

(19)



(11)

**EP 3 550 250 A1**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**09.10.2019 Bulletin 2019/41**

(51) Int Cl.:  
**F28F 9/02 (2006.01)**

(21) Application number: **18461545.8**

(22) Date of filing: **05.04.2018**

(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**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**KH MA MD TN**

(72) Inventors:  
• **JONCZYK, Radoslaw**  
**PL 32-050 Skawina (PL)**  
• **ROD, Janusz**  
**PL 32-050 Skawina (PL)**

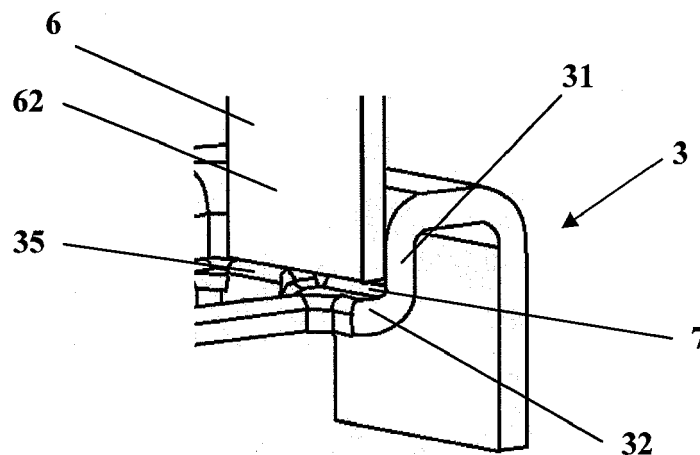
(74) Representative: **Bialkowski, Adam**  
**Valeo Systèmes Thermiques**  
**ZA l'Agiot**  
**8 rue Louis Lormand**  
**CS 80517 La Verrière**  
**78322 Le Mesnil Saint Denis Cedex (FR)**

(71) Applicant: **Valeo Autosystemy SP. Z.O.O.**  
**32-050 Skawina (PL)**

(54) **HEAT EXCHANGER**

(57) A heat exchanger (1) comprises a core (2), at least one header (3) situated at and connected to least one end of the core (2) and a housing (6) enclosing the core (2). The housing (6) is received in the at least one header (3). The at least one header (3) is provided at its bottom (32) with supporting sections (35). The supporting

sections (35) are provided at the bottom (32) in positions, which correspond to positions of walls of the housing (6), which need be sealed. The housing (6) rests on the supporting sections (35) so that a gap (7) is created between the housing (6) and the bottom (32) of the at least one header (3).



**Fig. 4**

## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a heat exchanger, especially to a heat exchanger for a vehicle, with improved means for positioning a housing in a header of the water cooled heat exchanger.

### PRIOR ART

**[0002]** Generally, a conventional prior art heat exchanger comprises a core and two headers situated at two longitudinal ends of the core. One header is connected to an inlet tank, while the other is connected to an outlet tank. The heat exchanger comprises a housing, which encloses the core. Longitudinal ends of the housing are received in the headers. The housing, when inserted into the header, rests on a bottom of the header and contact surfaces between the housing and the headers should be as flat as uniform as possible. All components of the heat exchanger are connected to one another by brazing. However, due to limitations of manufacturing and brazing techniques the contact surfaces can become uneven or can be provided with ridges and folds. In result, the housing can be twisted or tilted with respect to the headers. This in turn can compromise proper contact between the housing and the headers, especially at a brazing area. It also means that the housing and the headers may not be properly brazed to one another, which may lead to leaks, especially at areas near corners of the headers.

**[0003]** A solution similar to the one described above is disclosed in DE102010040983 A1. In this heat exchanger the housing comprises a series of protruding tabs, which are received in cut-outs of the headers when the housing rests on the headers. The tabs help to maintain the position of the housing with respect to the headers when the heat exchanger is first assembled. Still, following brazing and due to any manufacture defects of the headers, the tabs can slid out of the cut-outs. In result, the housing can rotate/tilt with respect to the headers and this can lead to the situation, where non-brazed areas are formed between the housing and the headers, which in turn can be a source of leaks.

**[0004]** Moreover, very often, housings used in a heat exchanger consist of a few separate plates, which are connected to one another to form the housing itself. Due to machining restrictions corresponding corners of the headers cannot imitate, at their entire length down to the bottom of the headers, the shape of the corners of the housing what means that the housing can be blocked too early at its corners in the headers. In other words the housing can be tilted with respect to the headers, which affects the brazing quality.

