(19) Europäisches Patentamt
European Patent Office
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(11) **EP 3 312 521 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.04.2018 Bulletin 2018/17

(51) Int Cl.:
F24F 13/14 *(2006.01)* ***F24F 11/75*** *(2018.01)*
F24F 11/74 *(2018.01)*

(21) Application number: **17196600.5**

(22) Date of filing: **16.10.2017**

(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 MD

(30) Priority: **20.10.2016 BE 201605786**

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(54) **VENTILATION DEVICE**

(57) The present invention relates to a ventilation device (1), comprising an air flow passage (2) and a self-regulating valve (5) which is arranged in the air flow passage (2) so as to be tiltable and comprises a control limb (7) and a return limb (8) which are arranged on either side of the tilting point (6) at an angle with respect to each other and which are impingeable by the air flow in such a way that, at negative pressure at the outlet (4) with respect to the inlet (3) at increasing pressure difference between the inlet (3) and the outlet (4), said self-regulating valve (5) moves in a first direction of rotation (R) in order to restrict the air flow opening by means of the control limb (7) and, at positive pressure at the outlet (4) with respect to the inlet (3) at increasing pressure difference, moves in a second direction of rotation (S) in order to restrict the air flow opening by means of the return limb (8).

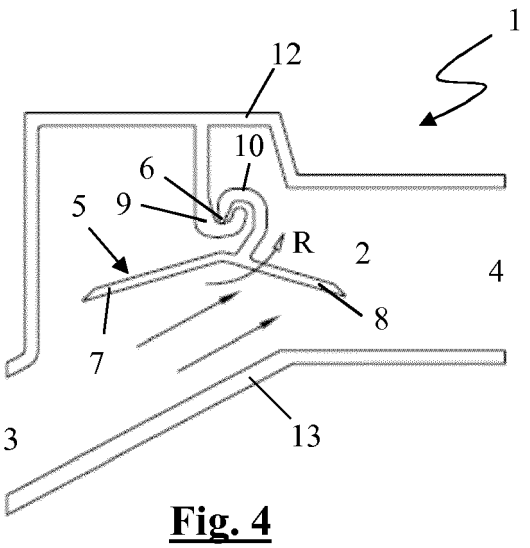

Fig. 4

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Description

[0001] The present invention relates to a ventilation device comprising an air flow passage for allowing air to flow through said air flow passage from an inlet to an outlet and a self-regulating valve which is arranged in the air flow passage so as to be tiltable about a tilting point in order to regulate an air flow opening in the air flow passage, in such a way that, at negative pressure at the outlet with respect to the inlet at an increasing pressure difference between the inlet and the outlet, said self-regulating valve moves in a first direction of rotation in order to restrict the air flow opening and, at positive pressure at the outlet with respect to the inlet at an increasing pressure difference, moves in a second direction of rotation, opposite to the first direction of rotation, in order to restrict the air flow opening.

[0002] In addition, the present invention relates to a method for converting an existing ventilation device to a ventilation device according to the present invention.

[0003] The pressure differences across building components, including ventilation facilities, are continuously subject to changes due to variations in temperatures, wind speeds and directions, as well as the use of the building (opening doors and windows, use of ventilation devices). With conventional ventilation devices, this results in a continuous change in the air flow rate. An increasing number of ventilation devices are provided with an automatic adjustment of the air flow opening (cross section of the passage) and consequently also of the air flow rate, based on the pressure difference across the ventilation grille (the ventilation device). Such ventilation devices are known, inter alia, from NL 1 025 600 C2, EP 0 606 945 A1, NL 1 014 499 C, EP 2 051 020 A1, EP 0 362 913 A1, EP 0 503 722 A1, NL 9 102 132 A, DE 35 28 527 A1 etc. and are usually described as being self-regulating.

[0004] In order to regulate them, such self-regulating ventilation grilles may be provided with a self-regulating valve which automatically changes the cross section of the passage or the air flow opening of a ventilation device when the pressure difference across the ventilation device changes. The present invention relates to such ventilation devices which operate without an actuator or motor (with an autonomous self-regulating valve).

