



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.09.2016 Bulletin 2016/36

(51) Int Cl.:
F24H 3/04 (2006.01) F24H 9/02 (2006.01)

(21) Application number: **15157167.6**

(22) Date of filing: **02.03.2015**

(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:
MA

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(54) **Heating device**

(57) The present invention relates to a heating device (1),

- with a housing (4) having a first frame part (2) and a second frame part (3), in which housing electric heating elements (5) are arranged,
- wherein the heating elements (5) are held by an upper longitudinal end in an upper seal (6) and by a lower longitudinal end in a lower seal (7),
- wherein the upper seal (6) has a number of through-openings (9) corresponding to the number of heating elements (5), in which the heating elements (5) are respectively received in a sealed manner,
- wherein the first and the second frame part (2, 3) between the two seals (6, 7) delimit a permeable heating chamber (11),
- wherein the upper seal (6) seals the heating chamber (11) in a fluid-tight/gas-tight manner against a connection chamber (12),
- wherein the upper seal (6) in the region of the through-openings (9) lies with a continuous, rectangular surface (13) tightly against the first frame part (2) and with an identical surface (13) tightly against the second frame part (3).

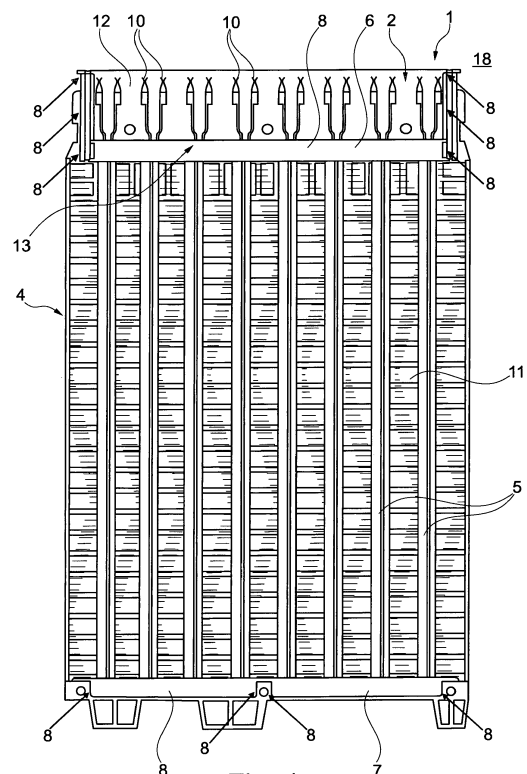


Fig. 1

Description

[0001] The present invention relates to a heating device, in particular for a vehicle air conditioning system.

[0002] Known heating devices with a housing having a first frame part and a second frame part, in which at least two, preferably even a plurality of, elongated heating elements are arranged, are to be found in almost every modern air conditioning system and are therefore generally known. Here, each heating element is held in a shared upper seal by a respective upper longitudinal end, whereas it is held by a respective lower longitudinal end in an associated lower seal. Both the upper and the lower seal are arranged or respectively clamped here at two opposite sides between the two frame parts, wherein to assist the installation and also the gas tightness between the seals and the frame parts, a lubricating/sealing material is arranged. In order to be able to electrically contact the electric heating elements with a voltage supply, the upper seal has a number of through-openings, corresponding to the number of heating elements, through which respectively an electrical connection of an associated heating element is directed and in which the heating elements are respectively received in a sealed manner. The first and the second frame part have here a permeable, in particular gas-permeable grid structure between the two seals, and delimit in this region a heating chamber. This heating chamber is sealed in a fluid-tight and gas-tight manner via the upper seal with respect to a connection chamber, in which the electrical connections of the heating elements are arranged.