### PURPOSE OF THE INVENTION

**[0005]** The purpose of the present invention is to provide a heat exchanger, which would overcome the drawbacks described in connection with the prior art.

**[0006]** In particular, the purpose of the present invention is to provide a heat exchanger, in which the housing and the headers would be properly brazed to one another at their entire perimeters, what significantly reduces the risk of any leaks being formed.

### SUMMARY OF THE INVENTION

**[0007]** A heat exchanger according to the present invention comprises a core, at least one header situated at and connected to least one end of the core and a housing enclosing the core. The housing is received in the at least one header. The at least one header is provided at its bottom with supporting sections. The supporting sections are provided at the bottom in positions, which correspond to positions of walls of the housing, which need be sealed. The housing rests on the supporting sections so that a gap is created between the housing and the bottom of the at least one header.

**[0008]** Further advantageous embodiments of the present invention are defined in dependent claims.

**[0009]** The heat exchanger according to the present invention provides a reliable solution, which ensures a sealed connection between the housing and the header(s). Use of the supporting sections results in the housing being separated in a longitudinal direction of the housing and the core from the bottom of the header (s) in a repeatable and predictable manner. Any defects in the manufacturing and brazing processes of the heat exchanger, especially the bottom of the header, does not affect the position of the housing because any folds and creases created at the bottom of the header do not extend high enough to reach an edge of the housing, which is in contact with the supporting sections.

**[0010]** Moreover, the supporting sections provide well defined contact points between the housing and the headers. Any randomness of the contact points is almost entirely reduced.

**[0011]** Additionally, as the position of the housing with respect to the header is secured, the present invention provides a continuous and stable brazing area between the walls of the housing and a peripheral wall of the header. It means that the relative position of the housing and the header does not change during brazing and a solder can easily solidify and bond to the housing and the header at the entire brazing area, leaving no non-brazed points.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]** The present invention is described in more detail below, with reference to the accompanying drawings, which present non-limiting embodiments of the present invention, where:

Fig. 1 shows a perspective view of a heat exchanger of the present invention;  
 Fig. 2 shows a perspective view of a header;  
 Fig. 3 shows a top view of the header;  
 Fig. 4 shows a partial cut-away perspective view of the heat exchanger;  
 Fig. 5 shows a perspective detailed view of another example of the header; and  
 Fig. 6 shows a schematic view of a brazing area between the header and a housing.

## EMBODIMENTS OF THE INVENTION

**[0013]** A heat exchanger 1 comprises a core 2 and two headers 3 situated at and connected to two longitudinal ends of the core 2. The heat exchanger 1 further comprises an inlet tank 4 and an outlet tank 5. The inlet and outlet tanks 4, 5 are connected to the headers 3 and are used to deliver a fluid to be cooled down, preferably air, to and out of the core 2.

**[0014]** The core 2 includes a plurality of flat hollow flow tubes 21 and a plurality of flow turbulators 22 placed therebetween. The flat hollow flow tubes 21 are in fluid communication, through the headers 3, with the inlet and outlet tanks 4, 5 and define together a first fluid circuit for the fluid to be cooled down. The heat exchanger 1 further comprises a housing 6, shown schematically in Fig. 1, which encloses and seals the core 2. The housing 6 defines a second fluid circuit for a coolant. The housing 6 comprises inlet and outlet ports 61, shown schematically in Figure 1, through which the coolant flows into and out of the housing 6.

**[0015]** In the embodiment shown in the Fig. 1 the housing 6 is made of two opposing plate members 62 and two outermost flat hollow flow tubes 21, which are connected to one another at their edges. The housing 6 is inserted with its longitudinal ends, with respect to a longitudinal direction A of the heat exchanger 1, the core 2 and the housing 6, into the headers 3.

**[0016]** The header 3 comprises a peripheral wall 31 and a bottom 32. The peripheral wall 31 has teeth 33 protruding therefrom in the longitudinal direction A of the heat exchanger 1, which are bent over the inlet and outlet tanks 4, 5 to connect the inlet and outlet tanks 4, 5 to the headers 3. The bottom 32 comprises a plurality of slots 34, which receive the flat hollow flow tubes 21 of the core 2.

