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(54) FIRE-RESISTANT VENTILATION GRILLE

(57) The present invention relates to a fire-resistant ventilation grille (1) for fitting in a wall or floor, comprising several slats (2) which are arranged essentially parallel to each other and which each comprise a strip (3) of expandable material which is provided to expand substantially in one dimension on account of heat and which each comprise a strip (4) of expandable material which is provided to expand in three dimensions on account of heat.

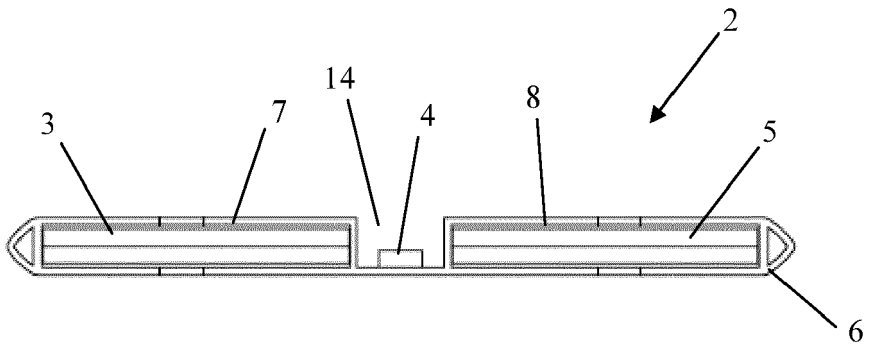

Fig. 2

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Description

[0001] The present invention relates to a fire-resistant ventilation grille for fitting in a wall or a floor for air flow through the wall or the floor, comprising several slats which are arranged essentially parallel to each other and which each comprise a strip of expandable material which is provided to expand substantially in one dimension on account of heat.

[0002] Such fire-resistant ventilation grilles are typically placed in essentially vertical walls, doors or hatches as a wall and in horizontal floors to prevent fire propagation between a first space and a second space. An example of such a ventilation grille is described in BE 1 019 543A3.

In this case, these ventilation grilles secure an air flow opening between this first space and this second space. The expandable material used herein is a material which will characteristically expand on account of the heat which is generated during a fire. During a fire, the expandable material expands until the air flow opening is sealed off essentially completely. In this way, fire propagation can be halted for a certain amount of time.

[0003] The slats in such a grille are arranged with respect to each other at such a distance apart that, on the one hand, the desired ventilation capacity is ensured and, on the other hand, the openings between the slats are essentially closed off by means of the expandable material when the expandable material expands.

[0004] Most current fire-resistant ventilation grilles of this type halt the propagation of fire for approximately 1 hour or in exceptional cases for 90 minutes. By a well-considered choice of the expandable material, the dimensions and the positioning thereof, this duration may be increased slightly.

[0005] It is now the object of the present invention to significantly increase the time for which such a ventilation grille can halt the propagation of fire.

[0006] This object of the invention is achieved by providing a fire-resistant ventilation grille for fitting in a wall or a floor for air flow through the wall or the floor, comprising several slats which are arranged essentially parallel to each other and which each comprise at least one strip of expandable material which is provided to expand substantially in one dimension on account of heat and which each comprise at least one strip of expandable material which is provided to expand in three dimensions on account of heat.

[0007] Due to a combination of this one-dimensional expandable material and this three-dimensional expandable material, the time during which such a ventilation grille can halt the propagation of fire can be increased significantly.

Although such three-dimensional expandable material may provide fire retardancy for a longer period of time than such a one-dimensional expandable material, this material has to date not been used in such ventilation grilles, because it pulverizes at such temperatures which occur during a fire and in relatively large openings, if no additional element is used which gives the arrangement a structural strength. The structures which are normally used to keep such three-dimensional expandable material in position after it has expanded during fire, are not suitable to be incorporated in this type of ventilation grille, since they would either reduce the ventilation capacity too much (e.g. metal grilles) or are seen as inconvenient. By now arranging the one-dimensional expandable material together with the three-dimensional expandable material, it is possible to ensure that the one-dimensional expandable material retains the three-dimensional expandable material to a sufficient degree in case of fire. The three-dimensional expandable material in turn helps to fill the holes which appear in the one-dimensional material after a fire has been burning for 1 hour.

