US 20170131044A1

(19) **United States**

(12) **Patent Application Publication**

Martins et al.

(10) **Pub. No.: US 2017/0131044 A1**

(43) **Pub. Date: May 11, 2017**

(54) **HEADER FOR EXCHANGER BUNDLE OF A HEAT EXCHANGER**

(71) Applicant: **Valeo Systemes Thermiques**, Le Mesnil Saint Denis (FR)

(72) Inventors: **Carlos Martins**, Le Chesnay (FR); **Anne-Sylvie Magnier-Cathenod**, Saint-Cloud (FR)

(73) Assignee: **Valeo Systemes Thermiques**, Le Mesnil Saint Denis (FR)

(21) Appl. No.: **15/323,566**

(22) PCT Filed: **Jul. 3, 2015**

(86) PCT No.: **PCT/EP2015/065223**

§ 371 (c)(1),
(2) Date: **Jan. 3, 2017**

(30) **Foreign Application Priority Data**

Jul. 3, 2014 (FR) 1456404

Publication Classification

(51) **Int. Cl.**

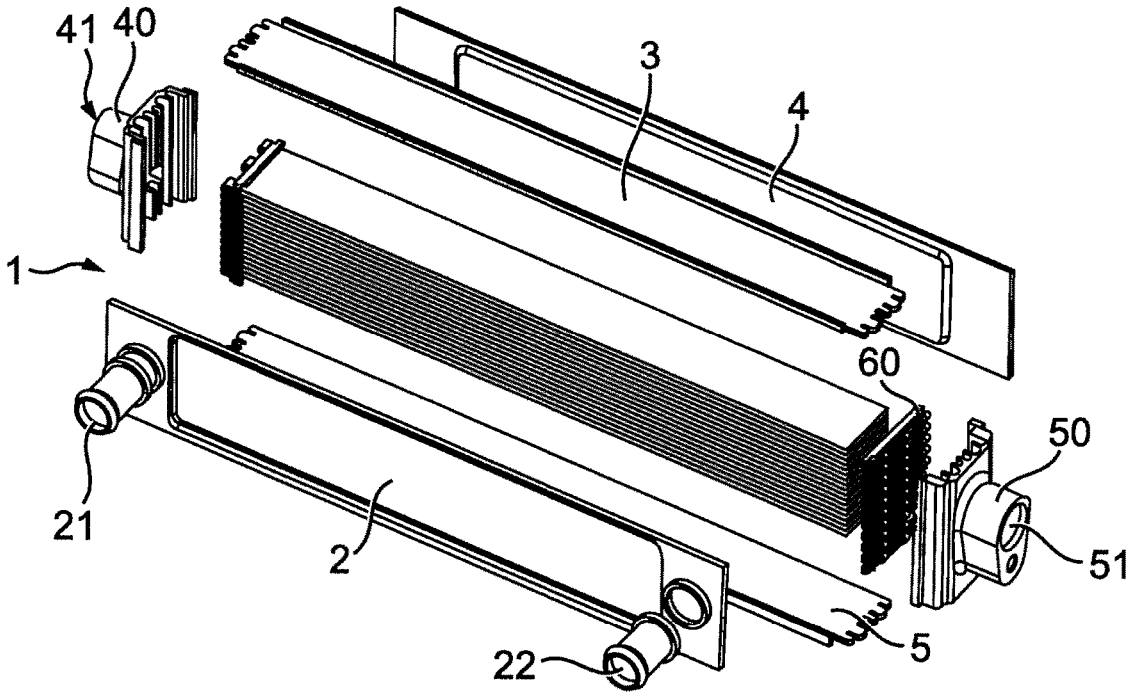
F28F 9/02	(2006.01)
F28F 9/00	(2006.01)
F28F 9/14	(2006.01)
F28D 7/16	(2006.01)
F28F 21/08	(2006.01)