[0003] A disadvantage in the heating devices known from the prior art, however, is the comparatively laborious installation thereof and the sealing of the connection chamber, because in particular the upper seal is highly fissured and therefore requires a laborious application of lubricating/sealing material. The lubricating/sealing material is, however, also absolutely necessary for facilitating the installation, because a comparatively great frictional resistance exists between the frame parts and the seals, so that an installation without using such a lubricating/sealing material would not be possible. The lubricating/sealing material therefore fulfils two functions.

[0004] The present invention is concerned with the problem of indicating for a heating device of the generic type an improved or at least an alternative embodiment, which in particular increases the tightness and facilitates the installation.

[0005] This problem is solved according to the invention by the subject matter of the independent claim 1. Advantageous embodiments are the subject matter of the dependent claims.

[0006] The present invention is based on the general idea of constructing so as to be distinctly less fissured a seal for sealing a heating chamber with respect to an electrical connection chamber and for holding individual electric heating elements, whereby the tightness is increased and the application of a lubricating/sealing ma-

terial is facilitated. The heating device according to the invention, which can be used in particular for a vehicle air conditioning system of a motor vehicle, has here in a known manner a first frame part and a second frame part, which together form a housing, wherein in this housing at least two elongated electric heating elements are arranged. The at least two heating elements are held here respectively by an upper longitudinal end in an upper seal and by a lower longitudinal end in an opposite lower seal. The two seals, in turn, are arranged or respectively clamped at two opposite sides between the two frame parts. In order to both increase the sealing effect of the seals and also to facilitate the installation of the heating device, the lubricating/sealing material, for example grease, is arranged between the seals and the frame parts. Furthermore, the upper seal has a number of through-openings corresponding to the number of heating elements, through which respectively electrical connections of a respectively heating element are directed and in which the heating elements are respectively received in a sealed manner. The lower seal seals the heating chamber in a liquid-tight and gas-tight manner to bottom. In addition, both the first and the second frame part have a permeable grid structure and thereby delimit an in particular gas-permeable heating chamber between the two seals. This heating chamber is sealed by the upper seal in a fluid-tight and gas-tight manner against the previously mentioned connection chamber, wherein in this connection chamber the electrical connections of the heating elements are arranged. According to the invention, the upper seal now lies in the region of the through-openings with a continuous, rectangular surface tightly against the first frame part and with a likewise continuous, rectangular surface tightly against the second frame part. These two continuous, rectangular surfaces were highly segmented and fissured in conventional heating devices known from the prior art, whereby a plurality of differently aligned surfaces was present, which had to be acted on laboriously and in particular also by means of a large amount of lubricating/sealing material. Through the highly fissured surfaces, a high risk with respect to a gas leakage also existed. Through the rectangular surfaces, continuous from one side to the other, according to the invention therefore not only can the action upon these surfaces with the necessary lubricating/sealing material be executed considerably more simply, but additionally also an increased tightness can be achieved, because the continuous, rectangular surfaces constitute a distinctly lower risk of a gas leakage. With the upper seal constructed according to the invention, owing to the reduced effort for applying the lubricating/sealing material in addition also the installation can be distinctly facilitated.

[0007] Expediently, the lower seal has at least two receiving openings to receive the respective lower longitudinal ends of the at least two heating elements, wherein the lower seal in the region of the receiving openings lies with two rectangular surfaces tightly against the first

frame part and with two opposite rectangular surfaces lies tightly against the second frame part. Compared with lower seals known from the prior art therefore, in a similar manner to with the upper seal, here also a hitherto highly fissured surface can now be smoothed, whereby on the one hand the sealing effect can be improved and on the other hand the lubricating effort can be reduced.

[0008] In an advantageous further development of the solution according to the invention, the heating elements are constructed as PTC heating elements. PTC heating elements are so-called posistors, which can conduct the current better at low temperatures than at high temperatures. Their electrical resistance therefore increases with increasing temperature. By means of such PTC heating elements (Positive Temperature Coefficient), a comparatively simple but nevertheless exact regulating of a temperature can be achieved, wherein such PTC heating elements are, moreover, able to be produced comparatively economically and in almost any desired geometric shape.