[0008] With a ventilation grille according to the present invention, the strip of three-dimensional expandable material preferably extends, viewed in the direction of the air flow, at least partly next to said strip of one-dimensional expandable material. Due to the positioning of the ventilation grille, it is always possible to ensure that the strip of one-dimensional expandable material is directed towards the side with the potential fire hazard, so that the one-dimensional expandable material can consequently provide the required structure with a greater degree of certainty in order to retain the three-dimensional material, if necessary.

[0009] Said strip of expandable material may consist of one or several parts of such expandable material which may, if desired, also be arranged at some distance from one another. Preferably, these one or several parts of such a strip together extend over essentially the entire length of the slat.

[0010] If desired, a ventilation grille according to the present invention may in addition, if this is not seen as inconvenient, be provided with an air-permeable structural element, such as for example a mesh or grille, which extends, on the other side from the side on which the strip of one-dimensional expandable material extends at least partly, next to the strips of three-dimensional expandable material of the different slats in order to also ensure that the three-dimensional material is retained in its position for a sufficiently long period of time.

[0011] Preferably, the strip of three-dimensional expandable material in each slat of a ventilation grille according to the present invention is arranged at a distance from the strip of one-dimensional expandable material. In this way, the three-dimensional material is activated with a small delay with respect to the one-dimensional expandable material, which ensures that the ventilation grille can prevent fire extension for an even longer period of time.

[0012] Furthermore, each slat preferably comprises a sleeve comprising a hole which is at least partly filled with said strip of one-dimensional expandable material.

The fact is that one-dimensional expandable material is typically not moisture-proof and such a sleeve is a simple

way of protecting this one-dimensional expandable material from moisture. Alternatively, the one-dimensional expandable material could be provided with, for example, a moisture-resistant coating. This sleeve may also offer a visual advantage.

[0013] If a sleeve is provided, then this is preferably made of meltable and/or flammable material, so that this material will melt or burn virtually immediately in case of fire, so that the one-dimensional expandable material is exposed as quickly as possible to the temperatures at which it expands. Alternatively or additionally, the material of the sleeve could, for example, also be made to be heat-conductive, in which case this sleeve is easily ripped by the expanding expandable material in case of fire.

[0014] Preferably, such a sleeve is made from plastic.

[0015] Such a sleeve may, for example, be produced simply by means of extrusion.

[0016] With a ventilation grille according to the present invention in which the slats comprise said sleeve, the strip of three-dimensional expandable material is preferably attached to the outside of the sleeve in terms of production engineering.

[0017] If there is a fire hazard on both sides of the wall in which the ventilation grille is incorporated, each slat preferably comprises a second strip of one-dimensional expandable material which extends at least partly next to the strip of three-dimensional expandable material, on the other side from the side on which the firstmentioned strip of one-dimensional expandable material extends at least partly. In this way, the ventilation grille, viewed from both spaces between which the wall is arranged in which this ventilation grille is incorporated, delivers the same optimum performance.

Also in cases where there is a fire hazard on only one side of the wall, such a ventilation grille offers the advantage that the three-dimensional material is retained better in case of fire between the one-dimensional expandable material which then extends on both sides of the three-dimensional expandable material. In this way, the three-dimensional expandable material can be retained in an optimum manner even without additional structural elements. In this way, the ventilation capacity can be guaranteed even more reliably.

[0018] With such an embodiment in which a strip of one-dimensional expandable material is arranged along both sides of the strip of three-dimensional expandable material, both strips of one-dimensional expandable material are preferably arranged at a distance from the strip of three-dimensional expandable material.

[0019] A ventilation grille according to the present invention is furthermore constructed preferably essentially symmetrically, so that the action thereof is essentially identical, viewed from both spaces between which the wall is arranged in which this ventilation grille is incorporated.

[0020] With such an embodiment in which a strip of one-dimensional expandable material is arranged along both sides of the strip of three-dimensional expandable material, the sleeve preferably comprises a second hole, which is at least partly filled with the second strip of one-dimensional expandable material.

[0021] In a specific embodiment of a ventilation grille according to the present invention, at least one said strip of one-dimensional expandable material is arranged in the ventilation grille at an incline.