(52) **U.S. Cl.**

CPC ***F28F 9/0229*** (2013.01); ***F28D 7/1684*** (2013.01); ***F28F 21/084*** (2013.01); ***F28F 9/14*** (2013.01); ***F28F 9/001*** (2013.01); *F28F 2275/12* (2013.01)

(57) **ABSTRACT**

The present invention relates to a header usable with an exchanger bundle of a heat exchanger. Said exchanger bundle includes at least one first row of tubes and one second row of tubes. The tubes are suitable for enabling the flow of a first fluid in the exchanger bundle. The header includes at least: —one first contact element for supporting the top side of a first end of the first row of tubes; —one second contact element for supporting the bottom side of said first end of the first row of tubes and supporting the top side of a first end of the second row of tubes, the thickness of the second contact element defining the distance between said first and second rows of tubes; and —one third contact element for supporting the bottom side of said first end of the second row of tubes.



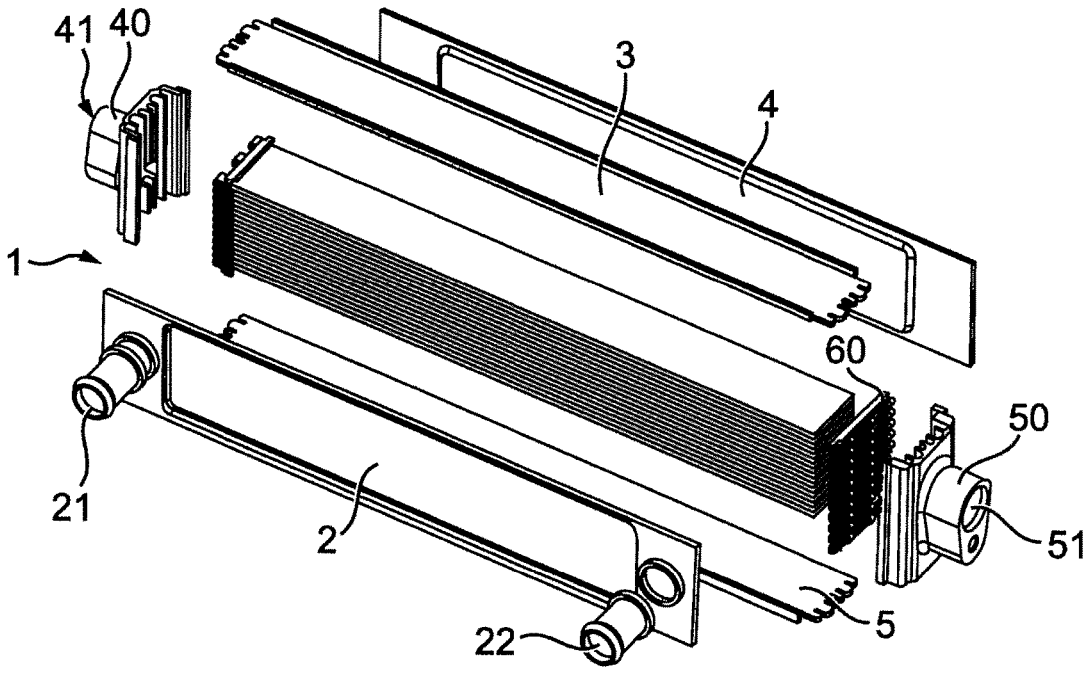


Fig. 1

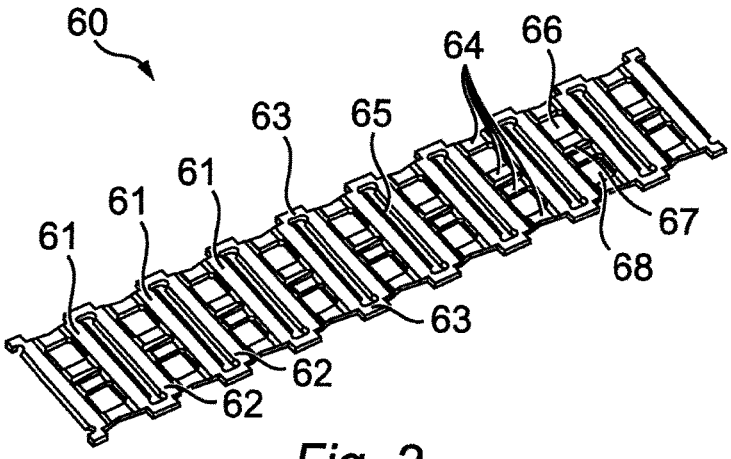