[0009] In an advantageous further development of the solution according to the invention, the two frame parts are made from plastic, in particular from PA6.6. Polyamide 6.6 is a partially crystalline polyamide with, however, better mechanical characteristics than PA6. PA6.6 is distinguished in particular also by a heat distortion resistance and a low water absorption, whereby it is predestined for use in the region of a heating device of a vehicle air conditioning system.

[0010] In a further advantageous embodiment of the solution according to the invention, the two frame parts are constructed as plastic injection moulded parts. The production of such plastic injection moulded parts makes it possible to produce these not only at the highest quality, but in addition also economically and, at the same time, with low unit costs.

[0011] Expediently, the two seals are made from silicone rubber. Silicone rubbers are materials able to be transferred into the rubber elastic state, which contain poly(organo)siloxanes which have accessible groups for crosslinking reactions. Of course, such silicone rubbers can also contain strengthening substances or respectively fillers, the type and quantity of which distinctly influence the mechanical and chemical behaviour of the silicone elastomers resulting through the crosslinking. The production of the seals from such a silicone rubber is possible in a comparatively cost-effective manner.

[0012] Further important features and advantages of the invention will emerge from the subclaims, from the drawings and from the associated figure description with the aid of the drawings.

[0013] It shall be understood that the features mentioned above and to be further explained below are able to be used not only in the respectively indicated combination, but also in other combinations or in isolation, without departing from the scope of the present invention.

[0014] Preferred example embodiments of the invention are illustrated in the drawings and are explained in

further detail in the following description, wherein the same reference numbers refer to identical or similar or functionally identical components.

[0015] There are shown, respectively diagrammatically,

Fig. 1 a view onto an opened heating device according to the invention,

Fig. 2 a view onto an upper seal in the heating device,

Fig. 3 an illustration of a first frame part of the heating device,

Fig. 4 an illustration of the second frame part of the heating device,

Fig. 5 a perspective view of a lower seal of the heating device according to the invention.

[0016] According to Fig. 1, a heating device 1 according to the invention, which can be used for example in a vehicle air conditioning system 18 of a motor vehicle, has a first frame part 2 (cf. also Fig. 3) which, with a second frame part 3 not shown in Fig. 1 (cf. Fig. 4), forms a housing 4. In this housing 4 at least two elongated heating elements 5, here even eight heating elements 5, are arranged, which can be embodied in particular as PTC heating elements. The heating elements 5 are held here by an upper longitudinal end in an upper seal 6 (cf. also Fig. 2) and by a lower longitudinal end in a lower seal 7 (cf. Fig. 5). The two seals 6 and 7 are arranged here at two opposite sides between the two frame parts 2, 3, wherein to facilitate the assembly of the heating device 1 and to increase the sealing effect between the seals 6, 7 and the two frame parts 2, 3 a lubricating/sealing material 8 is arranged.

[0017] Looking more closely at Fig. 2, it can be seen that the upper seal 6 has a number of through-openings 9 corresponding to the number of heating elements 5, through which respectively an electrical connection 10 of a respective heating element 5 is directed and in which the heating elements 5 are respectively received in a sealed manner. The first and the second frame part 2, 3 have a permeable grid structure here between the two seals 6, 7, as can also be clearly seen in particular in Figs. 3 and 4, and delimit a permeable heating chamber 11. Between the individual heating elements 5, of course ribs or other heat transmission elements can be arranged here for enlarging the surface and hence for improved heat transfer. The upper seal 6 seals the heating chamber 11 here in a fluid-tight/gastight manner against the connection chamber 12 (cf. Fig. 1) in which the electrical connections 10 of the heating elements 5 are arranged. Via the connection chamber 12 a connection takes place to a control device, for example. By connecting the control device not only the electric connection is made, but at the same time also the through holes 9 are sealed in the

upper seal 6. According to the invention, the upper seal 6 now lies in the region of the through-openings 9 with a continuous, rectangular surface 13 tightly against the first frame part 2 and with an opposite continuous, rectangular surface 13 tightly against the second frame part 3.