When such a grille is incorporated in an essentially vertical wall, the slats will extend substantially horizontally. The slats are seen as being arranged essentially horizontally when their sides extend essentially horizontally in the length direction. In the width direction, the slats may in this case optionally be arranged horizontally. When at least one strip of one-dimensional material is arranged at an incline, the slats will thus be arranged partly at an incline in the width direction. This means that this at least one strip of one-dimensional material is arranged at an angle with respect to a horizontal plane. Such an arrangement may be desired in order to make viewing through the grille more difficult or impossible.

[0022] A particularly preferred embodiment of a fire-resistant ventilation grille according to the present invention comprises a frame delimiting an air flow opening in which the slats are arranged, and comprises at least one rod which is arranged in the air flow opening and is fitted through each slat.

[0023] Still more preferably, this rod is only secured against tensile strain. In this way, this rod (or these several rods) can move freely in the frame upon expansion during a fire, so that the ventilation grille does not warp as a result of the expansion of one or several of these rods.

[0024] In said embodiments comprising a first and a second strip of one-dimensional expandable material per slat, at least one first said rod is preferably fitted through the firstmentioned strip of one-dimensional expandable material of each slat and at least one second said rod is preferably fitted through the second strip of one-dimensional expandable material of each slat.

[0025] Still more preferably, each first rod is arranged at a distance from each second rod in such an embodiment, viewed in the length direction of the slats. When the rods are arranged in the ventilation grille in a staggered manner, a weak spot in the first strip of one-dimensional expandable material, which is produced by the formation of the opening through which a rod is arranged at the location of this opening, may be compensated for by a completely intact second strip of one-dimensional expandable material and vice versa.

[0026] In a further preferred embodiment of a ventilation grille comprising one or several of said first rods extending through the first strip of one-dimensional expandable material and one or several said second rods extending through the second strip of one-dimensional expandable material, at least one first rod is held at a limited distance from a corresponding second rod by means of a connecting element. If desired, this limited distance may vary in a limited way, but is restricted in such a way

that it cannot increase excessively. Due to this connecting element, the two strips of one-dimensional expandable material cannot be forced apart (or only to a limited extent) by the three-dimensional expandable material trapped therein.

Still more preferably, each first rod is in this case connected to a corresponding second rod by means of such a connecting element, so that each first rod is held at a limited distance from a corresponding second rod.

Preferably, the one or several connecting elements are of rigid design, so that each first rod is held at a fixed distance from the corresponding second rod.

[0027] The one-dimensional expandable material of a ventilation grille according to the present invention preferably comprises silicate material and, more specifically, hydrated sodium silicate.

The three-dimensional expandable material preferably comprises expandable graphite.

[0028] The present invention will now be explained in more detail by means of the following detailed description of some preferred embodiments of a fire-resistant ventilation grille according to the present invention. The sole aim of this description is to give illustrative examples and to indicate further advantages and particulars of the present invention, and can therefore by no means be interpreted as a limitation of the area of application of the invention or of patent rights defined in the claims.

[0029] In this detailed description, reference numerals are used to refer to the attached figures, in which

- Fig. 1 shows an embodiment of a ventilation grille according to the present invention in perspective view;
- Fig. 2 shows a slat from the ventilation grille from Fig. 1 in cross section;
- Fig. 3 shows the ventilation grille from Fig. 1 in vertical cross section and in a cut-away perspective view.

[0030] The illustrated fire-resistant ventilation grille (1) comprises a frame (9) which delimits an air flow opening. Several slats (2) are arranged parallel to each other and essentially horizontally in this frame (9).

[0031] In the illustrated embodiment, the shape of the frame (9) is essentially rectangular. However, it is also possible to design such a ventilation grille (1) with, for example, a round frame (9).

This frame (9) may be made, for example, from wood or fibreboard. For this purpose, it is possible to use MDF, for example.

Other materials which are substantially non-expandable on account of heat may also be used to produce such a frame (9).

[0032] Between their ends, rods (10, 11) are provided through openings (12) in the slats (2). These rods (10, 11) are also provided through openings (13) in the frame (9) and then secured. In the illustrated embodiment, these rods (10, 11) are only secured against tensile strain, so that they hold the frame (9) together. In case of a fire, the rods (10, 11) can then expand freely in the frame (9), so that the ventilation grille (1) does not warp due to expansion of the rods (10, 11).