Fig. 2

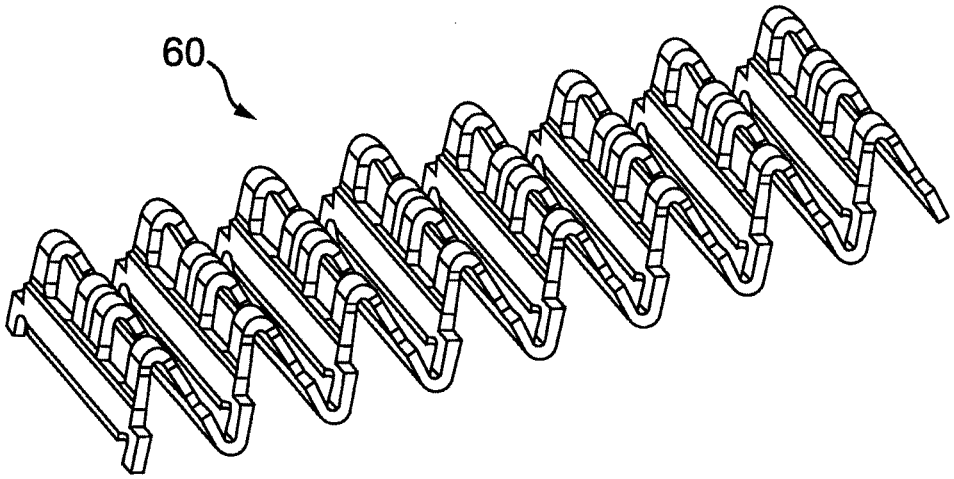


Fig. 3

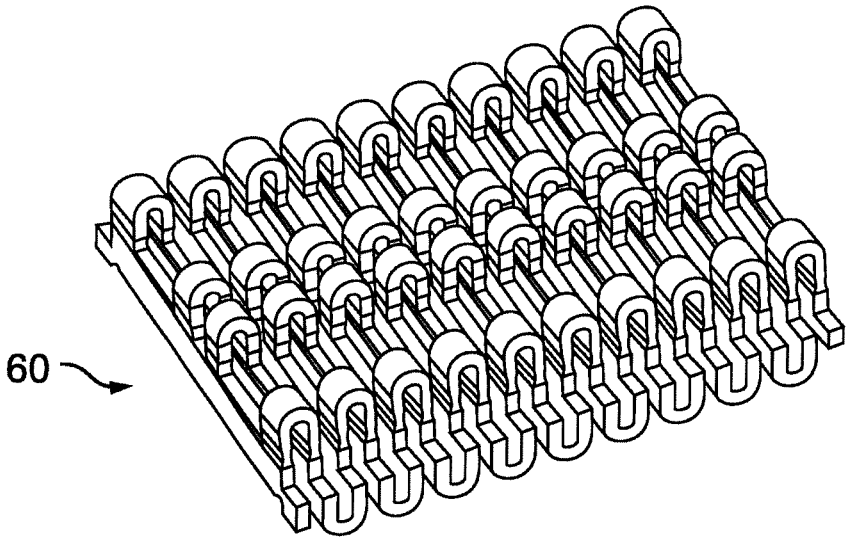


Fig. 4

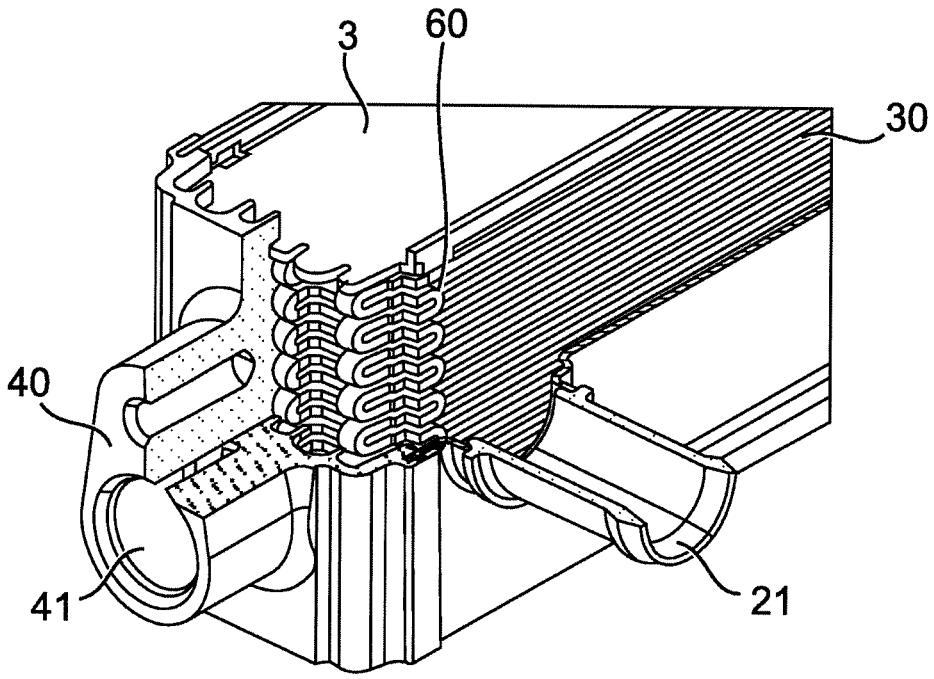


Fig. 5

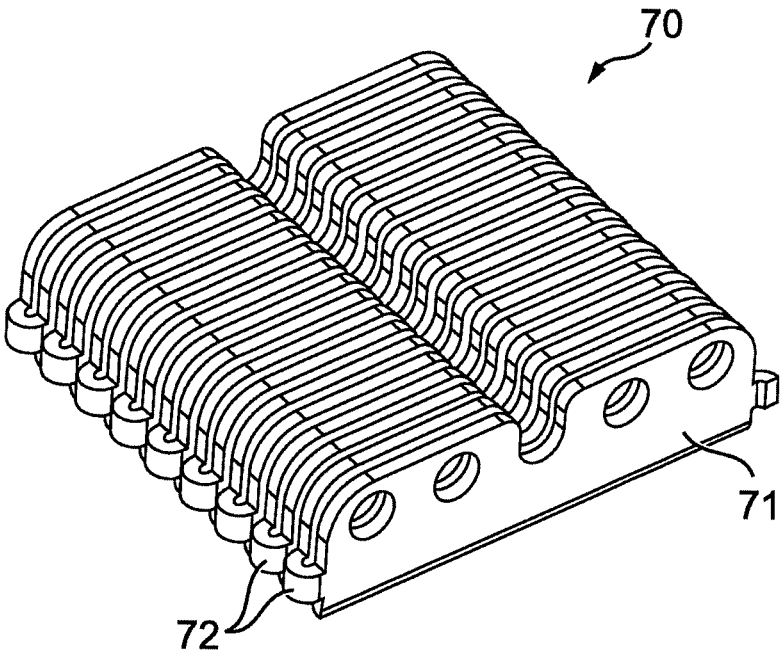


Fig. 6

HEADER FOR EXCHANGER BUNDLE OF A HEAT EXCHANGER

FIELD OF THE INVENTION

[0001] The present invention relates to a header for an exchanger bundle of a heat exchanger, such as a heat exchanger which is designed for motor vehicle. The header according to the present invention is particularly suitable for withstanding high pressures.

