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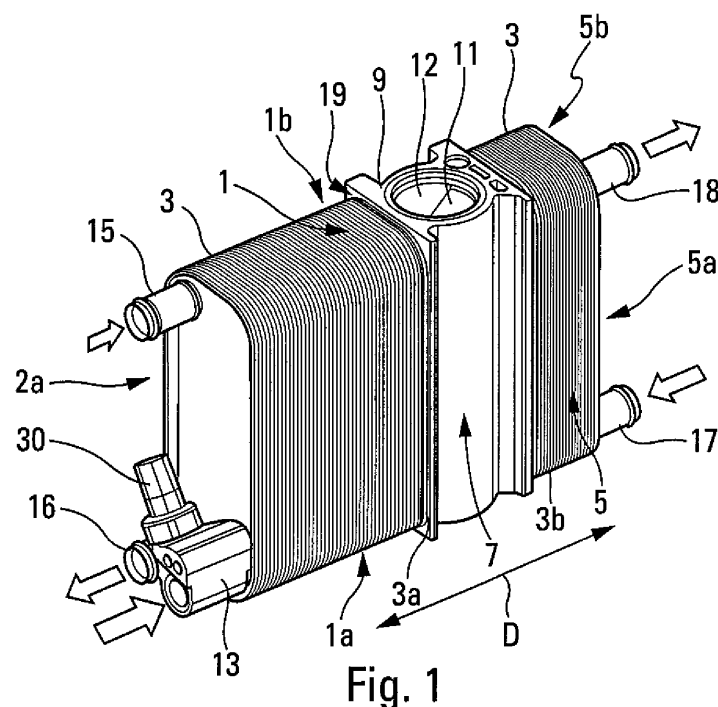
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(54) **Heat exchanger, especially condenser**

(57) Heat exchanger between a first fluid and a second fluid, said heat exchanger comprising a first core (1) defining flow passages for said first fluid and said second fluid stacked alternatively along a stacking direction to have both fluids exchanging heat there between, said heat exchanger further comprising a receiver (7) for said first fluid, said receiver comprising a body (9) defining

one tube receiving said first fluid, said tube having two open longitudinal extremities (11), said receiver further comprising caps (12) closing an internal volume (10) defined by said tube for said first fluid, said body (9) being attached to a side of said first core (1) oriented perpendicularly to said stacking direction.



## Description

**[0001]** The invention relates to a heat exchanger, especially a condenser for an air conditioning unit. While being developed to be used in automotive vehicle, it shall not be limited thereto.

**[0002]** In automotive applications, it is known for long condensers located in a vehicle front end. They are made of a core comprising tubes and fins located between the tubes. They provide a heat exchange between a refrigerant fluid flowing in the tubes and an air flow flowing through the fins. The core is generally provided with a condensing portion and a sub cooling portion in which the refrigerant fluid flows coming from a receiver attached to the core. Many solutions have been proposed to connect the receiver and the core.

**[0003]** It is also known condensers comprising a core made of plates stacked along a stacking direction, said plates alternatively defining a flow passage for the refrigerant fluid and a cooling liquid to have both fluids exchanging heat there between. The condensing portion and the sub cooling portions are defined by a corresponding number of plates. The solutions already proposed to integrate a receiver in such condensers can be improved.

**[0004]** The invention proposes in that view a heat exchanger between a first fluid and a second fluid, especially a condenser for an air conditioning unit, said heat exchanger comprising a first core defining flow passages for said first fluid and said second fluid stacked alternatively along a stacking direction to have both fluids exchanging heat there between, said heat exchanger further comprising a receiver for said first fluid, said receiver comprising a body defining one tube receiving said first fluid, said tube having two open longitudinal extremities, said receiver further comprising caps closing an internal volume defined by said tube for said first fluid, said body being attached to a side of said first core oriented perpendicularly to said stacking direction.

**[0005]** The invention provides a high degree of integration of the receiver in the heat exchanger. Thanks to its single internal volume, said receiver further gives the opportunity to use components coming from receiver technologies used in tubes and fins heat exchangers.