[0018] Compared with heating devices known hitherto, which have a highly fissured surface in the region of the surface 13, with the upper seal 6 configured according to the invention with a continuous rectangular surface 13, not only can the effort of lubricating or respectively greasing be considerably reduced, but in addition also the risk of a gas leakage can be considerably lessened.

[0019] On observing the lower seal 7, it can be seen that the latter has at least two receiving openings 14 to receive the respective lower longitudinal ends of the at least two heating elements 5 (cf. Fig. 5), wherein here of course the number of receiving openings 14 corresponds to the number of heating elements 5. The lower seal 7 lies here in the region of the receiving openings 14 with two rectangular surfaces 15 tightly against the first frame part 2 and with two opposite rectangular surfaces 15 tightly against the second frame part 3. The lower seal 7 is also distinctly less highly fissured in the region of the surfaces 15 than seals used hitherto in this region, whereby also in this region the lubricating effort can be considerably reduced and hence the installation can be distinctly simplified, and in addition the risk of a gas leakage can be minimized.

[0020] Observing again the upper seal 6 of Figs. 1 and 2, it can be seen that two projecting sealing pins 16 are arranged thereon, which in an installed heating device 1 are clamped between the two frame parts 2, 3 and are arranged parallel to the elongated heating elements 5. The sealing pins 16 have respectively a cross-like cross-section.

[0021] The two frame parts 2, 3 are preferably constructed as a plastic injection moulded part and, for example, from a polyamide 6.6. The two seals 6, 7, on the other hand, are preferably constructed from silicone rubber.

[0022] Observing Fig. 4, it can be seen that the second frame part 3 in the region of the upper seal 6 and the lower seal 7 has respectively at least two sleeve-shaped spacer elements 17, which project transversely to the plane of the second frame part 3 and are connected with one another via the two frame parts 2, 3.

[0023] Generally, with the new seals 6, 7 constructed according to the invention, an effort for applying the lubricating/sealing material 8 can be distinctly reduced and hence the installation can be distinctly simplified, wherein owing to the now distinctly enlarged and less highly fissured surfaces 13, 15 in addition also the risk of an undesired gas leakage can be reduced. Such a gas leakage is to be absolutely avoided in particular in the region of the upper seal 6, because no moisture is to penetrate into the electrical connection chamber 12, in order to prevent a corrosion of the electrical connections 10.

Claims

1. A heating device (1), in particular for a vehicle air conditioning system (18),

- with a housing (4) having a first frame part (2) and a second frame part (3), in which housing at least two elongated electric heating elements (5) are arranged,
- wherein the at least two heating elements (5) are held by an upper longitudinal end in an upper seal (6) and by a lower longitudinal end in a lower seal (7),
- wherein the two seals (6, 7) are arranged at two opposite sides between the two frame parts (2, 3),
- wherein between the seals (6, 7) and the frame parts (2, 3) a lubricating/sealing material (8) is arranged,
- wherein the upper seal (6) has a number of through-openings (9) corresponding to the number of heating elements (5), through which respectively an electrical connection (10) of a respective heating element (5) is directed and in which the heating elements (5) are respectively received in a sealed manner,
- wherein the first and the second frame part (2, 3) have a permeable grid structure between the two seals (6, 7) and delimit a permeable heating chamber (11),
- wherein the upper seal (6) seals the heating chamber (11) in a fluid-tight/gas-tight manner against a connection chamber (12), in which the electrical connections (10) of the heating elements (5) are arranged,
- wherein the upper seal (6) in the region of the through-openings (9) lies with a continuous, rectangular surface (13) tightly against the first frame part (2) and with a continuous, rectangular surface (13) tightly against the second frame part (3).

2. The heating device according to claim 1, **characterized in that** the lower seal (7) has a number of receiving openings (14) to receive the respective lower longitudinal ends of the heating elements (5) corresponding to the number of heating elements (5).