The rods (10, 11) are arranged in a staggered manner. Consequently, any weakened section in the first strip of one-dimensional expandable material (3) resulting from the opening (12) required for passing through a rod (10) is compensated for by an intact second strip of one-dimensional expandable material (5) in the row behind. Conversely, any weakened section in the second strip of expandable material (5) is compensated for by an intact first strip of expandable material (3) at the location of this weakened section.

In order to prevent the three-dimensional expandable material (4) forcing the 2 barriers of one-dimensional expandable material (3, 5) apart during a fire, connecting pieces (16) are provided by means of which each first rod (10) is held at a fixed distance from a corresponding second rod (11) in order to guarantee the distance between the strips of one-dimensional expandable material (3, 5).

[0033] In order to keep the slats (2) at the desired distance apart, support bushes (15) are in each case pushed over the rods (10) and arranged between the slats (2). The essentially vertically arranged rods (10) may be made, for example, from steel. The support bushes (15) may be made, for example, from plastic.

It is also possible, as is known from the prior art, to provide for example strips of expandable material which are enveloped by a plastic sleeve as vertical support elements, instead of the illustrated rods (10) and support bushes (15). These strips of expandable material with a plastic sleeve can then be provided with slots, in which case the slats (2) are fitted in these slots.

[0034] Each slat (2) of the illustrated ventilation grille (1) comprises two strips of one-dimensional expandable material (3, 5) which are arranged in holes (7, 8) of a sleeve (6) and a strip of three-dimensional expandable material (4) which is arranged in between and which is attached to the outside of this sleeve (6) in a central groove (14) of the sleeve (6).

The central groove (14) of the sleeve (6) is wider than the strip of three-dimensional expandable material (4) which is arranged centrally in this groove (14). In this way, the strips of one-dimensional expandable material (3, 5) are arranged on either side of the strip of three-dimensional expandable material (4), at a certain distance away. Here, the strips of one-dimensional expandable material (3, 5) fill the corresponding holes (7, 8) in the sleeve (6) essentially completely.

Both the strips of expandable material (3, 4, 5) and the sleeve (6) preferably extend essentially along the length of the slat (2).

The sleeve (6) is preferably made from meltable plastic and may be made from, for example, PVC or PS by means of, for example, extrusion.

Expandable materials may for example be used as ex-

pandable material (3, 4, 5). The one-dimensional expandable material (3, 5) is provided to expand substantially in one dimension on account of heat. Hydrated sodium silicate may for example be selected for this one-dimensional expandable material (3, 5). The three-dimensional expandable material (4) is provided to expand in three dimensions on account of heat. A graphite mixture on the basis of expandable graphite may for example be selected as the three-dimensional expandable material (4).

[0035] In the illustrated embodiment, the strips of expandable material (3, 4, 5) are arranged essentially horizontally. Optionally, one or several of these strips (3, 4, 5) may be arranged at an angle with respect to a horizontal plane in the width direction in order to make, for example, viewing through the ventilation grille (1) difficult or impossible. In this case, strips (3, 4, 5) may also be arranged at an angle with respect to each other.

[0036] In case of fire in a space next to the wall in which the illustrated ventilation grille (1) is fitted, first the sleeve (6) which is closest to this space will melt and the one-dimensional expandable material (3) arranged therein will expand. Then, after a small time delay, the three-dimensional expandable material (4) will also start to expand, followed by the second strip of one-dimensional expandable material (5). The expanding three-dimensional expandable material (4) is thus held between the expanding one-dimensional expandable material (3, 5) which provides the necessary structure in order to keep the pulverizing three-dimensional expandable material (4) in place. The three-dimensional expandable material (4) also helps to fill the small holes which appear in the one-dimensional material (3, 5) after a fire has been burning for 1 hour. Together, the expandable material (3, 4, 5) essentially seals off the entire air flow opening for hours after it has expanded, thus preventing fire extension through this air flow opening.

