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(54) ROOF WINDOW WITH VENTILATION ARRANGEMENT

(57) A roof window (1) is disclosed for being installed in a sloping roof structure of a building (16), the roof window (1) comprising a fixation frame (2) defining a fixation frame opening (7) and a division bar (8) dividing the fixation frame (2) opening (7) into two openings (9, 10), an insulating glass unit (11) covering a first (9) opening, and a wing (13), which is hinged to the fixation frame (2), which wing (13) in a closed position thereof covers at least a part of a second (10) opening, wherein the roof window (1) comprises ventilation air ducts (21), which provide ventilation passage through the second opening (10) of the roof window (1) while being rain proofed to prevent rain from entering from the exterior side (E) of the roof window (1) to the interior side (I) of the roof window (1) when the roof window (1) is installed in a roof structure of a building (16), the area of the ventilation passage covering at least 20% of the area of the second opening (10), such as at least 35% of the area of the second opening (10).

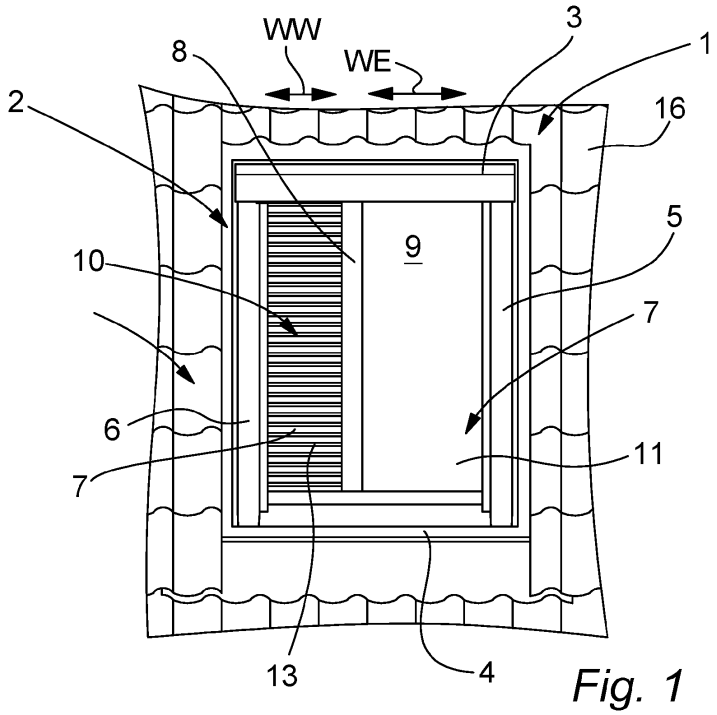

Fig. 1

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Description

[0001] The present invention relates to a roof window with an arrangement for enabling ventilation of the interior of the building in which the roof window is installed.

Background

[0002] Roof windows or skylights are windows intended for mounting in a sloping roof structure of a building, where the glass of the window when installed and in a closed position of the window, extends at the angle of the sloping roof, i.e. at an angle to horizontal, typically an angle between 15° and 55°, normally between 20° and 45°. Roof windows are usually installed in loft conversions within easy reach by the habitant and can readily be opened. Most roof windows are hinged to the fixation frame, which is fixed with respect to the roof structure, about a vertical pivot axis arranged at the top or at the centre of the window. Due to the sloping of the window, it is more susceptible to intrusion of rainwater in the open position than a facade window extending at a 90° angle to horizontal.

[0003] For this reason, the roof window should not be left open unattended. However, ventilation of the interior of the building by air exchange between the interior and the exterior of the building through the roof window is desirable. To solve this problem, patent applications EP 2 762 670 A1 and EP 2 698 485 A1 disclose the arrangement of ventilation openings in the fixed frame of roof window.

[0004] It is an object of the present invention to improve the ventilation function of such roof windows. It is yet an objective to provide such roof windows with lower manufacturing costs.

Brief description of the invention

[0005] The present invention relates to a roof window for being installed in a sloping roof structure of a building, the roof window comprising a fixation frame comprising a top bar, a bottom bar and two side bars, together defining a fixation frame opening and a division bar dividing the fixation frame opening into two openings, the roof window further comprising an insulating glass unit covering a first of the two openings, and a wing, which is hinged to the fixation frame, which wing in a closed position thereof covers at least a part of a second of the two openings, wherein the roof window comprises ventilation air ducts, which provide ventilation passage through the second opening of the roof window while being rain proofed to prevent rain from entering from the exterior side of the roof window to the interior side of the roof window when the roof window is installed in a roof structure of a building, the opening area of the ventilation passage preferably covering at least 20% of the area of the second opening, such as at least 35% of the area of the second opening.