[0005] Such ventilation devices are typically provided for supplying outdoor air to an interior space of a building. In this case, it is usually undesirable for hotter indoor air from the interior space of the building to flow outside via this ventilation device. DE 35 28 527 A1 describes such a ventilation device with a self-regulating valve which restricts the air flow opening at positive pressure at the outlet with respect to the inlet at increasing pressure difference across the valve and, at a certain pressure difference, even closes it off completely, thus preventing air from flowing through the ventilation grille in the opposite direction. However, during normal operation, this self-regulating valve to too great an extent prevents the supply of air through this ventilation device, so that such a ventilation device cannot be designed to be compact.

[0006] It is an object of the present invention to provide such a ventilation device, in which the valve has said self-regulating function at a negative pressure and also restricts the air flow at a positive pressure at the outlet with respect to the inlet at increasing pressure difference, in which said valve hinders the supply of air through the air flow opening at normal operation to a minimal extent, so that the ventilation device can be designed to be more compact.

[0007] This object of the invention is achieved by providing a ventilation device comprising an air flow passage for allowing air to flow through said air flow passage from an inlet to an outlet and a self-regulating valve which is arranged in the air flow passage so as to be tiltable about a tilting point in order to regulate an air flow opening in the air flow passage, in such a way that, at negative pressure at the outlet with respect to the inlet at an increasing pressure difference between the inlet and the outlet, said self-regulating valve moves in a first direction of rotation in order to restrict the air flow opening and, at positive pressure at the outlet with respect to the inlet at an increasing pressure difference, moves in a second direction of rotation, opposite to the first direction of rotation, in order to restrict the air flow opening, in which the self-regulating valve comprises a control limb which, viewed from the inlet to the outlet, is arranged upstream of the tilting point and comprises a return limb which, viewed from the inlet to the outlet, is substantially arranged downstream of the tilting point, at an angle with respect to the control limb, in which the control limb and the return limb are impingeable by the air flow, in such a way that the air flow opening is automatically adjusted by means of the control limb, on account of the air flow at negative pressure at the outlet with respect to the inlet at increasing pressure difference, and the air flow opening is automatically adjusted by means of the return limb at positive pressure at the outlet with respect to the inlet at increasing pressure difference.

[0008] By providing a separate limb for the self-regulating function and for the return function, i.e. a control limb and a return limb, respectively, and to arrange this control limb and this return limb in the specific arrangement according to the invention, the self-regulating valve hinders the air flow only to a minimal extent during normal operation and this self-regulating valve moves much more evenly. In this case, the expression "arranged at an angle with respect to each other" should be interpreted broadly, in the sense that these limbs are not arranged completely in line with each other. The limbs themselves may in this case have all kinds of shapes and may also be arranged partially in line with each other, if desired. Preferably, however, these limbs are also at an angle with respect to each other in a narrower sense.

The term "impingeable" indicates that the air flow can act on the respective limb, in such a way that a movement of the self-regulating valve is initiated thereby.

[0009] In a preferred embodiment, the self-regulating valve is arranged in the air flow passage in such a way that, at negative pressure at the outlet with respect to the inlet at increasing pressure difference, the forces acting on the return limb will initially outweigh any forces which may act on the control limb and eventually the forces acting on the control limb outweigh any forces which may act on the return limb.

More specifically, the valve may in this case be arranged in such a way that, at negative pressure at the outlet with respect to the inlet at increasing pressure difference, an air flow initially flows onto the return limb, then onto both the control limb and the return limb and subsequently only flows onto the control limb.

[0010] In order to be able to limit hotter indoor air from being able to flow outside to a maximum degree, the self-regulating valve is preferably arranged in the air flow passage in such a way that, at positive pressure at the outlet with respect to the inlet at a certain pressure difference, the air flow opening is closed off by means of the return limb.

[0011] Preferably, the control limb and the return limb are the only limbs of the self-regulating valve of a ventilation device according to the present invention which are impingeable by the air flow.

[0012] In a preferred embodiment, the control limb and the return limb are configured in such a way that the rotary movement in the first direction of rotation at increasing pressure difference is slower than the rotary movement in the second direction of rotation at increasing pressure difference.

[0013] Furthermore preferably, the self-regulating valve is configured such that, when there is no pressure difference between the inlet and the outlet, the return limb partially closes off the through-flow opening.

[0014] In a particularly preferred embodiment, the self-regulating valve is placed on one or more supporting bodies in order to arrange it in the air flow passage. Typically, placing the valve on a supporting body in this way results in a line contact between the valve and this supporting body which forms said tilting point. During tilting of the valve, this line contact may move, in which case said tilting point will also move.