**[0006]** According to various embodiment of the invention which can be taken together or separately:

- at least one of said caps is removable from said body to give access to said internal volume,
- said receiver comprises a flexible element securing said removable cap on said body,
- said heat exchanger comprises two said caps, each of said caps being respectively located at each of said longitudinal extremities of said tube,
- said body is made by casting and/or extrusion,
- said body is provided with a first plane longitudinal side attached to an end plate of the first core,
- said heat exchanger comprises a second core stacked with the first core along said stacking direc-

tion,

- said body is located between said first and said second cores,
- said body is brazed to the first and/or second cores,
- said body is provided with a second plane longitudinal face side attached to an end plate of said second core,
- said body is configured to have said first fluid flowing between said internal volume and said first core and/or between said internal volume and said second core,
- said first and second cores have independent second fluid circuits,
- said first and second cores have a common second fluid circuit,
- said body contains channels configured to have said second fluid flowing between said first core and said second core,
- a longitudinal axis of said tube is oriented in a plane perpendicular to said stacking direction,
- said body further comprises threaded holes to attach the heat exchanger on a support,
- said first and/or said second core comprise plates stacked along said stacking direction.

**[0007]** Other characteristics and advantages of the invention will appear in the description which follows and which refers to a detailed embodiment thereof, in reference to the figures in which, respectively:

- figure 1 is a perspective view of a first embodiment of a heat exchanger according to the invention,
- figure 2 is a perspective view of the heat exchanger of figure 1 under an opposed angle of view,
- figure 3 is a perspective view of a second embodiment of a heat exchanger according to the invention,
- figure 4 is a perspective view, cut along a longitudinal plane, of the heat exchanger of figure 3.

**[0008]** According to figures 1 to 4, the invention relates to a heat exchanger between a first fluid and a second fluid, especially a condenser for an air conditioning unit, more especially for automotive applications.

**[0009]** Said first fluid is for instance a refrigerant fluid, as the fluids known under R134a or R1234yf. The heat exchanger is configured to have it enter under gaseous phase and exit under liquid phase. The second fluid is for instance a cooling liquid as water added with some anti freeze like glycol. In other words, the cooling liquid may be a mixture of water and glycol.

**[0010]** Said heat exchanger comprises a first core 1 and optionally a second core 5 stacked with said first core along a stacking direction D. In case of a condenser, said first core is especially configured to achieve a condensation of said refrigerant fluid and said second core to achieve a subcooling thereof.

**[0011]** Said cores 1, 5 define flow passages for said first fluid and said second fluid stacked alternatively along

said stacking direction to have both fluids exchanging heat there between.

**[0012]** Said cores 1, 5 are for instance made of plates 3 stacked along said stacking direction to define said passages. In other words, a same plate defines a passage for the first fluid together with one of the adjoining plate and a passage for the second fluid with the other adjoining plate.

**[0013]** Said plates are for instance obtained by stamping a laminated plate of metal, especially aluminium and/or an aluminium alloy.

**[0014]** Said plates 3 may be of rectangular shape. As a consequence, said first and second cores 1, 5 have a parallelepipedic shape with lateral sides 1a, 1b, 1c, 5a, 5b, 5c parallel to said stacking direction, top sides 2a and bottom sides 6b parallel to said stacking direction.

**[0015]** Said plates 3 comprise for instance a rising edge, defining with a bottom of said plate a volume in which said fluids flow. Said plates are provided, for instance, with four holes managed in the bottom of said plates, two of said holes being provided for the circulation of the first fluid and two other of said holes for the circulation of the second fluid. The holes for the circulation of the first fluid may be located along a first longitudinal side of said plate and the holes for the circulation of the other fluid along the other longitudinal side.

**[0016]** Said heat exchanger further comprise collecting means or channels 42 to have said first fluid flowing from one of said passage for the first fluid to the next passage for the first fluid and said second fluid flowing from one of said passage for the second fluid to the next passage for the second fluid. Said collecting means are for instance constituted by two embossed portion of said plate bottom, each provided with one of said holes. More precisely, two of said holes are provided in a flat portion of said plates and the two others are provided at the top of said embossed portion. When stacked, the two holes of the embossed portion of one said plate are in communication with the two holes provided in the flat portion of the bottom of one of the adjoining plate. As a result, one of said fluid flows in the passage provided between said two plates and the other of said fluid flows through said holes from one of the adjoining passage to the other of the adjoining passage. Such connecting channels 42 can be seen here for on figure 4. They are collecting channels for the second fluid.

**[0017]** Said plates 3 of both first and second cores may be of the same type, the only difference between the two cores being the number of plates which are used to constitute them. It can also be seen that said plates are stacked from bottom to top in said first core 1 and from top to bottom in said second core 5.