[0006] The ventilation air ducts may be situated in the hinged wing and/or in a separate cover for a part of the second opening, which cover may be hinged to the fixation frame or be fixedly installed in the fixation frame. Ventilation air ducts in the wing and/or in a hinged cover provide said ventilation passage when the wing and/or hinged cover is in a closed position.

[0007] By arranging the ventilation air ducts in the roof window within the fixation frame and outside of the insulating glass unit and providing the roof window with a wing that can be moved between a closed position and an open position, where at least a part of the second opening is open between the interior and the exterior, the ventilation area of the roof window may be shifted between two states with different levels of ventilation of air between the interior and the exterior while a permanent minimum level of ventilation is ensured.

[0008] The fixation frame is preferably of a rectangular shape, where the top bar and bottom bar being mutually parallel and the side bars being mutually parallel.

[0009] The rain proofing may be achieved by providing ventilation openings through the wing or through a possible cover, so that the exterior side opening of each ventilation opening is at a lower level that the interior side opening when the roof window is installed in a roof structure of a building.

[0010] The wing preferably comprises a system for allowing a partial or complete closing off of the ventilation air passage through the ventilation air ducts.

[0011] The ventilation air ducts are preferably provided with insect screens and/or filters for removing particles from the ventilation air entering the interior, such as pollution particles and/or pollen.

[0012] The insulating glass unit is preferably fixedly installed to the fixation frame and is not hinged to the fixation frame. Hereby, a lighter roof window may be obtained, which is less costly to manufacture and may allow for a larger area of the insulating glass unit and thereby an enhanced influx of daylight due to the lack of need of a sash frame for the insulating glass unit for hinged connection to the fixation frame, due to the possibility of cleaning the exterior surface of the insulating glass unit from the interior of the roof window through the opening created when the wing is in the open position thereof.

[0013] It is particularly preferred that the second opening is of a width perpendicularly to the longitudinal extend of the division bar sufficient for a human arm to extend through the second opening when the wing is in an open position thereof, such as a width of at least 10 cm, preferably a width of at least 15 cm, in particularly of a width within the range of 10 to 30 cm, such as within a range of 15 to 25 cm, whereby the cleaning of the exterior surface of the insulating glass unit is made easier accessible.

[0014] In particular, the extent of the insulating glass unit in a direction perpendicular to a longitudinal extend of the division bar is within the range of 35 to 80 cm, such as

within the range of 45 to 65 cm so as to provide for easier cleaning of the exterior of the insulating glass unit by access from the interior through the opening provided by the wing in an open position thereof.

[0015] The division bar extends preferably substantially parallel to the side bars.

[0016] The wing comprises preferably cladding covers extending parallel to the division bar, the cladding covers covering the slit between edges of the wing and the division bar and the side bar, respectively. The cladding covers are provided to direct rainwater to flashing of the roof window or to the exterior surface of the insulating glass unit.

[0017] The wing extends preferably parallel to the division bar at least 50% of the distance that the insulating glass unit extends parallel to the division bar, preferably at least 75% thereof, such as the full extent of the insulating glass unit.

[0018] The division bar preferably extends between two parallel opposing bars of the fixation frame and connects said opposing bars. In particular, the division bar extends preferably between the set of parallel opposing bars of the fixation frame of the largest mutual distance.

[0019] In a preferred embodiment of the roof window, the insulating glass unit and the wing in a closed position thereof extends in substantially parallel planes.

[0020] The wing is in a preferred embodiment hinged to the bar of the fixation frame that delimits the second opening and extends parallel to the division bar, whereby the wing is movable relatively to the fixation frame about an axis extending substantially parallel to the division bar. In an alternative embodiment, the wing is centrally hinged to the division bar and to the bar of the fixation frame that delimits the second opening, preferably around a hinge axis extending parallel to the longitudinal extent of the top bar and/or the bottom bar.

[0021] In a preferred embodiment, the wing in a closed position thereof completely covers the second opening.