PRIOR ART

[0002] A heat exchanger of the type used in the motor vehicle industry in principle comprises a casing or housing comprising in its interior heat exchange elements which permit the exchange of heat from a first fluid to a second fluid. These elements which permit this exchange of heat can for example comprise tubes.

[0003] The tubes situated inside a heat exchanger can be present within an exchanger bundle comprising a plurality of tubes arranged substantially parallel to one another. The tubes can be positioned in a row or a plurality of rows which are parallel to one another. The tubes are retained at their respective ends on a first and a second header. The tubes make it possible to guide the first fluid inside said tubes, from a first end of an exchanger bundle to the second end of the exchanger bundle.

[0004] The tubes taken as a whole define between one another, in combination with the walls of the housing, channels which guide the second fluid from the second end of the heat exchanger to the first end of the heat exchanger. Thus, a heat exchanger makes possible in particular the counter-current circulation of a first and a second fluid within said heat exchanger.

[0005] Other elements such as plates, fins and flow disturbers can be provided as a complement to the tubes which form the exchanger bundle, in order to improve the exchange of heat between the first and the second fluid.

[0006] Headers which are designed for an exchanger bundle of a heat exchanger are known in the prior art. The housing is in the form of a casing comprising a plurality of walls which form the exterior of the housing, and define the volume in which the heat exchange takes place. In principle, the housing is provided with inlets and outlets which are designed for the first and the second fluid at a first and a second end of the housing. These inlets and outlets thus allow the heat exchanger to be connected to inlet piping which makes it possible to convey the first and second fluids in the direction of the heat exchanger and to outlet piping which make it possible to convey the first and second fluids to a final destination, when said first and second fluids have passed through the heat exchanger.

[0007] A header for the exchanger bundle of a heat exchanger as described above is disclosed in European patent application EP 2463612. The header disclosed in said application comprises a plurality of elements stacked on one another inside a housing in order to obtain said header.

[0008] According to document EP 2463612, the elements must be secured to one another before the use of the heat exchanger. Securing of the different elements to one another is essential for optimum functioning, in order to allow the heat exchanger comprising a header of this type to function in high-pressure conditions. However, the securing methods are relatively complex and costly. In addition, the weight of all the components increases the weight of the vehicles significantly.

SUBJECT OF THE INVENTION

[0009] The objective of the present invention concerns obtaining a header for an exchanger bundle of a heat exchanger which has low production costs and a reduced weight, and makes it possible to ensure functioning which is designed for high-pressure conditions.

[0010] The header for an exchanger bundle of a heat exchanger according to the present invention is intended to eliminate the disadvantages of the heat headers known in the prior art, by proposing a design which is improved in terms of the establishment of heat exchange.

[0011] For this purpose, the present invention concerns a header which is designed to be used with an exchanger bundle of a heat exchanger, said exchanger bundle comprising at least a first row of tubes and a second row of tubes, the tubes being designed to permit the circulation of a first fluid in the exchanger bundle, the header comprising at least:

- **[0012]** a first contact element, in order to retain the upper side of a first end of the first row of tubes;
- **[0013]** a second contact element, in order to retain the lower side of said first end of the first row of tubes, and in order to retain the upper side of a first end of the second row of tubes, the thickness of the second contact element defining the distance between said first and second rows of tubes; and
- **[0014]** a third contact element, in order to retain the lower side of said first end of the second row of tubes;
- **[0015]** the first, second and third contact elements being equidistant;
- **[0016]** the first end of the first contact element being connected to the first end of the second contact element by means of at least a first bent connector; and
- **[0017]** the second end of the second contact element being connected to the second end of the third contact element by means of at least a second bent connection element.

[0018] According to an embodiment of the present invention, the plate comprises metal such as aluminum.

[0019] According to an embodiment of the present invention, the material of said plate comprises plated aluminum.