**[0018]** Said heat exchanger further comprises here a receiver 7 for said first fluid. Said receiver is connected upstream with said first core 1 and optionally downstream with said second core 5. In case of a condenser said receiver aims at separating the part of said refrigerant fluid potentially still in an gaseous phase from the part in

liquid phase to let only said liquid phase part flow downstream. It may also aim at filtering and/or drying said refrigerant fluid.

**[0019]** According to the invention, said receiver 7 comprises a body 9 defining one tube receiving said first fluid. Said tube has two open longitudinal extremities 11, one of them being partially visible on figure 1 and 2. In other words, said tube is oriented along a straight line. It has here a circular section. Said receiver 7 further comprises caps 12, especially two caps, one of them being partially visible on figure 1 and 2, closing an internal volume 10 defined by said tube for said first fluid. Said caps 12 may be respectively located at each of said longitudinal extremities of said tube.

**[0020]** Said body 9 is attached to a side of said first core 1 oriented perpendicularly to said stacking direction, here a bottom side of said first core 1.

**[0021]** The invention thus gives the possibility to obtain a high degree of integration together with the use of a receiver which is easy to manufacture.

**[0022]** Said body 9 is configured to have said first fluid flowing between said internal volume 10 and said first core 1 and/or between said internal volume 10 and said second core 5. More precisely, the first fluid enters the first core 1 through an inlet flange 13 provided on a top end plate of said first core 1 to flow between the plates 3 of said first core 1. It then flows in said receiver 7 and from said receiver 7 to said second core 5 through respective first channels, not visible, provided in said body 9. It finally flows between the plates 3 of said second core 5 to exit through an outlet flange 14 provided on a bottom end plate of said second core 5. Said inlet flange 13 may be provided with a sensor 30.

**[0023]** As illustrated by the embodiment of figure 1 and 2, said first core 1 and said second core 5 may have independent circuits for said second fluid. Here, said second fluid enters the first core 1 through an inlet flange 15, flows in said first core 1 in the corresponding passage provided between the plates and exits the first core 1 through an outlet flange 16. Said second fluid enters the second core 5 through an inlet flange 17, flows in said second core 5 in the corresponding passage provided between the plates and exits the second core 5 through an outlet flange 18.

**[0024]** As illustrated by the embodiment of figures 3 and 4, said first core 1 and said second core 5 may have a common second fluid circuit. As a result, said body 9 here contains second channels 40, more precisely two second channels 40, configured to have said second fluid flowing between said first core 1 and said second core 5. Said second channels 40 are provided, for instance, in the proximity of both longitudinal extremities 11 of said body 9. They are here oriented perpendicularly to said internal volume 10. They are advantageously located on a same side of the body 9.

**[0025]** Said first core 1 and said second core 5 are here provided each with two collecting channels 42 for the second fluid, located on a same side of each core, ad-

vantageously in the proximity of some of its edges. A first of said collecting channel 42 is an inlet collecting channel and a second of said collecting channels 42 is an outlet collecting channel. Said inlet and outlet collecting channels 42 are respectively located in the prolongation of each other on said first and second cores 1, 5, said second channels 40 being located there between to connect them.

**[0026]** Said heat exchanger can then comprise only one inlet flange 17 and one outlet flange for the second fluid 18. They are here provided on said second core 5 but can also be located on said first core 1.

**[0027]** Coming back to more general features which can be met on both illustrated embodiments, at least one of said caps 12 is advantageously removable from said body 9 to give access to said internal volume 10. Said receiver 7 may comprise in that view a flexible element, like a circlip, securing said removable cap on said body 9.

**[0028]** The body 9 is made for instance by casting and/or by extrusion, especially from aluminium and/or aluminium alloy, and if needed by machining.

**[0029]** Said body 9 is advantageously located between said first and said second cores 1, 5 especially between a bottom end plate 3a of said first core 1 and a top end plate 3b of said second core 5. Said end plates 3a, 3b are here the first plate of the stacked plates of each core 1, 5.

**[0030]** A longitudinal axis of said tube is advantageously oriented in a plane perpendicular to said stacking direction. Said body 9 may have the same longitudinal extension as the first and/or second core plates 3.

**[0031]** Said body 9 is advantageously provided with a first plane longitudinal side 19 attached to an end plate of the first core 1, here said bottom end plate 3a, and/or a second plane longitudinal face side 20 attached to an end plate of said second core 12, here said top end plate 3b.