[0022] It is preferred that at least each of the side bars of the fixation frame comprises a protrusion extending in a longitudinal direction of the side bar for accommodating a sheet material, such as plasterboards, for lining of a window reveal of the building, and preferably each of the top bar and the bottom bar of the fixation frame furthermore comprises a protrusion extending in a longitudinal direction of the bar for accommodating a sheet material for lining of the window reveal. Hereby, the lining of the roof window reveal is installed is made easier.

[0023] In a particular embodiment of the roof window, the fixation frame comprises two subframes, each subframe comprising a subframe top bar, a subframe bottom bar, a subframe first side bar and a subframe second side bar, wherein a first of said subframes define the first opening and a second of said subframes define the second opening. Thereby, the installation of the roof window may become easier as the two subframes may be installed separately. Also, a subframe having a wing may be connected to subframes having an insulating glass unit of different width and thereby providing a larger flexibility as to sizes of roof windows of this type offered for sale. In particular, this embodiment of the roof window is arranged so that the first subframe side bar of a first subframe is arranged parallel to and abutting the subframe second side bar of a second subframe, said subframe first side bar and said subframe second side bar together forming the division bar,

wherein the top bar comprises the subframe top bar of the first subframe and the subframe top bar of the first subframe arranged consecutively,

wherein the bottom bar comprises the subframe bottom bar of the first subframe and the subframe bottom bar of the first subframe arranged consecutively, and

wherein the first side bar comprises the subframe first side bar of the second subframe and the second side bar comprises the subframe second side bar of the second sub frame.

[0024] The invention also relates to the roof window as disclosed herein and installed in a roof structure of a building, such as a sloping roof structure of a building, wherein the lining of the window reveal and the inner wall surface of the building leaves the whole of the wing exposed to the interior of the building.

[0025] The invention furthermore relates to a roof window as disclosed herein and installed in a roof structure of a building, such as a sloping roof structure of a building, wherein each of the ventilation air ducts has an exterior opening to the exterior side of the roof window and an interior opening to the interior side of the roof window, and wherein the exterior opening of each of the ventilation air ducts are situated at a position below the interior opening of the same ventilation air duct. The vertical distance between the exterior openings of the ventilation air ducts and the corresponding interior opening of the same ventilation air duct is preferably at least 3 cm, such as at least 5 cm, preferably in the range of 3 to 10 cm, such as in the range of 5 to 8 cm to overcome the possible action of wind blowing the rain from the exterior opening towards the interior opening.

[0026] The roof structure of the building may have a roof pitch angle larger than 8° such as larger than 15° and smaller 55°, i.e. the angle to horizontal, typically and preferably an angle between 20° and 45°.

Brief description of figures

[0027] Some embodiments of the present disclosure are illustrated in the enclosed drawing, of which

Fig. 1 is a view from the exterior of a roof window according to the present disclosure installed in a sloping roof structure,

Fig. 2 is a cross-section of a roof window according to

one embodiment, in which the wing is closed,

Fig. 3 is a cross-section of the roof window of Fig. 2, in which the wing is in a partly open state,

Fig. 4 is a longitudinal section of the wing of the roof window of Figs. 2 and 3,

Fig. 5 is a second embodiment of a roof window according to the present disclosure, installed in a sloping roof structure,

Fig. 6 is view from the interior of a building wherein the roof window of Fig. 5 is installed in a roof structure of the building, and

Fig. 7 is an embodiment of a frame of a roof window according to the present disclosure.

Detailed description

[0028] Embodiments of the present disclosure of a roof window 1 are shown in the drawing. The roof window 1 comprises a fixation frame 2 having a top bar 3, a bottom bar 4 and two side bars 5, 6 forming a fixation frame opening 7. The fixation frame 2 has a substantially rectangular shape as shown in Fig. 1. A division bar 8 extending between the top bar 3 and the bottom bar 4 divides the fixation frame opening 7 into a first opening 9 and a second opening 10. The first opening 9 is covered by an insulating glass unit 11, such as a double glazing or triple glazing window with a gas, such as argon, between the glazing, or a vacuum insulating glass (VIG) unit, which insulating glass unit 11 preferably is fixedly arranged in the fixation frame 2, i.e. so that the insulating glass unit 11 is not hinged to the fixation frame 2 and cannot be moved between an open and a closed position. The second opening 10 is covered by a wing 13 that is mounted in a wing sash 24 that is hinged to the second side bar 6 of the fixation frame 2 so that an opening is formed between the wing 13 and the division bar 8 when the wing 13 is in an open position as shown in Fig. 4. The second opening 10 is of a width WW between the division bar 8 and the second side bar 6 sufficient for a human arm to extend through the second opening 10 for cleaning of the external surface of the insulating glass unit 11 from the inside of the building 16. Thus, the second opening 10 should be of a width WW of at least 10 cm, such as of at least 15 cm, e.g. in the range of 10 to 30 cm, such as in the range of 15 to 25 cm.

