed together in such a way as to create an interior volume defining the first header 87.

[0105] More specifically, the second baseplate 91 comprises a first large contact face 94 and the second cover 93 comprises a second large contact face 94. Arranged in this way, the second baseplate 91 and the second cover 93 are assembled with the large contact face 94 of the second baseplate 91 and the large contact face 94 of the second cover 93 pressed against one another.

[0106] The second baseplate 91 is pierced with a plurality of second orifices 95 similar in shape and layout to the first orifices 21 of the heat exchanger 1 according to the first embodiment of the invention.

[0107] The second baseplate 91 is equipped on its longitudinal edges with a plurality of catching tabs 97 intended to be folded over on top of the second cover 93, on an exterior face, which is opposite to the large contact face 94 of the second cover 93.

[0108] The second cover 93 has a first longitudinal cavity 99 and a second longitudinal cavity 101. The first longitudinal cavity 99 and the second longitudinal cavity 101 are elongated in the longitudinal direction and are mutually adjacent in the transverse direction. For preference, the first longitudinal cavity 99 and the second longitudinal cavity 101 have cross sections of substantially semicircular shape.

[0109] According to one particular embodiment, the first longitudinal cavity 99 and the second longitudinal cavity 101 are produced by pressing a metal plate in order to obtain the second cover 93.

[0110] The first longitudinal cavity 99 is separated from the second longitudinal cavity 101 by a first partition 103 created, in particular, in the form of a longitudinal dividing wall 103. The longitudinal dividing wall 103 is obtained, in particular, by an absence of pressing of a corresponding part of the second cover 93.

[0111] The first longitudinal cavity 99 and the second longitudinal cavity 101 respectively have a longitudinal end open onto a longitudinal end of the second cover 93.

[0112] In addition, the first longitudinal cavity 99 and the second longitudinal cavity 101 have a closed opposite longitudinal end made up of a second partition 105 produced, in particular, in the form of a transverse dividing wall 105 of the second cover 93. In a similar way to the longitudinal dividing wall 103, the transverse dividing wall 105 of the second cover 93 is obtained notably by an absence of pressing of a corresponding part of the second cover 93.

[0113] The transverse dividing wall 105 of the second cover 93 is, in the particular embodiment depicted, positioned in a median position with respect to the second cover 93 in the longitudinal direction.

[0114] When the heat exchanger 85 according to the second embodiment of the invention is in the assembled state, the longitudinal dividing wall 103 and the transverse dividing wall 105 act as partitions which create within the first header 87 a first chamber 117 and a second chamber 118.

[0115] The first chamber 117 and the second chamber 118 have their relative positions corresponding to the relative positions of the first cavity 99 and of the second cavity 101, and in which some of the second orifices 95 of a first row 7A and some of the second orifices 95 of the second row 7B are respectively housed.

[0116] On the opposite side of the transverse dividing wall 105 from the first cavity 99 and the second cavity 101, the second cover 93 has a plurality of transverse cavities 107. The transverse cavities 107 are of elongate shape in the transverse direction. In particular, the transverse cavities 107 are produced by pressing.

[0117] The transverse cavities 107 are adjacent to one another in the longitudinal direction. Two adjacent transverse cavities 107 are separated by a second partition 109 produced, in particular, in the form of an additional dividing wall 109. Each additional dividing wall 109 is notably obtained by an absence of pressing of a corresponding part of the second cover 93.

[0118] When the second baseplate 91 and the second cover 93 are assembled with one another, the transverse dividing wall 105 and the additional dividing walls 109 act like partitions. The transverse dividing wall 105 and the additional dividing walls 109 create, within the interior space of the first header 87, third chambers 111. The third chambers 111 are adjacent to one another in the longitudinal direction.

[0119] According to the alternative form presented given by way of nonlimiting example, each third chamber 111 houses two second orifices 95 of the first row and the second row of second orifices 95.

[0120] Thus defined, each third chamber 111 individually or in combination defines a return compartment.

[0121] Alternatively or in addition, one of the third chambers 111 houses a single second orifice 95 of the first row 7A and the second row 7B of second orifices 95.

[0122] Quite clearly, the number of second orifices 95 of the first row 7A and the second row 7B of second orifices 95 opening into each third chamber 111 may be greater than or less than three.

[0123] Each third chamber 111 places one or more tubes 5 of the first row 7A in fluidic communication with a corresponding number of tubes 5 of the second row 7B.

[0124] The second baseplate 91 has, facing the open longitudinal end of the first longitudinal cavity 99 and of the second longitudinal cavity 101, two supports 110. The supports 110 are of semicircular cross section produced, in particular, by the pressing of the second baseplate 91.

[0125] When the second baseplate 91 and the second cover 93 are assembled with one another, the supports 110, in combination with the first longitudinal cavity 99 and the second longitudinal cavity 101, delimit orifices of circular cross section suited to accepting the first pipe 13 and the second pipe 15, which here are produced in the form of cylindrical components of circular cross section.

[0126] The second header 89 has a second baseplate 112 similar to the second baseplate 91 of the first header 87, except that it has no supports 110.

[0127] The second header 89 also has a second cover 113, having two longitudinal cavities 115. The two longitudinal cavities 115 of the second cover 113 of the second header 89 are adjacent to one another in the transverse direction. Advantageously, the two longitudinal cavities 115 are produced by pressing and are separated from one another by a first partition 116 produced, in particular, in the form of a longitudinal
dividing wall 116. The longitudinal dividing wall 116 is notably obtained by an absence of pressing of a corresponding part of the second cover 113.