**[0032]** Said body 9 may further comprise threaded holes 21 to attach the heat exchanger on a support, here four threaded holes.

**[0033]** Said body is advantageously brazed to the first and/or second cores, for instance one shot.

## Claims

1. Heat exchanger between a first fluid and a second fluid, said heat exchanger comprising a first core (1) defining flow passages for said first fluid and said second fluid stacked alternatively along a stacking direction to have both fluids exchanging heat there between, said heat exchanger further comprising a receiver (7) for said first fluid, said receiver comprising a body (9) defining one tube receiving said first fluid, said tube having two open longitudinal extremities (11), said receiver further comprising caps (12) closing an internal volume (10) defined by said tube for said first fluid, said body (9) being attached to a

side of said first core (1) oriented perpendicularly to said stacking direction.

2. Heat exchanger according to claim 1 wherein at least one of said caps (12) is removable from said body (1) to give access to said internal volume (10).
3. Heat exchanger according to claim 2 wherein said receiver (7) comprises a flexible element securing said removable cap (12) on said body (9).
4. Heat exchanger according to any of claims 1 to 3 comprising two said caps (12), each of said caps (12) being respectively located at each of said longitudinal extremities (11) of said tube.
5. Heat exchanger according to any of claims 1 to 4 wherein the body (9) is made by casting.
6. Heat exchanger according to any of claims 1 to 4 wherein the body (9) is made by extrusion or casting process.
7. Heat exchanger according to any of claims 1 to 6 wherein the body (9) is provided with a first plane longitudinal side (19) attached to an end plate (3a) of the first core (1).
8. Heat exchanger according to any of claims 1 to 7 comprising a second core (5) stacked with the first core (1) along said stacking direction.
9. Heat exchanger according to claim 8 wherein said body (9) is located between said first and said second cores (1, 5).
10. Heat exchanger according to any of claims 8 or 9 wherein said body (9) is brazed to the first and/or second cores (1, 5).
11. Heat exchanger according to any of claims 8 to 10 wherein the body (9) is provided with a second plane longitudinal face side (20) attached to an end plate (3b) of said second core (5).
12. Heat exchanger according to any of claims 8 to 11 wherein said body (9) is configured to have said first fluid flowing between said internal volume (10) and said first core (1) and/or between said internal volume (10) and said second core (5).
13. Heat exchanger according to any of claims 8 to 12 wherein said first and second cores (1, 5) have independent second fluid circuits
14. Heat exchanger according to any of claims 8 to 11 wherein said body (9) contains channels configured to have said second fluid flowing between said first

core (1) and said second core (5), said first and second cores (1, 5) having a common second fluid circuit.

15. Heat exchanger according to any of said preceding claims wherein a longitudinal axis of said tube is oriented in a plane perpendicular to said stacking direction. 5
16. Heat exchanger according to any of said preceding claims wherein said body (9) further comprises threaded holes (21) to attach the heat exchanger on a support. 10