[0029] The wing 13 in Fig. 1 is provided with ventilation air ducts 21 connecting the interior side I of the roof window 1 with the exterior side E of the roof window 1 when the wing 13 is in its closed position. The ventilation ducts 21 are shown in the longitudinal section of the wing 13 in Fig. 4. The ventilation air ducts 21 are provided with insect screens (not shown) and may accommodate filters (not shown) to prevent dust, pollution particles and pollen to enter the interior side I of the roof window 1 whereas air may pass back and forth through the ventilation air ducts 21.

[0030] This roof window 1 with a divided fixation frame opening 7 covered by a fixedly installed insulation glass unit 11 and a movable wing 13 is less expensive to manufacture than a roof window where the insulation glass unit is arranged to be opened and closed, typically by the use of a centre hinges, because the provision of a large sash and gaskets between the sash and the frame are avoided. Furthermore, the insulation glass unit 11 may extend over a larger area as the sash is redundant which provides for an improved thermal insulation of the roof window as the insulation glass unit, in particular a vacuum insulation glass (VIG) unit provides an improved thermal insulation as compared to the sash, and the larger area of the insulation glass unit 11 further provides for improvement of daylight influx through the roof window 1.

[0031] Each of the side bars 5, 6 as well as the top bar 3 and the bottom bar 4 of the fixation frame 2 comprises a protrusion 14 extending in a longitudinal direction of the bars 3, 4, 5 6 for accommodating plasterboard 15 lining of the window reveal 20 of the building 16. The lining of the window reveal 20 made by plasterboards 15 is installed so that it leaves the whole of the wing 13 exposed to the interior of the building 16 as shown in Fig. 5. The side bars 5, 6, the top bar 3 and the bottom bar 4 are furthermore provided with a second protrusion 14' extending parallel to the first protrusion 14 so that a recess 19 is formed between the protrusions 14, 14' to accommodate the plasterboards 15 used for lining the window reveal 20.

[0032] When the roof window 1 is installed in a sloping roof structure of a building 16, the exterior openings 17 of the ventilation air ducts 21 to the exterior side E of the roof window 1 are situated at a position below the interior opening 18 of the same ventilation air duct 21 as shown in the longitudinal section shown in Fig. 4 so as to prevent incoming rain from reaching the interior opening 18. The distance D between the exterior openings 17 of the ventilation air ducts 21 and the corresponding interior opening 18 of the same ventilation air duct 13 is preferably at least 3 cm, such as in the range of 5 to 8 cm to overcome the possible action of wind blowing the rain from the exterior opening 17 towards the interior opening 18.

[0033] The embodiment of the roof window 1 shown in Figs. 5 and 6 comprises a hinged wing 13 and a fixedly installed cover 22 placed in the second opening 10, where the ventilation air ducts 21 are arranged in the cover 22 as well as in the wing 13. In alternative embodiments of the present invention, the ventilation air ducts 21 may be arranged solely in the wing 13 or solely in the cover or covers 22.

[0034] An embodiment of the fixation frame 2 of a the roof window 1 is shown in Fig. 7, wherein the roof window tow mutually combined subframes 2a, 2b, where each subframe 2a, 2b comprises a subframe top bar 3a, 3b, a subframe bottom bar 4a, 4b, a subframe first side bar 5a, 5b and a subframe second side bar 6a, 6b. The first subframe 2a define the first opening 9 for the insulating glass unit 11 and the second subframe 2b define the second opening 10 for the hinged wing 13. The sub-

frames 2a, 2b are arranged next to each other so that the division bar 8 of the fixation frame 2 is formed by the first subframe side bar 5a of the first subframe 2a and the subframe second side bar 6b of the second subframe 2b, which are arranged parallel to and abutting. The top bar 3 of the fixation frame 2 comprises the subframe top bar 3a of the first subframe 2a and the subframe top bar 3b of the first subframe 2b arranged consecutively, and the bottom bar 4 comprises the subframe bottom bar 4a of the first subframe 2a and the subframe bottom bar 4b of the first subframe 2b arranged consecutively. The first side bar 5 and the second side bar 6 of the fixation frame 2 are constituted by the subframe first side bar 5b of the second subframe 2b and the subframe second side bar 6a of the second sub frame 2b, respectively.