[0015] In a specific embodiment of a ventilation device according to the present invention, the self-regulating valve comprises a hook element, and the ventilation device comprises a corresponding hook element which is arranged in the air flow passage, onto which the hook element of the self-regulating valve is hooked in order to arrange the self-regulating valve in the air flow passage.

[0016] If the self-regulating valve is supported on a supporting body in such an embodiment, then this supporting body is configured as said hook element.

[0017] In a particular embodiment of a ventilation device according to the present invention, the tilting point is arranged at the top of the air flow passage, so that the self-regulating valve is arranged substantially at the top of the air flow passage.

[0018] Preferably, the self-regulating valve of a ventilation device according to the present invention is arranged closer to the inlet of the air flow passage than to the outlet.

[0019] The control limb of a ventilation device according to the present invention preferably extends substantially between the tilting point and the inlet. The return limb preferably extends between the tilting point and the outlet.

[0020] In addition, the object of the present invention is also achieved by providing a method for converting a ventilation device, comprising an air flow passage for allowing air to flow through said air flow passage from an inlet to an outlet, in which a self-regulating valve is arranged in the air flow passage in such a way that an above-described embodiment of a ventilation device according to the present invention is obtained.

[0021] More specifically, this method may be provided for converting a ventilation device comprising a self-regulating valve which is arranged in the air flow passage so as to be tiltable about a tilting point to regulate an air flow opening in the air flow passage, in which the fitted self-regulating valve is then preferably replaced by a self-regulating valve by means of which an above-described embodiment of a ventilation device according to the present invention is obtained.

[0022] The present invention will now be explained in more detail by means of the following detailed description of a preferred ventilation device according to the present invention. The sole aim of this description is to give illustrative examples and to indicate further advantages and details of the present invention, and can thus not be interpreted as a limitation of the area of application of the invention or of the patent rights defined in the claims.

[0023] In this detailed description, reference numerals are used to refer to the attached drawings, in which

- Fig. 1 diagrammatically shows a cross section of a prior-art ventilation device;
- Fig. 2 diagrammatically shows a cross section of the ventilation device from Fig. 1 at negative pressure at the outlet with respect to the inlet;
- Fig. 3 diagrammatically shows a cross section of the ventilation device from Fig. 1 at a decreasing pressure difference with respect to Fig. 2;
- Fig. 4 diagrammatically shows a cross section of a ventilation device according to the invention;
- Fig. 5 diagrammatically shows a cross section of the ventilation device from Fig. 4 at negative pressure at the outlet with respect to the inlet;
- Fig. 6 diagrammatically shows a cross section of the ventilation device from Fig. 4 at increasing pressure difference with respect to Fig. 5;
- Fig. 7 diagrammatically shows a cross section of the ventilation device from Fig. 4 at decreasing pressure difference with respect to Fig. 6;
- Fig. 8 diagrammatically shows a cross section of the ventilation device from Fig. 4 at positive pressure at

the outlet with respect to the inlet;

- Fig. 9 diagrammatically shows a cross section of the ventilation device from Fig. 1 at increasing pressure difference with respect to Fig. 8.

[0024] The illustrated ventilation devices (1) are typically ventilation grilles (1) which are intended to be incorporated or installed at the top of a window in order to make air flow through a wall in which this window is incorporated possible.

[0025] These ventilation devices (1) comprise several part profiled sections which are assembled to form, on the one hand, a top profiled section (12) and, on the other hand, a bottom profiled section (13). The various part profiled sections may be made, for example, from plastic or aluminium, for example by means of extrusion. Together with head plates which are attached to the ends of these profiled sections (12, 13), these profiled sections (12, 13) form an elongated, substantially beam-shaped housing for the ventilation grilles (1).

[0026] An air flow passage (2) extends between the top profiled section (12) and the bottom profiled section (13) through which air from an inlet (3), which is typically arranged in an exterior space, can flow to an outlet (4), which is typically arranged in an interior space. By means of the ventilation device (1), it is then possible to pass fresh air from the exterior space to the interior space.