[0020] The invention also relates to a plate made of a bendable material comprising bending elements, said plate being configured such that, when it is bent by means of bending elements, it forms a header as claimed in any one of the preceding claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The objectives, subjects and characteristics of the present invention, as well its advantages, will become more clearly apparent from reading the following description of a preferred embodiment of a heat exchanger according to the invention, provided with reference to the drawings, in which;

[0022] FIG. **1** shows an exploded view of a heat exchanger comprising a header of an exchanger bundle according to an embodiment of the present invention;

[0023] FIG. **2** represents the header in FIG. **1**, according to an initial flat form, before bending of said header;

[0024] FIG. **3** shows the header in FIG. **2**, according to an intermediate form, during the bending of said header;

[0025] FIG. **4** represents the header according to FIGS. **2** and **3**, according to a final form, after the bending of said header;

[0026] FIG. **5** shows an assembled heat exchanger comprising the header according to FIGS. **2**, **3**, **4**; and

[0027] FIG. **6** represents a header for an exchanger bundle according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF AN EMBODIMENT

[0028] FIG. **1** represents, according to an exploded view, a first embodiment of a heat exchanger **1** comprising at least one header **60** for an exchanger bundle **10** according to the present invention.

[0029] The heat exchanger **1** comprises walls **2**, **3**, **4** which, when assembled, form a casing or housing representing the outer wall of said heat exchanger **1**. The wall **3** forms the upper part of the heat exchanger **1**, the wall forms the base of said heat exchanger **1**, and the walls **2**, **4**, form the lateral parts of said heat exchanger **1**.

[0030] Inside the casing, the heat exchanger contains an exchanger bundle which permits an exchange of heat between a first and a second fluid. The exchanger bundle comprises rows of tubes **30** which are stacked in a manner substantially parallel to one another, in order to form a stack **31**.

[0031] At its two ends, the stack **31** of tubes **30** is connected to two headers **60** with a plurality of functions. Thus, the headers **60** can receive and retain the different tubes **30** of the stack **31**. The headers **60** are arranged in a position substantially parallel to one another.

[0032] The form and functioning of the headers **60** are described hereinafter in detail with reference to FIGS. **1**, **2**, **3** and **4**.

[0033] As shown in FIG. **1**, each header **60** is connected to a connection element **40**, **50**. The connection **40** is provided with an inlet **41** for a first fluid, said fluid being able to penetrate inside the heat exchanger **1** via the inlet **41**. The connection **50** is provided with an outlet **51**. The first fluid can circulate inside the different tubes **30** which form the stack **31** in the direction of the connection **50**. The first fluid can then exit from the heat exchanger **1** via the outlet **51** of the connection **50**.

[0034] The first fluid, which circulates from the inlet **41** to the outlet **51**, is for example a fluid such as the oil which is present in an oil circuit, and needs to be cooled during its conventional use. In order to be cooled, said fluid circulates inside tubes **30** which together form the stack **31**. Channels are present on the exterior of the tubes **30**, thus allowing a second fluid to be displaced in a counter-current manner relative to the first fluid, from an inlet **22** which is present in the wall **2**, to an outlet **21** which is also present in said wall **2**. In order to create the different channels between the tubes **30** which form the stack **31**, said tubes **30** can be connected to one another, with a distance imposed between each tube such that the second fluid can circulate from the inlet **22** to the outlet **21**.

[0035] According to the present invention, it is important for the different tubes **30** which together form the stack **31** to be secured in an optimum manner, in order to permit use of the heat exchanger **1** in high-pressure conditions.

[0036] According to FIG. **1**, the headers **60** make it possible to secure the different plates relative to one another, and to ensure the functionality of the heat exchanger **1**.