List of reference numerals

[0035]

1	Roof window
2	Fixation frame
2a	First subframe
2b	second subframe
3	Top bar
3a, 3b	Subframe top bar
4	Bottom bar
4a, 4b	Subframe bottom bar
5	First side bar
5a, 5b	Subframe first side bar
6	Second side bar
6a, 6b	Subframe second side bar
7	Fixation frame opening
8	Division bar
9	First opening
10	Second opening
11	Insulating glass unit
12	Hinge
13	Wing
14	Protrusion
15	Plasterboards
16	Building
17	Exterior openings of the ventilation air ducts
18	Interior openings of the ventilation air ducts
19	Recess
20	Inner window reveal lining
21	Ventilation air ducts
22	Cover
23	Cladding covers
24	Wing sash
D	Vertical distance between the exterior opening of the ventilation air ducts and the corresponding interior opening of the same ventilation air duct
I	Interior side
E	Exterior side
WE	Width of first opening
WW	Width of second opening

Claims

1. A roof window (1) for being installed in a sloping roof structure of a building (16), the roof window (1) comprising a fixation frame (2) comprising a top bar (3), a bottom bar (4), a first side bar (5) and a second side bar (6), together defining a fixation frame opening (7) and a division bar (8) dividing the fixation frame (2) opening (7) into two openings (9, 10), the roof window (1) further comprising an insulating glass unit (11) covering a first (9) of the two openings, and a wing (13), which is hinged to the fixation frame (2), which wing (13) in a closed position thereof covers at least a part of a second (10) of the two openings, wherein the roof window (1) comprises ventilation air ducts (21), which provide ventilation passage through the second opening (10) of the roof window (1) while being rain proofed to prevent rain from entering from the exterior side (E) of the roof window (1) to the interior side (I) of the roof window (1) when the roof window (1) is installed in a roof structure of a building (16), the area of the ventilation passage covering at least 20% of the area of the second opening (10), such as at least 35% of the area of the second opening (10).

2. The roof window (1) according to claim 1, wherein the insulating glass unit (11) is fixedly installed to the fixation frame (2) and is not hinged to the fixation frame (2).

3. The roof window (1) according to claim 2, wherein the second opening (10) is of a width perpendicularly to the longitudinal extend of the division bar (8) sufficient for a human arm to extend through the second opening (10) when the wing (13) is in an open position thereof, such as a width of at least 10 cm, preferably a width of at least 15 cm, in particularly of a width within the range of 10 to 30 cm, such as within a range of 15 to 25 cm.

4. The roof window (1) according to any of the preceding claims, wherein the extent of the insulating glass unit (11) in a direction perpendicular to a longitudinal extend of the division bar (8) is within the range of 35 to 80 cm, such as within the range of 45 to 65 cm.

5. The roof window (1) according to any of the preceding claims, wherein the division bar (8) extends substantially parallel to the side bars (5, 6).

6. The roof window (1) according to claim 5, wherein the wing (13) comprises cladding covers (23) extending parallel to the division bar (8), the cladding covers (23) covering the slit between edges of the wing (13) and the division bar (8) and the side bar (5, 6), respectively.

7. The roof window (1) according to any of the preceding claims, wherein the wing (13) extends parallel to the division bar (8) at least 50% of the distance that the insulating glass unit (11) extends parallel to the division bar (8), preferably at least 75% thereof.

8. The roof window (1) according to any of the preceding claims, wherein the division bar (8) extends between two parallel opposing bars (2, 3, 5, 6) of the fixation frame (2) and connects said opposing bars (2, 3, 5, 6).

9. The roof window (1) according to claim 8, wherein the division bar (8) extends between the set of parallel opposing bars (2, 3, 5, 6) of the fixation frame (2) of the largest mutual distance.

10. The roof window (1) according to any of the preceding claims, wherein the insulating glass unit (11) and the wing (13) in a closed position thereof extends in substantially parallel planes.

11. The roof window (1) according to any of the preceding claims, wherein the wing (13) is hinged to the bar of the fixation frame (2) that delimits the second opening (10) and extends parallel to the division bar (8), whereby the wing (13) is movable relatively to the fixation frame (2) about an axis extending substantially parallel to the division bar (8).