[0027] A self-regulating valve (5) is suspended in the air flow passage (2) so as to be tiltable about a tilting point (6). To this end, a hook-shaped profiled-section part (9) is provided in the top profiled section (12) in the illustrated ventilation devices (1). The self-regulating valve (5) is in turn provided with a hook-shaped part (10) by means of which this valve (5) is hooked onto the top profiled section (12) via the hook-shaped profiled-section part (9) in order to suspend this valve (5) in the air flow passage (2).

The self-regulating valve (5) may, for example, be made of plastic by means of extrusion.

[0028] The self-regulating valve (5) of the ventilation device (1) according to the invention comprises a control limb (7) which extends substantially on a first side of the tilting point (6) and a return limb (8) which extends substantially on a second side of the tilting point (6), viewed in the direction of air flow. This control limb (7) and this return limb (8) are substantially arranged according to the direction of air flow and are both impingeable.

With the prior-art ventilation device (1), the counterweight (11) of the self-regulating valve (5) does not extend substantially according to the direction of air flow and is not impingeable, as the air flow cannot act thereon in such a manner here that this would initiate a movement of the self-regulating valve (5).

[0029] Below, we will explain the difference in operation of both illustrated self-regulating valves (5). If there is a negative pressure at the outlet (4) with respect to the inlet (3), as is illustrated in Figs. 2 and 5, this will cause an air flow through the air flow passage (2). This air flow causes the self-regulating valve (5) to move according to a first direction of rotation (R). With both self-regulating valves (5), the air flow opening is gradually restricted by this tilting movement, so that the air flow is automatically adjusted at increasing pressure difference, depending on the pressure difference. With the illustrated self-regulating valve (5) according to the invention, the air flow in this case initially only has an impact on the inner part of the self-regulating valve (5), in which case the air flow flows only onto the return limb (8), as can be seen in Fig. 4. Only after a specific angular displacement does the air flow also have an impact on the outer part of the self-regulating valve (5), in which case the air flow also flows onto the control limb (7), as can be seen in Fig. 5. Subsequently, the impact on the inner part of the self-regulating valve (5) gradually diminishes and the air flow only flows onto the control limb (7), as can be seen in Fig. 6. In this way, the movement of the self-regulating valve (5) is more even compared to the existing self-regulating valve (5).

[0030] When the air flow is reversed and there is positive pressure at the outlet (4) with respect to the inlet (3), then the air flow causes the self-regulating valve (5) to move in the opposite direction of rotation (S).

The prior-art self-regulating valve (5) in this case returns to its starting position, as can be seen in Fig. 3.

The self-regulating valve (5) according to the invention initially also returns to its starting position (Fig. 4), following which the air flow has a great impact on the outer part of the valve (5), with air flow only flowing onto the return limb (8), as can be seen in Fig. 8, until this return limb (8) closes off the air flow opening, as can be seen in Fig. 9, and air discharge via the ventilation grille (1) is prevented.

[0031] The self-regulating valve (5) according to the invention has the additional advantage that so-called flapping of this valve (5), i.e. caused by the valve (5) hitting against the top profiled section (12), is prevented. When there is negative pressure at the outlet (4) with respect to the inlet (3) and the valve (5) has substantially closed off the through-flow opening, then the valve (5) will want to tilt back when the pressure difference decreases. The prior-art valve (5) tilts so quickly in this case that it will start to flap. With the valve (5) according to the invention, after only a slight rotation, the inner part of the valve (5) is again subjected to the impact of the rest of the air flow through the air flow passage (2), as can be seen in Fig. 7, as a result of which the movement of the valve (5) is slowed down and the risk of flapping is significantly reduced.

Claims

1. Ventilation device (1) comprising an air flow passage (2) for allowing air to flow through said air flow passage (2) from an inlet (3) to an outlet (4) and a self-regulating valve (5) which is arranged in the air flow

passage (2) so as to be tiltable about a tilting point (6) in order to regulate an air flow opening in the air flow passage (2), in such a way that, at negative pressure at the outlet (4) with respect to the inlet (3) at an increasing pressure difference between the inlet (3) and the outlet (4), said self-regulating valve (5) moves in a first direction of rotation (R) in order to restrict the air flow opening and, at positive pressure at the outlet (4) with respect to the inlet (3) at an increasing pressure difference, moves in a second direction of rotation (S), opposite to the first direction of rotation (R), in order to restrict the air flow opening, **characterized in that** the self-regulating valve (5) comprises a control limb (7) which, viewed from the inlet (3) to the outlet (4), is substantially arranged upstream of the tilting point (6) and comprises a return limb (8) which, viewed from the inlet (3) to the outlet (4), is substantially arranged downstream of the tilting point (6), at an angle with respect to the control limb (7), in which the control limb (7) and the return limb (8) are impingeable by the air flow, in such a way that the air flow opening is automatically adjusted by means of the control limb (7), on account of the air flow at negative pressure at the outlet (4) with respect to the inlet (3) at increasing pressure difference, and the air flow opening is automatically adjusted by means of the return limb (8) at positive pressure at the outlet (4) with respect to the inlet (3) at increasing pressure difference.