**[0017]** The header 3 is provided at the bottom 32 with a series of supporting sections 35, preferably in the form of steps, which protrude from the bottom 32 in the vicinity of the peripheral wall 31 towards the housing 6. Preferably, the supporting sections 35 are in contact with the peripheral wall 31. When the heat exchanger 1 is assembled the housing 6 fits with its longitudinal ends into the headers 3, occupies the space between the peripheral wall 31 and the core 2, as shown in Fig. 4, and rests on/is in contact with the supporting sections 35. The supporting sections 35 can be 0.1-5.0 mm high, as measured from

the bottom 32 of the header 3 towards the housing 6.

**[0018]** The supporting sections 35 of the header 3 are provided at positions, which correspond to positions of walls of the housing 6, which need be sealed with respect to the header 3. In the embodiment of the present invention shown in figures 1-3 the walls of the housing 6 to be sealed are two opposing plate members 62. Therefore, the supporting sections 35 are located at the bottom 32 next to two opposing portions of the peripheral wall 31 of the header 3, which correspond to the two opposing plate members 62 of the housing 6. In other words the supporting sections are 35 associated with the walls of the housing 6, which need be sealed.

**[0019]** Preferably, as shown in the figures, the header 3 and the housing 6 have a square/rectangular cross section with corners and the supporting sections 35 are located near the corners of the header 3, next to the aforementioned two opposing portions of the peripheral wall 31. More precisely, four supporting sections 35 are provided and they are divided into two sets, two supporting sections 35 in each set, and these two sets are located at two opposing portions of the bottom 32, each supporting section 35 near respective corner of the header 3, as shown in fig. 3.

**[0020]** When the housing 6 rests on the supporting sections 35 a gap 7 is formed between the housing 6 and the bottom 32 of the header 3. In other words the housing 6 is not in direct contact with the bottom 32 and is spaced apart from the bottom 32. This also ensures that contact points between the housing 6 and the header 3 are well defined and controlled. Otherwise, due to errors and imperfections in the header manufacturing process the bottom 32 could include ridges and folds protruding from the bottom and the contact points would be random, which could lead to non-sealed connection between the housing 6 and the header 3 and resultant leaks. A secondary effect is that a continuous and uniform brazing/contact area is ensured between the housing 6 and the peripheral wall 31 of the header 3.

**[0021]** The present invention is not limited to the embodiments described above. In different embodiments of the present invention the form/shape of the supporting sections 35 can vary. For example, the supporting sections 35 can have a cuboid form with a flat top, as shown in Figs. 2-4. Alternatively, the supporting sections 35 can have a rounded form, as shown in fig. 5.

**[0022]** In the preceding description the housing 6 was defined as being made of two opposing plate members 62 and two outermost flat hollow flow tubes 22. In another embodiment of the present invention the housing 6 can comprise four separate plates, which together form the housing 6 itself, are connected to one another at their edges and enclose the core 2 therein. In this case all four separate plates of the housing 6 are walls that need be sealed. In result, the supporting sections 35 are located near each portion of the peripheral wall 31 of the header 3.

**[0023]** Moreover, the plates of the housing 6 need not be necessarily flat. The plates can have other shapes, if

desirable.

**[0024]** In yet another embodiment of the present invention, not shown in the drawings, the heat exchanger 1 can also comprise only one header 3, which is situated at and connected to one end of the core 2. In such a case, the core 2 defines a U-shaped first fluid circuit, which starts and ends at the same one header 3. The header 3 comprises an inlet and outlet ports or one inlet/outlet tank is connected thereto. The housing 6 encloses the core 2 and is received with its one end in the one header 3, while the other end of the housing 6 is closed.

**[0025]** All components of the heat exchanger 1, namely the core 2, the header(s) 3, the inlet/outlet tank(s) 4, 5 and the housing 6, are connected to each other by brazing. Materials used for the heat exchanger 1 are those suitable for brazing, for example aluminum and its alloys.

**[0026]** In the embodiment of the heat exchanger 1 where the housing 6 is made up of two opposing plate members 62 the walls of the housing 6 that need be sealed are two opposing plate members 62, for the reasons explained above. The supporting sections 35 ensure that the contact points between the two opposing plate members 62 and the header 3 are well defined and the two opposing plate members 62 rest in place when the heat exchanger 1 is assembled and brazed. The outermost flat hollow flow tubes 21, which also form the housing 6, are already inserted into slots 34 of the headers 3. This connection is usually subject to different tolerance requirements and in itself is relatively more fluid-tight. It means that the outermost flat hollow flow tubes 21 are properly brazed to the header 3 without the need for assisting arrangements. If the housing 6 includes four separate plate members, which define the housing 6 itself and enclose entirely the core 2 therein all these four separate plate members are walls of the housing 6 that need be sealed.