12. The roof window (1) according to any of the preceding claims, wherein the wing (13) in a closed position thereof completely covers the second opening (10).

13. The roof window (1) according to any of the preceding claims, wherein at least each of the side bars (5, 6) of the fixation frame (2) comprises a protrusion (14) extending in a longitudinal direction of the side bar (5, 6) for accommodating a sheet material (15), such as plasterboards, for lining of an inner window reveal (20) of the building (16), and preferably each of the top bar (3) and the bottom bar (4) of the fixation frame (2) furthermore comprises a protrusion (14) extending in a longitudinal direction of the bar for accommodating a sheet material (15) for lining of the inner window reveal (20) of the building (16).

14. The roof window (1) according to any of the preceding claims, wherein the fixation frame (2) comprises two subframes (2a, 2b), each subframe (2a, 2b) comprising a subframe top bar (3a, 3b), a subframe bottom bar (4a, 4b), a subframe first side bar (5a, 5b) and a subframe second side bar (6a, 6b), wherein a first of said subframes (2a) define the first opening (9) and a second of said subframes (2b) define the second opening (10).

15. The roof window according to claim 14,
wherein the first subframe side bar (5a) of a first subframe (2a) is arranged parallel to and abutting the subframe second side bar (6b) of a second subframe (2b), said subframe first side bar (5a) and said subframe second side bar (6b) together forming the division bar (8),
wherein the top bar (3) comprises the subframe top bar (3a) of the first subframe (2a) and the subframe top bar (3b) of the first subframe (2b) arranged consecutively,
wherein the bottom bar (4) comprises the subframe bottom bar (4a) of the first subframe (2a) and the subframe bottom bar (4b) of the first subframe (2b) arranged consecutively, and
wherein the first side bar (5) comprises the subframe first side bar (5b) of the second subframe (2b) and the second side bar (6) comprises the subframe second side bar (6a) of the second sub frame (2b).

16. The roof window (1) according to any of the preceding claims and installed in a roof structure of a building (16), such as a sloping roof structure of a building (16), wherein the sheet material (15) for lining of an inner wall surface of the building (16) leaves the whole of the wing (13) exposed to the interior of the building (16).

17. The roof window (1) according to any of the preceding claims and installed in a roof structure of a building (16), such as a sloping roof structure of a building (16), wherein each of the ventilation air ducts (21) has an exterior opening (17) to the exterior side (E) of the roof window (1) and an interior opening (18) to the interior side (I) of the roof window (1), and wherein the exterior opening (17) of each of the ventilation air ducts (21) are situated at a position below the interior opening (18) of the same ventilation air duct (21) with a vertical distance (D) of at least 3 cm, such as in the range of 3 to 10 cm.

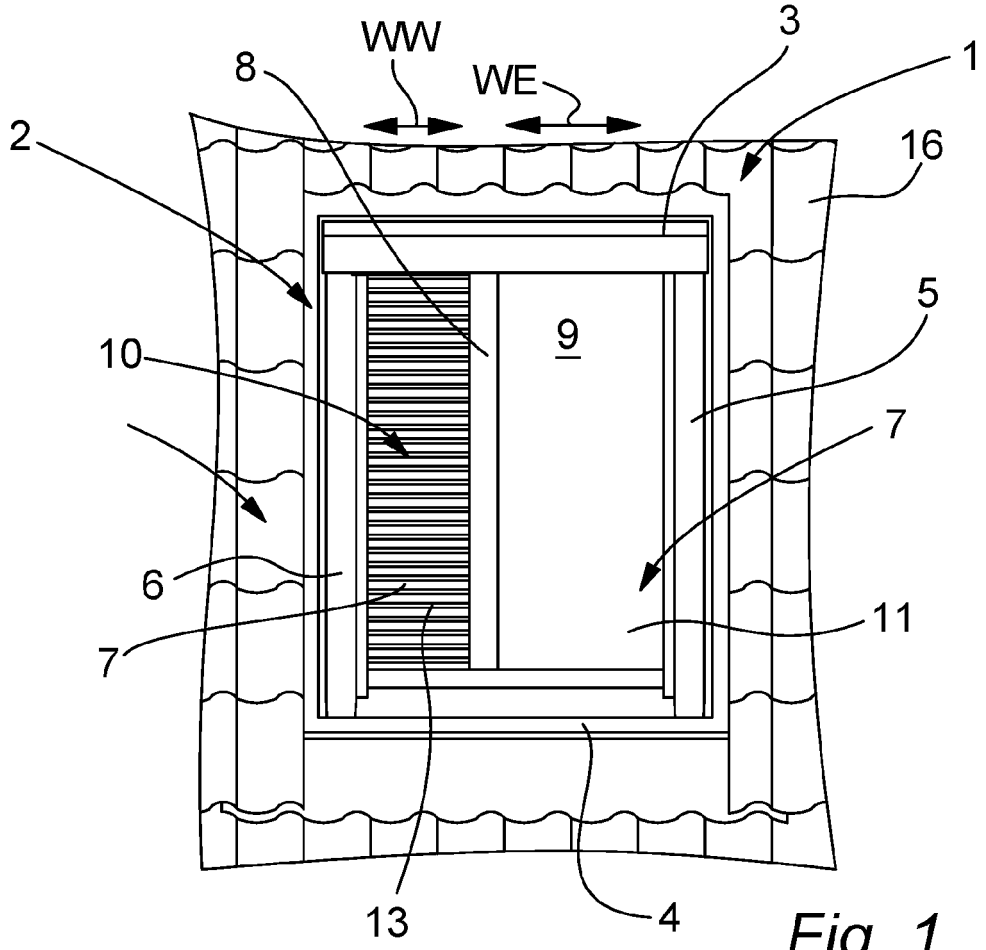
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Fig. 1