Claims

1. Fire-resistant ventilation grille (1) for fitting in a wall or floor for air flow through the wall or floor, comprising several slats (2) which are arranged essentially parallel to each other and which each comprise at least one strip (3) of expandable material which is provided to expand substantially in one dimension on account of heat, **characterized in that** each slat (2) comprises at least one strip (4) of expandable material which is provided to expand in three dimensions on account of heat.

2. Fire-resistant ventilation grille (1) according to Claim 1, **characterized in that** the strip of three-dimensional expandable material (4) extends, viewed in the direction of the air flow, at least partly next to the strip of one-dimensional expandable material (3).

3. Fire-resistant ventilation grille (1) according to Claim 2, **characterized in that** the ventilation grille (1) comprises an air-permeable structural element, such as for example a mesh, which extends, on the other side from the side on which the strip of one-dimensional expandable material (3) extends at least partly, next to the strips of three-dimensional expandable material (4) of the different slats (2).

4. Fire-resistant ventilation grille (1) according to Claim 2 or 3, **characterized in that** the strip of three-dimensional expandable material (4) is arranged at a distance from the strip of one-dimensional expandable material (3).

5. Fire-resistant ventilation grille (1) according to one of the preceding claims, **characterized in that** each slat comprises a sleeve (6) comprising a hole (7) which is at least partly filled with said strip of one-dimensional expandable material (3).

6. Fire-resistant ventilation grille (1) according to Claim 5, **characterized in that** the sleeve (6) is made from meltable and/or flammable material.

7. Fire-resistant ventilation grille (1) according to Claim 5 or 6, **characterized in that** the sleeve (6) is made from plastic.

8. Fire-resistant ventilation grille (1) according to one of Claims 5 to 7, **characterized in that** the strip of three-dimensional expandable material (4) is attached to the outside of the sleeve (6).

9. Fire-resistant ventilation grille (1) according to one of the preceding claims and Claim 2, **characterized in that** each slat (2) comprises a second strip of one-dimensional expandable material (5) which extends at least partly next to the strip of three-dimensional expandable material (4), on the other side from the side on which the firstmentioned strip of one-dimensional expandable material (3) extends at least partly.

10. Fire-resistant ventilation grille (1) according to one of Claims 5 to 8 and Claim 9, **characterized in that** the sleeve (6) comprises a second hole (8) which is at least partly filled with the second strip of one-dimensional expandable material (5).

11. Fire-resistant ventilation grille (1) according to one of the preceding claims, **characterized in that** at least one said strip of one-dimensional expandable material (3, 5) is arranged in the ventilation grille (1) at an incline.

12. Fire-resistant ventilation grille (1) according to one of the preceding claims, **characterized in that** the

ventilation grille (1) comprises a frame (9) which delimits an air flow opening in which the slats (2) are arranged, and comprises at least one rod (10, 11) which is arranged in the air flow opening and is fitted through each slat (2).

13. Fire-resistant ventilation grille according to Claim 12, **characterized in that** the rod (10, 11) is only secured against tensile strain.

14. Fire-resistant ventilation grille according to Claim 9 or 10 and Claim 12 or 13, **characterized in that** at least one first said rod (10) is fitted through the first-mentioned strip of one-dimensional expandable material (3) of each slat (2) and at least one second said rod (11) is fitted through the second strip of one-dimensional expandable material (5) of each slat (2).

15. Fire-resistant ventilation grille (1) according to Claim 14, **characterized in that**, viewed in the length direction of the slats (2), each first rod (10) is arranged at a distance from each second rod (11).

16. Fire-resistant ventilation grille (1) according to Claim 14 or 15, **characterized in that** at least one first rod (10) is held at a limited distance from a corresponding second rod (11) by means of a connecting element (16).

17. Fire-resistant ventilation grille (1) according to one of the preceding claims, **characterized in that** the one-dimensional expandable material (3, 5) comprises silicate material.

18. Fire-resistant ventilation grille (1) according to one of the preceding claims, **characterized in that** the three-dimensional expandable material (4) comprises expandable graphite.