[0037] FIG. **2** shows one of the headers **60** in the initial form of a flat plate. The header **60** comprises two faces, and is punched such as to arrange the circulation of the fluid between the different tubes, as well as the passage for the tubes themselves. The plate as shown in FIG. **2** is bent during a bending procedure in order to obtain the header **60**, as shown in FIG. **1**. The intermediate form obtained during the bending procedure is shown in FIG. **3**. The final form of the head after the bending procedure is shown in FIG. **4**.

[0038] In order to permit implementation of the bending process and the different functionalities of the header **60**, said header **60** is provided with a series of contact elements **61**, **62** which are connected to one another by means of connection elements **63**, **64**, **65** designed to be bent. Each first contact element **61** is connected to a second contact element **62** by means of two connection elements **63** which are located substantially on the borders of the plate. Each second contact element **62** is connected to a first adjacent contact element **61** by means of a series of four connection elements **64** situated between the two borders of the plate **60**. The contact elements **61**, **62** delimit between one another the openings **65** which are designed to allow a tube of the stack **30** to pass individually as shown in FIG. **1**.

[0039] The openings **66**, **67**, **68** form together a passage which makes it possible to allow a row of tubes **30** of the stack **31** to pass. The thickness of the plate **60** corresponds to the height of passage of the cooling liquid which circulates between the different tubes **30**, from the inlet **22** to the outlet **21**, as shown in FIG. **1**. The plate **60** is specifically treated to obtain chamfered surfaces for the purpose of facilitating the insertion of the different tubes **30** of the stack **31**. In addition, the plate **60** comprises grooves which make it possible to avoid blocking of the micro-channels by the fluid before the plate is bent. The header **60**, which is obtained after bending of the plate **60**, as shown in FIG. **4**, is generally designed for a number of tubes less than 30. In practice, the thickness of the header **60**, as shown in FIG. **4**, is limited to approximately 500 mm. In addition, according to the present invention, the different tubes **30** which form together the stack **31** are secured by means of a light, inexpensive device.

[0040] FIG. **5** shows the use within a heat exchanger **1** of the header **60** according to the present invention. The outer wall of the heat exchanger is partially removed in order to show the different elements of said heat exchanger **1**. FIG. **5** shows the outlet **21** via which the cooling fluid is discharged. The header **60**, as well as the different tubes **30** which form the stack **31**, can be seen inside the heat exchanger **1**. The production of a header **60** as shown in FIGS. **2**, **3**, **4** is relatively inexpensive, and makes it possible to obtain a particularly light header **60**. Thanks to the form and functionalities of the header **60**, the heat exchanger **1** can be used in high-pressure conditions.

[0041] FIG. **6** represents a header **70** according to a variant of the present invention. The header **70** comprises contact elements **61** which make it possible to retain the different tubes **30** of a stack **31** according to FIG. **1**, and which are

connected by connection elements **72** situated on the lateral edge of said header **70**. The connection elements **72** make it possible to carry out a bending process in order to obtain said header **70**.

1. A header which is designed to be used with an exchanger bundle of a heat exchanger, said exchanger bundle comprising:

at least a first row of tubes and a second row of tubes, the tubes being designed to permit the circulation of a first fluid in the exchanger bundle−, the header comprising at least:

a first contact element to retain the upper side of a first end of the first row of tubes;

a second contact element to retain the lower side of said first end of the first row of tubes, and in order to retain the upper side of a first end of the second row of tubes, the thickness of the second contact element defining the distance between said first and second rows of tubes; and

a third contact element to retain the lower side of said first end of the second row of tubes,

wherein:

the first, second and third contact elements are equidistant,

the first end of the first contact element is connected to the first end of the second contact element by at least a first bent connector, and

the second end of the second contact element is connected to the second end of the third contact element by at least a second bent connection element.

2. The header as claimed in claim **1**, wherein said header comprises metal such as aluminum.

3. The header as claimed in claim **2**, wherein the material of said header comprises plated aluminum.

4. A plate made of a bendable material comprising bending elements, said plate being configured such that, when the plate is bent by means of connection elements, the plate forms a header as claimed in claim **1**.

* * * * *