2. Ventilation device (1) according to Claim 1, **characterized in that** the self-regulating valve (5) is arranged in the air flow passage (2) in such a way that, at negative pressure at the outlet (4) with respect to the inlet (3) at increasing pressure difference, the forces acting on the return limb (8) will initially outweigh any forces which may act on the control limb (7) and eventually the forces acting on the control limb (7) outweigh any forces which may act on the return limb (8).

3. Ventilation device (1) according to Claim 2, **characterized in that** the self-regulating valve (5) is arranged in the air flow passage (2) in such a way that, at negative pressure at the outlet (4) with respect to the inlet (3) at increasing pressure difference, an air flow initially flows only onto the return limb (8), then onto both the control limb (7) and the return limb (8) and subsequently only flows onto the control limb (7).

4. Ventilation device (1) according to any of the preceding claims, **characterized in that** the self-regulating valve (5) is arranged in the air flow passage (2) in such a way that, at positive pressure at the outlet (4) with respect to the inlet (3) at a certain pressure difference, the air flow opening is closed off by means of the return limb (8).

5. Ventilation device (1) according to any of the preceding claims, **characterized in that** the control limb (7) and the return limb (8) are the only limbs (7, 8) of the self-regulating valve (5) which are impingeable by the air flow.

6. Ventilation device (1) according to any of the preceding claims, **characterized in that** the control limb (7) and the return limb (8) are configured in such a way that the rotary movement in the first direction of rotation (R) at increasing pressure difference is slower than the rotary movement in the second direction of rotation (S) at increasing pressure difference.

7. Ventilation device (1) according to any of the preceding claims, **characterized in that** the self-regulating valve (5) is configured such that, when there is no pressure difference between the inlet (3) and the outlet (4), the return limb (8) partially closes off the through-flow opening.

8. Ventilation device (1) according to any of the preceding claims, **characterized in that** the self-regulating valve (5) is placed on one or more supporting bodies (9) in order to arrange it in the air flow passage (2).

9. Ventilation device (1) according to any of the preceding claims, **characterized in that** the self-regulating valve (5) comprises a hook element (10), and **in that** the ventilation device (1) comprises a corresponding hook element (9) which is arranged in the air flow passage (2), onto which the hook element (10) of the self-regulating valve (5) is hooked in order to arrange the self-regulating valve (5) in the air flow passage (2).

10. Ventilation device (1) according to Claims 8 and 9, **characterized in that** the hook element (9) of the ventilation device (1) which is arranged in the air flow passage (2) serves as said supporting body (9).

11. Ventilation device (1) according to any of the preceding claims, **characterized in that** the tilting point (6) is arranged at the top of the air flow passage (2), so that the self-regulating valve (5) is arranged substantially at the top of the air flow passage (2).

12. Ventilation device (1) according to any of the preceding claims, **characterized in that** the self-regulating valve (5) is arranged closer to the inlet (3) of the air flow passage (2) than to the outlet (4).

13. Ventilation device (1) according to any of the preceding claims, **characterized in that** the control limb (7) extends substantially between the tilting point (6) and the inlet (3).

14. Ventilation device (1) according to any of the preceding claims, **characterized in that** the return limb (8) extends substantially between the tilting point (6) and the outlet (4).

15. Method for converting a ventilation device (1), comprising an air flow passage (2) for allowing air to flow through said air flow passage (2) from an inlet (3) to an outlet (4), **characterized in that** a self-regulating valve (5) is arranged in the air flow passage (2) in such a way that a ventilation device (1) according to any of the preceding claims is obtained.