3. The heating device according to claim 2, **characterized in that** the lower seal (7) in the region of the receiving openings (14) lies with two rectangular surfaces (15) tightly against the first frame part (2) and with two rectangular surfaces (15) tightly against the second frame part (3).

4. The heating device according to one of claims 1 to 3,

characterized in that

the heating elements (5) are constructed as PTC heating elements.

5. The heating device according to one of claims 1 to 4,
characterized in that
on the upper seal (6) two projecting sealing pins (16) are arranged, which in an installed heating device (1) are clamped between the two frame parts (2, 3) and are arranged parallel to the elongated heating elements (5). 5 10
6. The heating device according to claim 5,
characterized in that
the sealing pins (16) have respectively a cross-like cross-section. 15
7. The heating device according to one of claims 1 to 6,
characterized in that
the two frame parts (2, 3) are constructed from plastic, in particular from PA 6.6. 20
8. The heating device according to one of claims 1 to 7,
characterized in that
the two frame parts (2, 3) are constructed as plastic injection moulded parts. 25
9. The heating device according to one of claims 1 to 8,
characterized in that
the two seals (6, 7) are constructed from silicone rubber. 30
10. The heating device according to one of claims 1 to 9,
characterized in that
the second frame part (3) in the region of the upper seal (6) and of the lower seal (7) has respectively at least two sleeve-shaped spacer elements (17), which project transversely to the plane of the second frame part (3) and are connected with one another via the two frame parts (2, 3). 35 40
11. An air conditioning system (18) of a motor vehicle with a heating device (1) according to one of claims 1 to 10. 45

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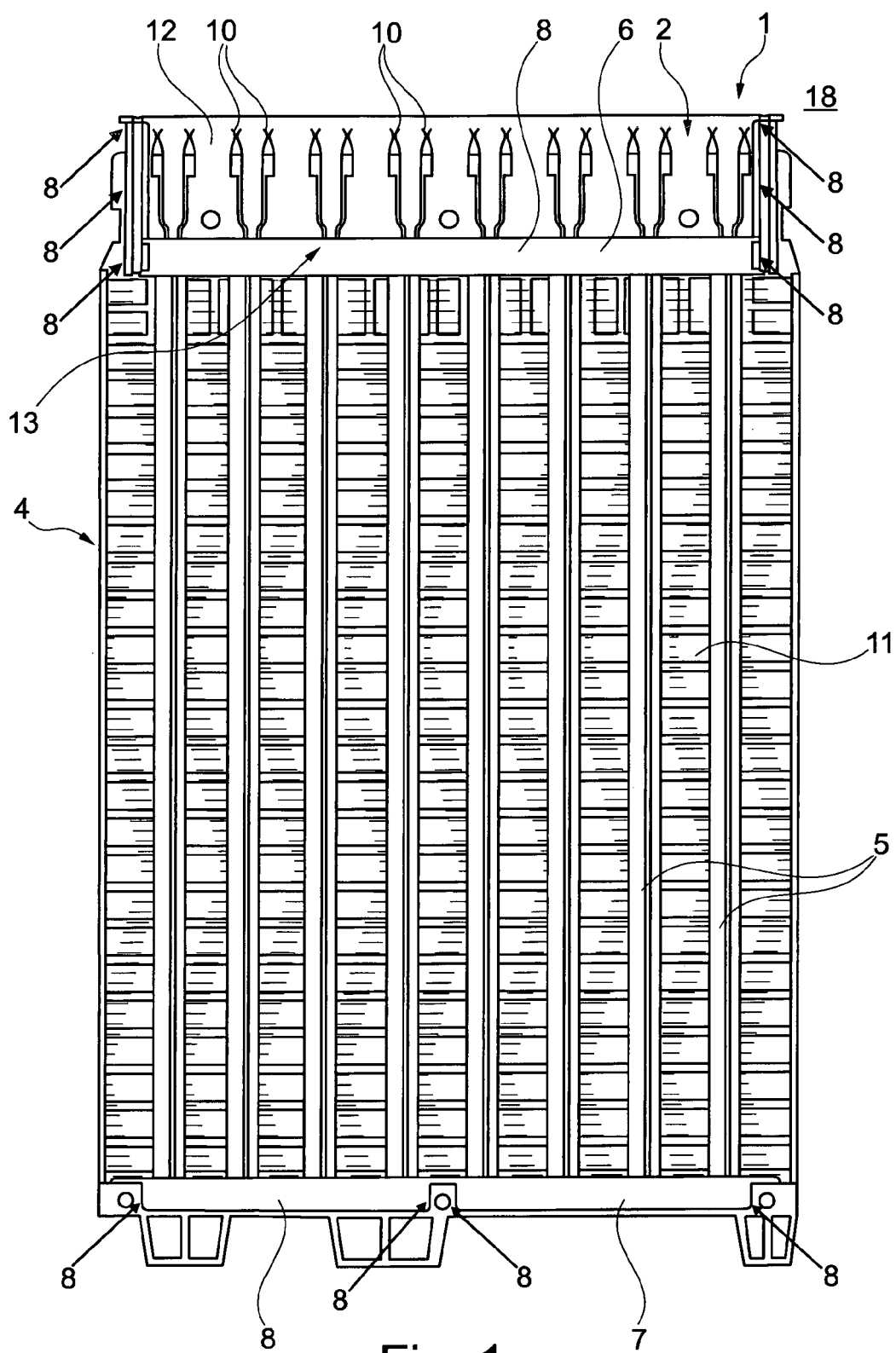