[0128] When the second cover 113 and the second baseplate 112 are assembled, the longitudinal dividing wall 116 of the second cover 113 acts like a partition and divides the interior of the second header 89 into two longitudinal chambers which place in mutual fluidic communication on the one hand, all of the tubes 5 of the first row 7A and, on the other hand, all of the tubes 5 of the second row 7B.

[0129] FIG. 11 depicts the heat exchanger 85 according to FIG. 7 in a view similar to FIG. 5. As FIG. 11 shows, the circulation of coolant through the heat exchanger 85 is similar to the circulation of coolant through the heat exchanger 1 according to the first embodiment of the invention, except that the through-passages 38 for coolant between the second chamber and the third chamber are replaced by the plurality of third chambers 111.

[0130] Advantageously, the heat exchanger 1 according to the first embodiment and the heat exchanger 85 according to the second embodiment further comprise fixing means designed in such a way that the heat exchanger according to the present invention when on board a motor vehicle occupies a position such that the tubes 5 extend horizontally in a vertical direction when the vehicle is positioned substantially horizontally.

[0131] Such positioning, advantageously combined with the four-pass circulation of coolant, means that differences in temperature of the air leaving the heat exchanger can be reduced as far as possible.

[0132] What is more, according to the first embodiment, it is conceivable to fit a plurality of additional partitioning elements 30 and a plurality of stiffening elements 51 in the first header 9 and/or the second header 11. Likewise, according to the second embodiment, it is conceivable to have at least one transverse dividing wall similar to the transverse dividing wall 105, in the second header 89 of the heat exchanger 85. Likewise, it is possible to have a plurality of transverse dividing walls 105 in the first header 87 of the heat exchanger 85.

[0133] These alternative embodiments make it possible to obtain heat exchangers which have a number of passes higher than four.

[0134] One particular application of the present invention is as an internal condenser in a motor vehicle air conditioning circuit operating at least in a heat pump mode, the internal condenser being positioned in a housing of the vehicle heating, ventilation and/or air conditioning installation.

[0135] Quite clearly, the invention is not restricted to the embodiments previously described and given solely by way of example. It encompasses various modifications, alternative forms and other variants that a person skilled in the art might imagine within the scope of the present invention and notably all combinations of the various embodiments described hereinabove.

1. A heat exchanger comprising:
   a plurality of tubes arranged in a core bundle of tubes which has a width in a longitudinal direction, a depth in a transverse direction and a height in a vertical direction and which allows for a circulation of a coolant;
   a first header and a second header into which the tubes of the core bundle of tubes open; and
   a first partition arranged respectively in the first header and in the second header,

   with the first partition respectively dividing the first header and the second header, at least partially, into a first compartment and a second compartment which are adjacent in the transverse direction;

   wherein the heat exchanger comprises at least one second partition dividing the first compartment and the second compartment of the first header into a first chamber, a fourth chamber, and at least one return compartment which is adjacent, in the longitudinal direction, to the first chamber and to the fourth chamber.

2. The heat exchanger as claimed in claim 1, wherein the plurality of tubes is arranged in a first row and in a second row, and wherein some of the tubes of the first row open into the first chamber of the first header and into the first compartment of the second header, some of the tubes of the second row open into the fourth chamber of the first header and into the second compartment of the second header, and some of the tubes of the first row and of the second row open into the return compartment of the first header.

3. The heat exchanger as claimed in claim 1, further comprising a first pipe and a second pipe opening respectively into the first chamber and the fourth chamber of the first header.

4. The heat exchanger has claimed in claim 1, wherein the first partition divides the return compartment into a second chamber and a third chamber.

5. The heat exchanger as claimed in claim 4, wherein the first partition is a dividing partition separating the second chamber from the third chamber and is pierced with at least one through-passage.

6. The heat exchanger as claimed in claim 1, further comprising at least one baseplate and at least one cover, which are assembled one with the other to form the first header and/or the second header.

7. The heat exchanger as claimed in claim 6, wherein the first partition is formed by a projection of the cover and/or of the baseplate toward the baseplate and/or the cover and in contact with the baseplate and/or with the cover.

8. The heat exchanger as claimed in claim 6, wherein the second partition comprises an additional partitioning element interposed between the baseplate and the cover.

9. The heat exchanger as claimed in claim 8, wherein the additional partitioning element is configured to conform in terms of shape to the first header and/or the second header.

10. The heat exchanger as claimed in claim 6, wherein the cover is formed of a pressed metal plate defining at least one first longitudinal cavity and one second longitudinal cavity.

11. The heat exchanger as claimed in claim 10, wherein the first partition is formed of a non-pressed region of the metal plate.

12. The heat exchanger as claimed in claim 10, wherein the second partition is formed of a non-pressed region of the metal plate.

13. The heat exchanger as claimed in claim 10, wherein the pressed metal plate that forms the cover comprises at least one transverse cavity delimited by two second partitions forming the return compartment.

14. The heat exchanger as claimed in claim 2, wherein the first partition divides the return compartment into a second chamber and a third chamber.

15. The heat exchanger as claimed in claim 14, wherein the first partition is a dividing partition separating the second chamber from the third chamber and is pierced with at least one through-passage.
16. The heat exchanger as claimed in claim 3, wherein the first partition divides the return compartment into a second chamber and a third chamber.

17. The heat exchanger as claimed in claim 16, wherein the first partition is a dividing partition separating the second chamber from the third chamber and is pierced with at least one through-passage.

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