**[0027]** Generally, in the context of the present invention "walls of the housing 6, which need be sealed" are to be understood as walls of the housing 6 that are likely to be susceptible to connection issues as explained above. Consequently, if the terminal flat hollow flow tubes 21 constitute a part of the housing 6, they need not be sealed in this sense, as the way of connecting the tubes 21 via introduction into the header slots 34 implies smaller susceptibility to leaks (for example, there are stricter tolerance requirements, and the tubes 21 and/or slots 34 are dimensioned so that the tubes 21 need to be pushed inside the slots 34, etc.). Moreover, a wall of the housing 6 is to be understood as one essentially continuous wall/surface of the housing 6 limited by edges/abrupt bends.

## Claims

1. A heat exchanger (1) comprising:

a core (2);

at least one header (3) situated at and connected to at least one end of said core (2); and  
a housing (6) enclosing said core (2), said housing (6) being received in said at least one header (3);

### characterized in that

said at least one header (3) is provided at its bottom (32) with supporting sections (35);  
wherein said supporting sections (35) are provided at said bottom (32) in positions, which correspond to positions of walls of said housing (6), which need be sealed; and  
wherein said housing (6) rests on said supporting sections (35) so that a gap (7) is created between said housing (6) and said bottom (32) of said at least one header (3).

2. The heat exchanger according to claim 1, **characterized in that** said supporting sections (35) are 0.1-5.0 mm high, as measured from said bottom (32) of said at least one header (3) towards said housing (6).
3. The heat exchanger according to any of the preceding claims, **characterized in that** said supporting sections (35) have a cuboid form.
4. The heat exchanger according to any of claims 1-2, **characterized in that** said supporting sections (35) have a rounded form.
5. The heat exchanger according to any of the preceding claims, **characterized in that** said core (2) comprises a plurality of flat hollow flow tubes (21) and said heat exchanger (1) comprises two opposing plate members (62), two outermost flat hollow flow tubes (21) and said two opposing plate members (62) defining together said housing (6), said supporting sections (35) being provided at said bottom (32) in positions corresponding to positions of said two opposing plate members (62).
6. The heat exchanger according to claim 5, **characterized in that** it comprises four supporting sections (35) and said supporting sections (35) are divided into two sets, two supporting sections (35) in each set, said sets being located at two opposing portions of said bottom (32), corresponding to said positions of said two opposing plate members (62).
7. The heat exchanger according to any of claims 1-4, **characterized in that** said housing (6) includes four plate members connected to one another at their edges and defining said housing (6), said supporting sections (35) being provided at said bottom (32) in positions corresponding to positions of said four plate members.

8. The heat exchanger according to any of the preceding claims, **characterized in that** said at least one header (3) and said housing (6) both have a rectangular cross section with corners, said supporting sections (35) being situated near said corners of said at least one header (3). 5
9. The heat exchanger according to any of the preceding claims, **characterized in that** it comprises two headers (3), said housing (6) being received with its two longitudinal ends in said two headers (3). 10