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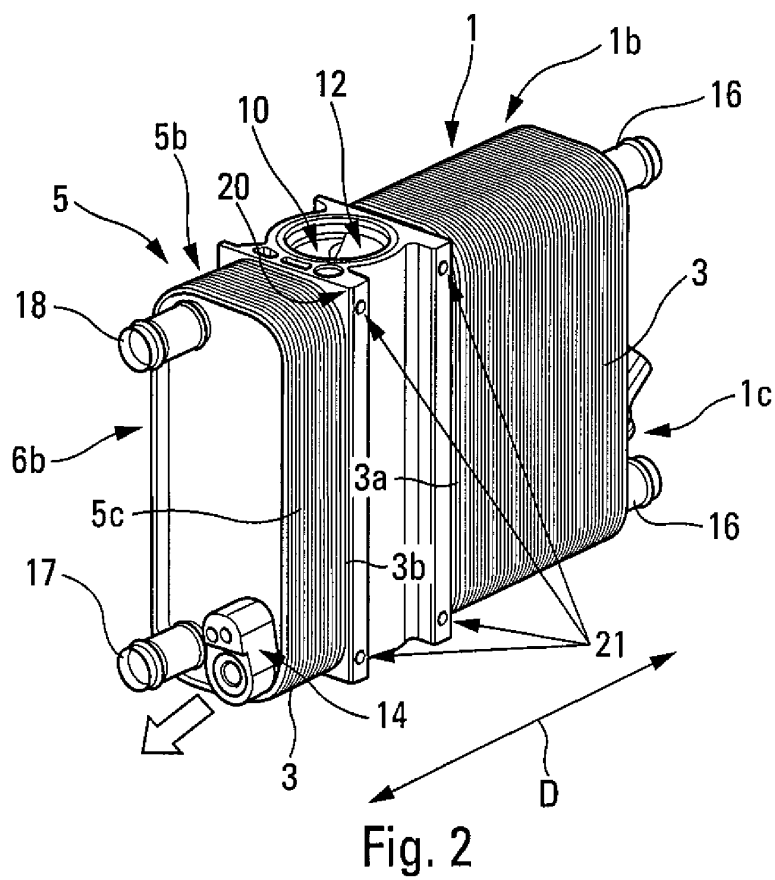
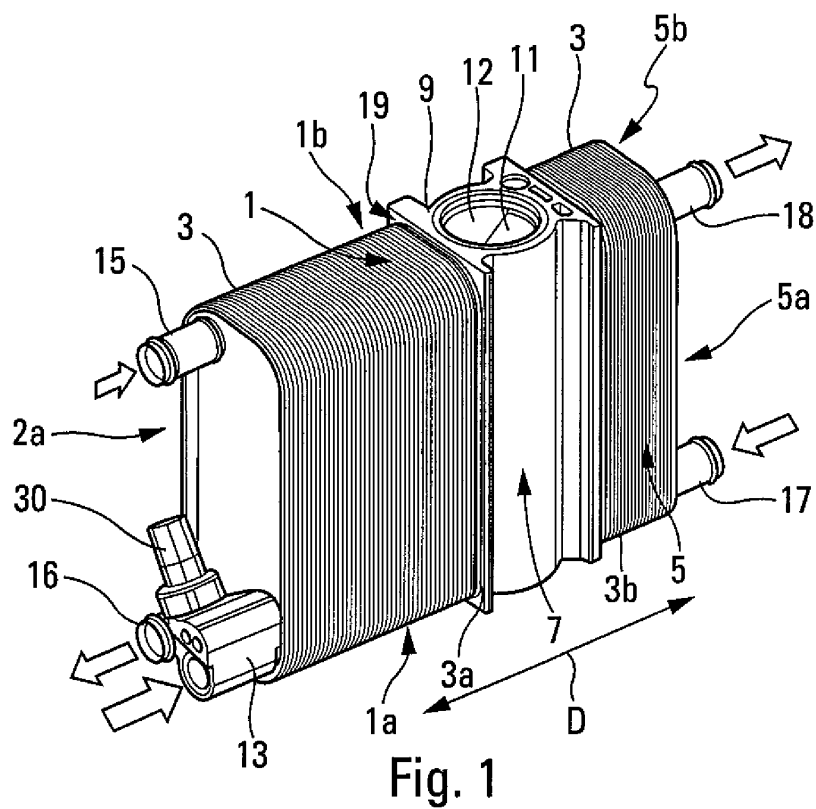
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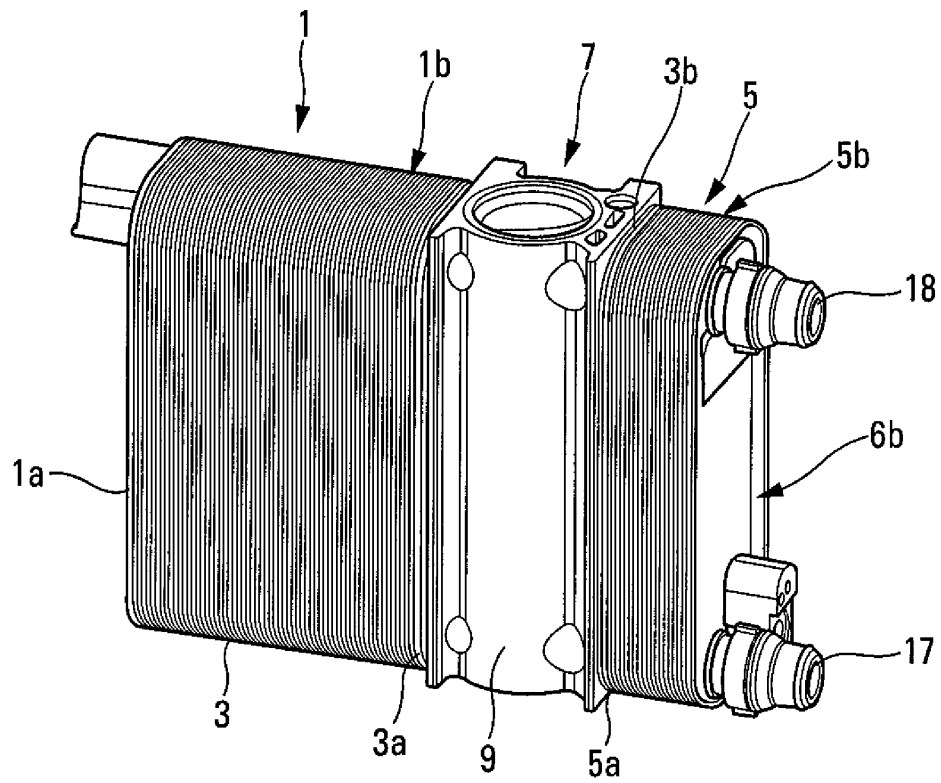