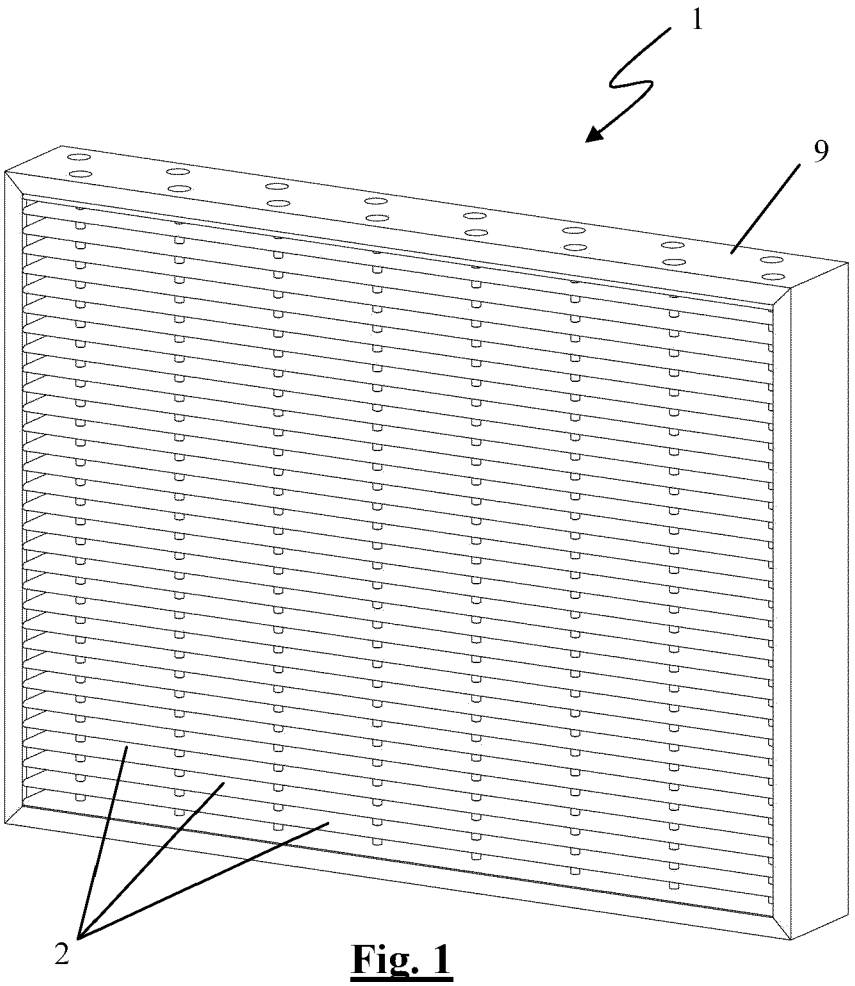

Fig. 1

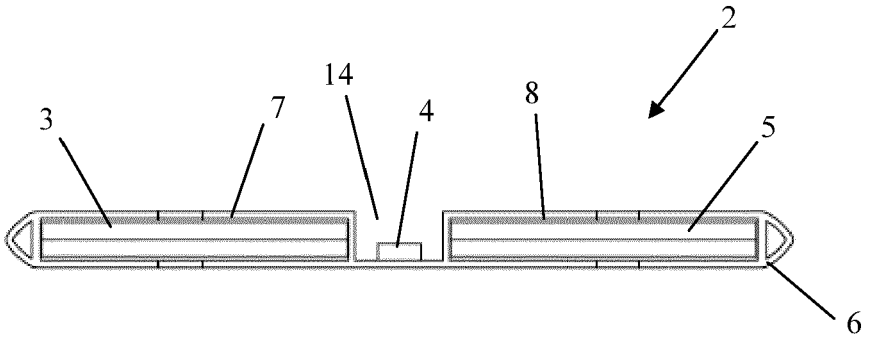

Fig. 2

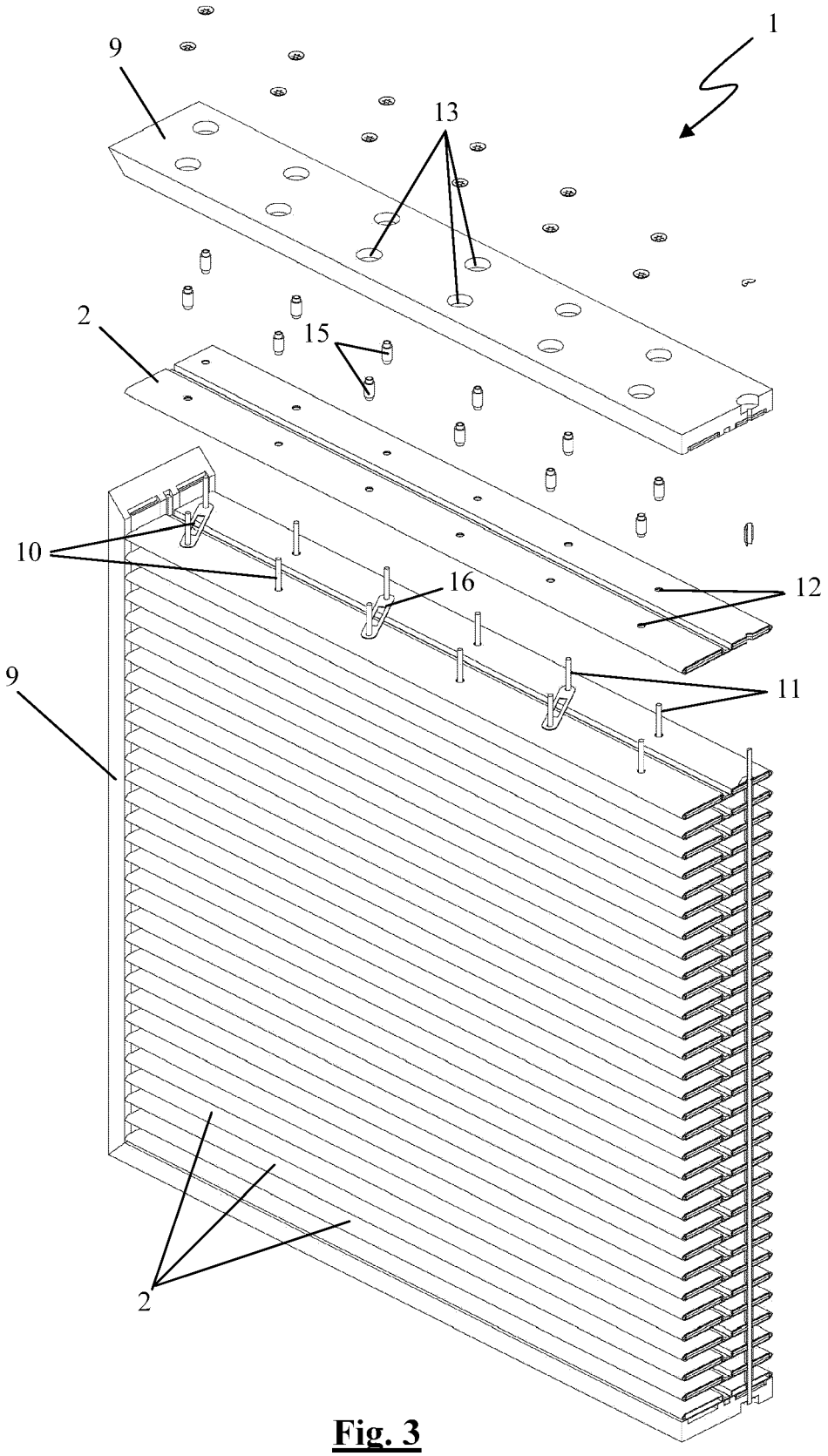

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 4665

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	US 2014/273799 A1 (ERB BLAKE NORMAN [US] ET AL) 18 September 2014 (2014-09-18) * paragraph [0041] - paragraph [0045] * * figures *	1-18	INV. F24F13/08 A62C2/06 F24F11/00
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A	US 2007/277458 A1 (GRABOYES STEVEN M [US]) 6 December 2007 (2007-12-06) * paragraph [0008] * * paragraph [0010] - paragraph [0019] * * figures *	1	
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A	GB 2 475 258 A (COXON CHRISTOPHER JOHN [GB]) 18 May 2011 (2011-05-18) * abstract; figures *	1	TECHNICAL FIELDS SEARCHED (IPC) F24F A62C E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 April 2017	Mattias Grenbäck

CATEGORY OF CITED DOCUMENTS

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