15

20

25

30

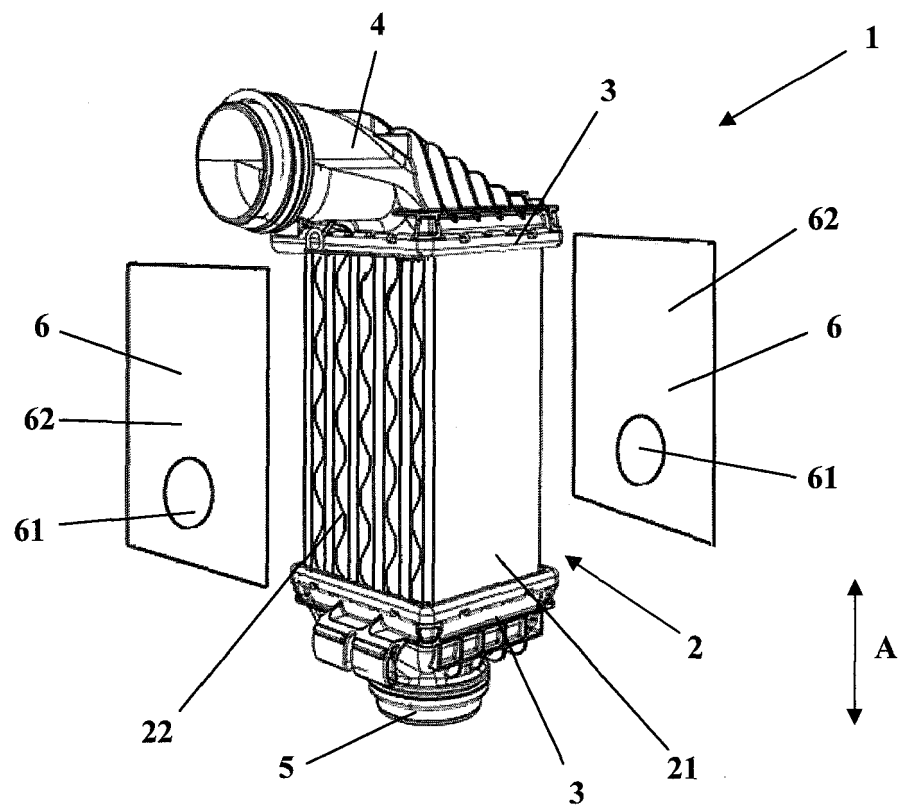
35

40

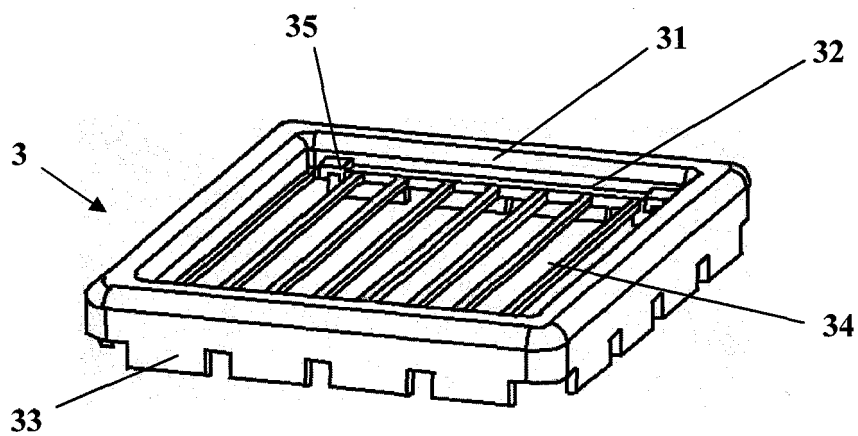
45

50

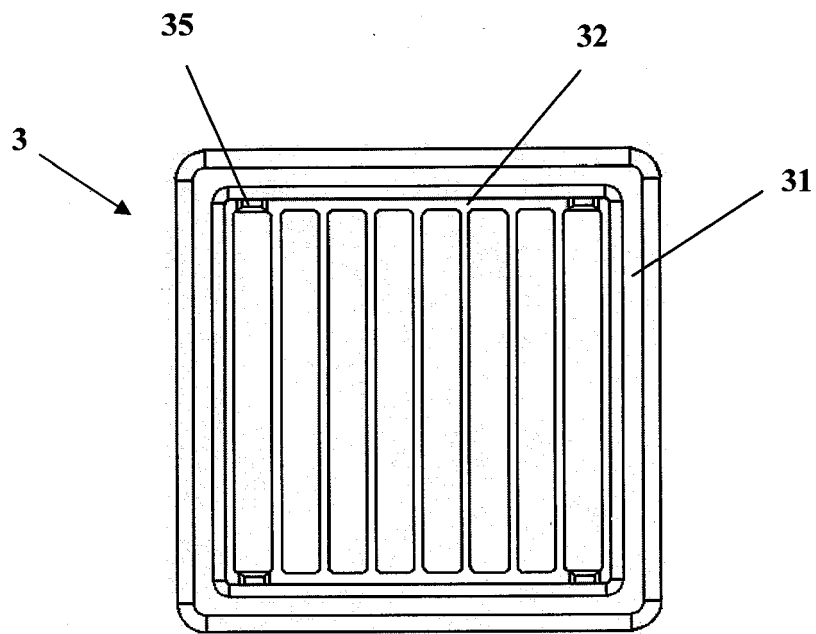
55



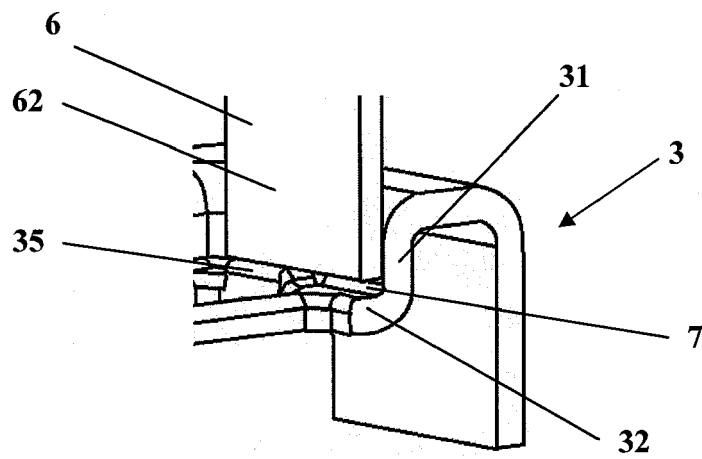
**Fig. 1**



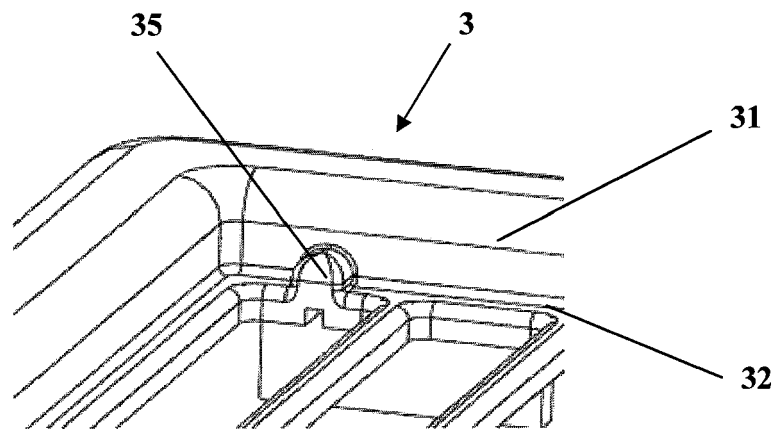
**Fig. 2**



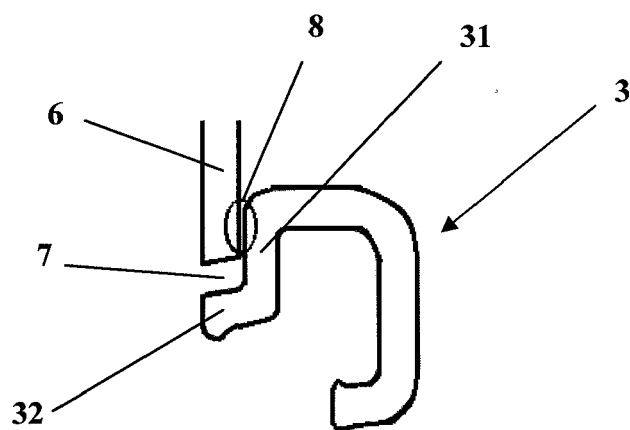
**Fig. 3**



**Fig. 4**



**Fig. 5**



**Fig. 6**





## EUROPEAN SEARCH REPORT

 Application Number  
 EP 18 46 1545

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	ES 2 260 971 A1 (VALEO TERMICO SA [ES]) 1 November 2006 (2006-11-01)	1,2,5-9	INV. F28F9/02
A	* figures 2,3 *	3,4	
X	JP 2007 077839 A (USUI KOKUSAI SANGYO KK) 29 March 2007 (2007-03-29)	1	
A	* figure 15 *	3,4	
A	US 2003/019616 A1 (HAYASHI TAKAYUKI [JP] ET AL) 30 January 2003 (2003-01-30)	1-9	
	* figure 6 *		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F28F
Place of search		Date of completion of the search	Examiner
Munich		20 September 2018	Martínez Rico, Celia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 1  
 EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 46 1545

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

20-09-2018

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
ES 2260971 A1	01-11-2006	NONE	
JP 2007077839 A	29-03-2007	JP 4931390 B2 JP 2007077839 A	16-05-2012 29-03-2007
US 2003019616 A1	30-01-2003	DE 10233407 A1 FR 2827949 A1 FR 2830929 A1 US 2003019616 A1	20-02-2003 31-01-2003 18-04-2003 30-01-2003

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- DE 102010040983 A1 [0003]