Fig. 3

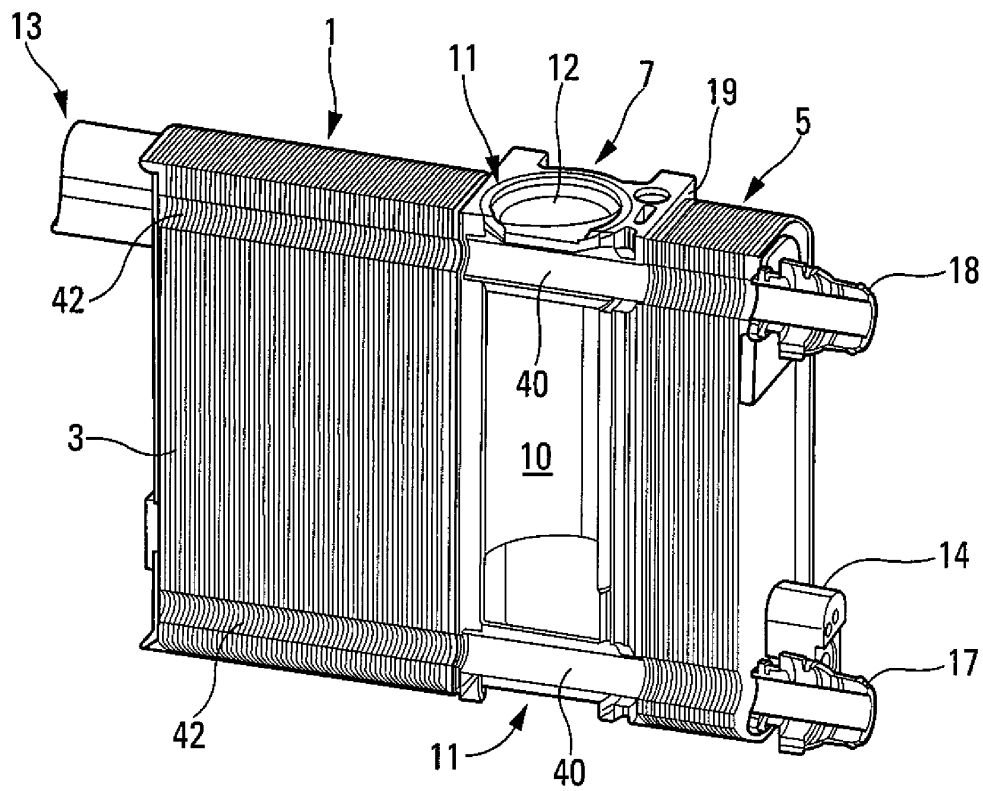


Fig. 4



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Application Number  
EP 13 46 1514

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                                                                                                        |                                                                                                                                                                                                                                                                              |                                         |
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| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages                                                                          | Relevant to claim                                                                                                                                                                                                                                                            | CLASSIFICATION OF THE APPLICATION (IPC) |
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| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                                                                                                        |                                                                                                                                                                                                                                                                              |                                         |
| Place of search<br>Munich                                                                                                                                                                                               |                                                                                                                                                        | Date of completion of the search<br>21 June 2013                                                                                                                                                                                                                             | Examiner<br>Bain, David                 |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                             |                                                                                                                                                        |                                                                                                                                                                                                                                                                              |                                         |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                        | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                         |

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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