Fig. 1

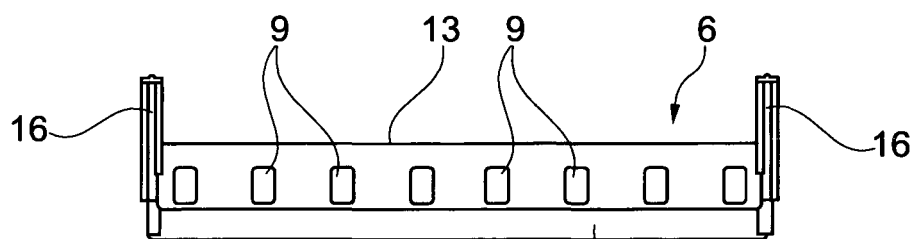


Fig. 2

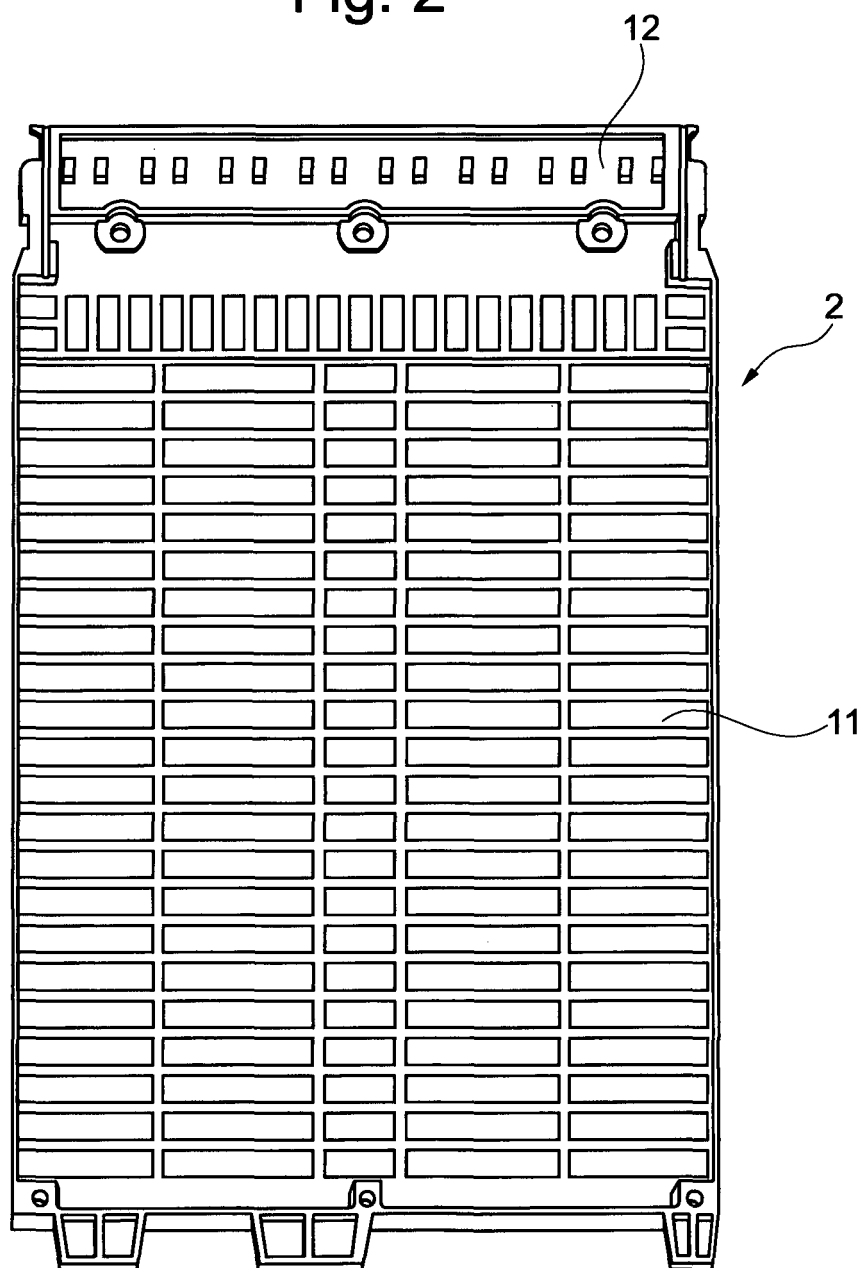
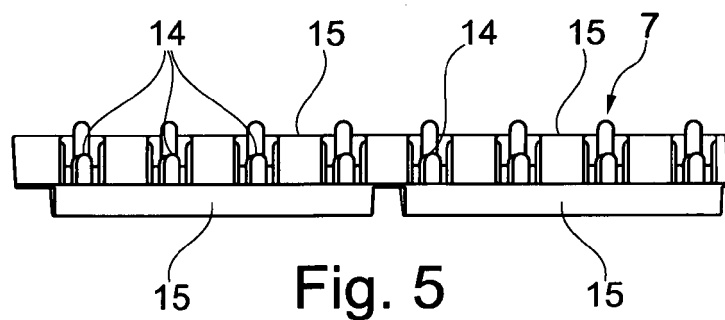
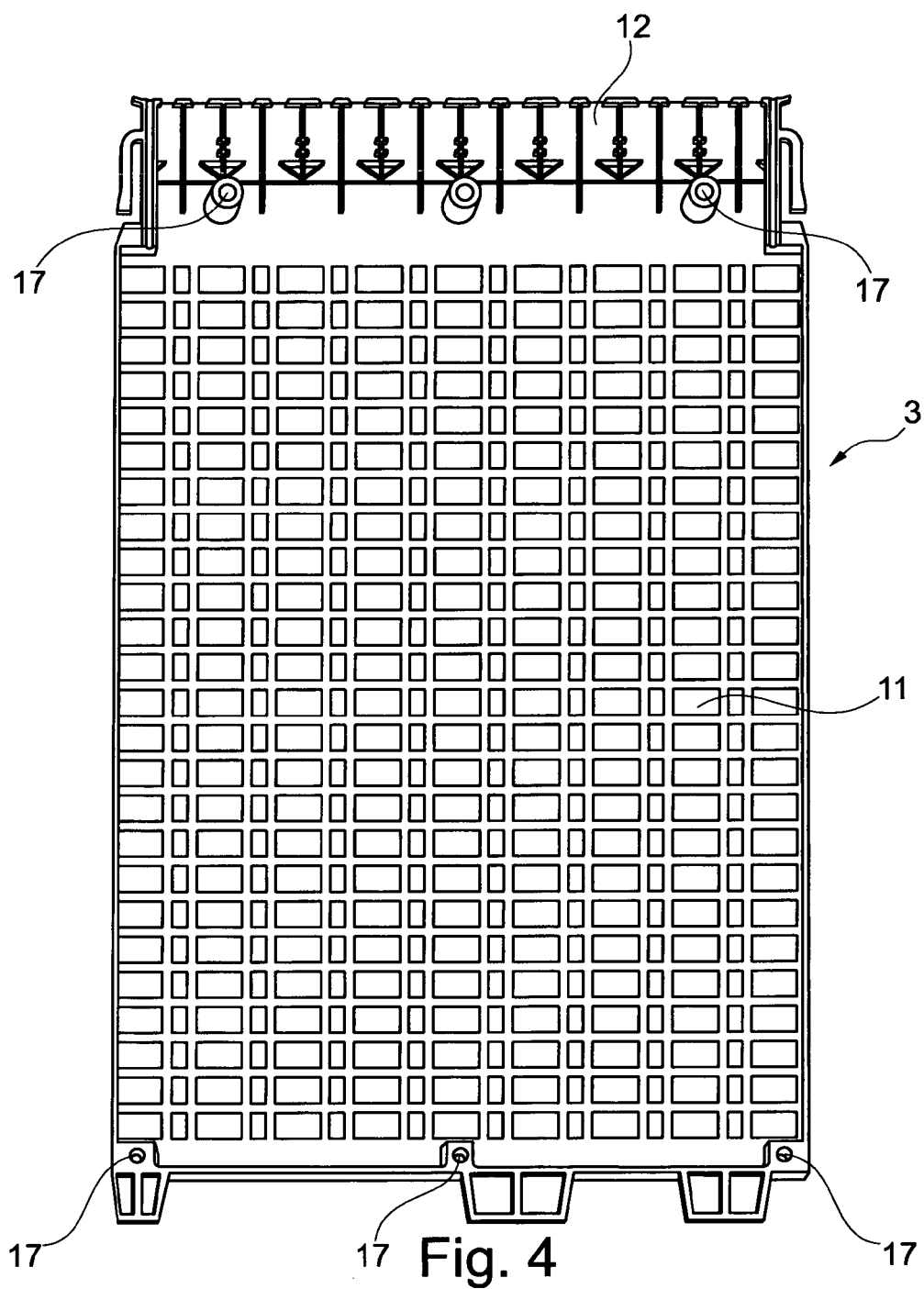


Fig. 3





EUROPEAN SEARCH REPORT

Application Number
EP 15 15 7167

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 2 395 295 A1 (BEHR GMBH & CO KG [DE]; BEHR FRANCE ROUFFACH SAS [FR]) 14 December 2011 (2011-12-14) * paragraphs [0036] - [0051]; figures 1-18 *	1-4,7-11	INV. F24H3/04 F24H9/02
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Y	EP 2 293 648 A1 (BEHR FRANCE ROUFFACH SAS [FR]) 9 March 2011 (2011-03-09) * paragraphs [0001], [0002], [0026] - [0034]; figures 1-5 *	1-4,7-11	

			TECHNICAL FIELDS SEARCHED (IPC)
			F24H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 August 2015	Examiner Blot, Pierre-Edouard
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			

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EPO FORM 1503 03/82 (P04C01)

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

EP 15 15 7167

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
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28-08-2015

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	EP 2395295	A1	14-12-2011	NONE

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