16. Method according to Claim 15 for converting a ventilation device (1), comprising a self-regulating valve (5) which is arranged in the air flow passage (2) so as to be tiltable about a tilting point (6) to regulate an air flow opening in the air flow passage (2), **characterized in that** the fitted self-regulating valve (5) is replaced by a self-regulating valve (5) by means of which a ventilation device (1) according to any of the preceding claims is obtained.

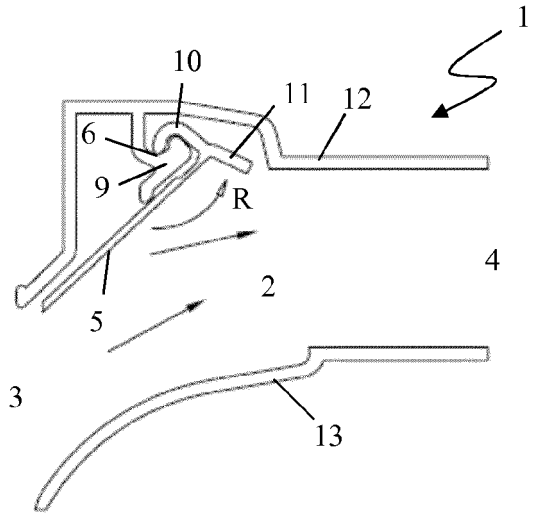

Fig. 1 PRIOR ART

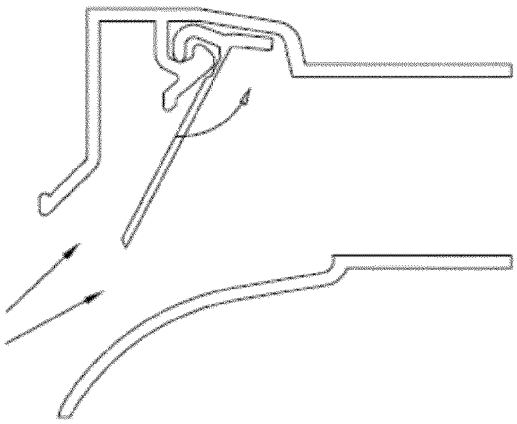

Fig. 2 PRIOR ART

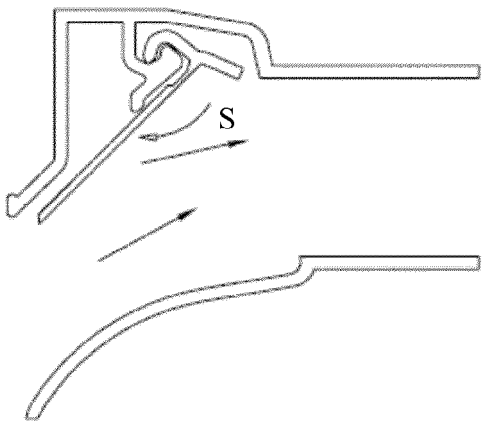

Fig. 3 PRIOR ART

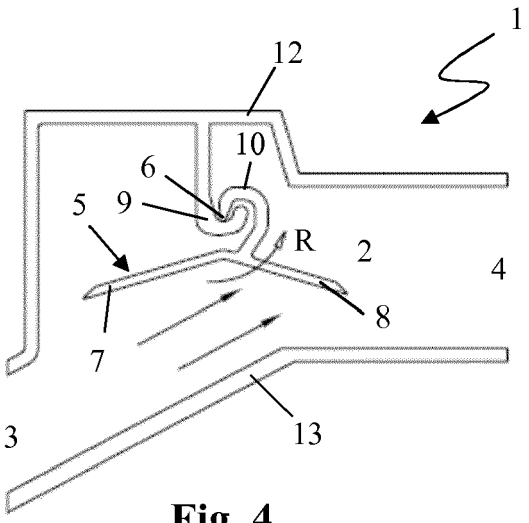

Fig. 4

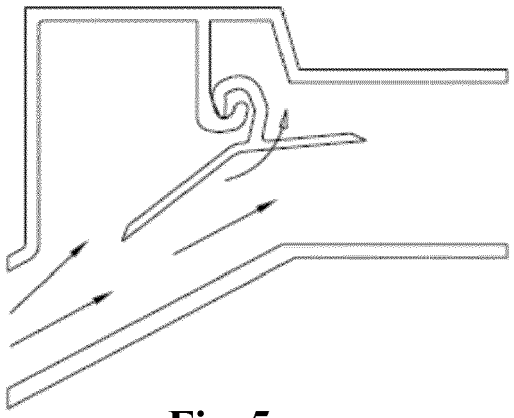

Fig. 5

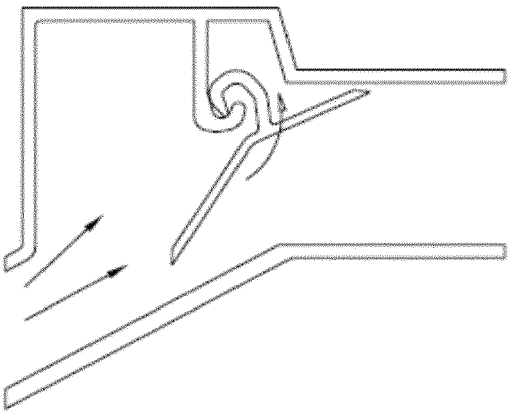

Fig. 6

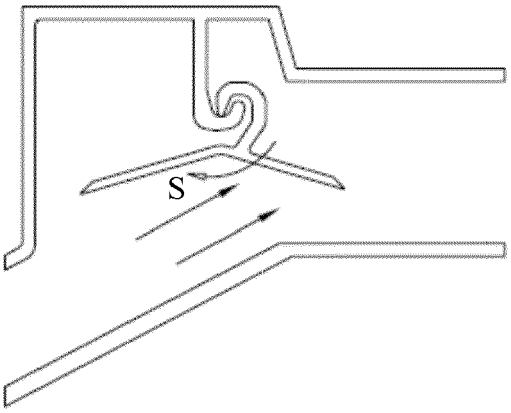

Fig. 7

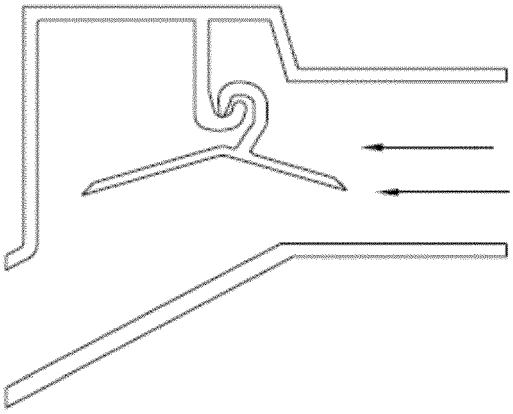

Fig. 8

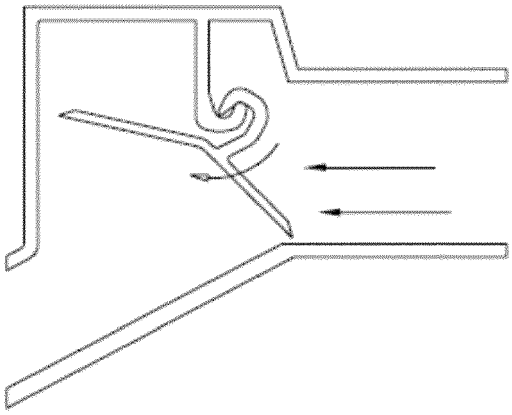

Fig. 9

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 6600

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	EP 2 051 020 A1 (DEMCONSTRUCT SARL [TN]) 22 April 2009 (2009-04-22) * the whole document *	1-16	INV. F24F13/14 F24F11/75 F24F11/74
X	NL 9 102 132 A (HEYCOP BEHEER BV) 16 July 1992 (1992-07-16) * page 3, line 13 - page 5, line 29 * * figures *	1,15	
X	WO 2006/088352 A1 (ALUSTA NATUURLIJKE VENTILATIET [NL]; MEESTER ANDREAS WILHELMUS JOZE [N]) 24 August 2006 (2006-08-24) * page 5, line 22 - page 8, line 9 * * figures *	1,15	
X	NL 1 017 867 C2 (HEYCOP SYSTEMEN B V [NL]) 21 October 2002 (2002-10-21) * page 3, line 30 - page 6, line 24 * * figures *	1,15	
A	BE 1 020 748 A3 (RENSON VENTILATION NV [BE]) 1 April 2014 (2014-04-01) * abstract; figures *	1	TECHNICAL FIELDS SEARCHED (IPC) F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 March 2018	Mattias Grenbäck

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 19 6600

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08-03-2018

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