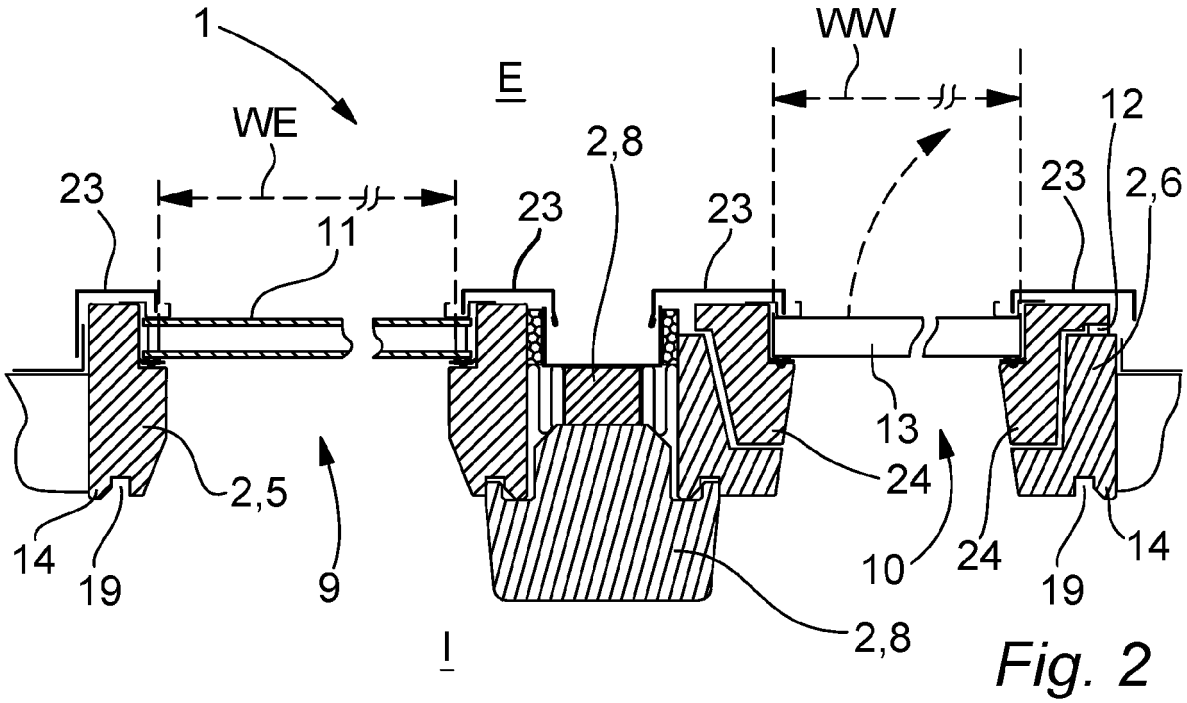
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Fig. 2

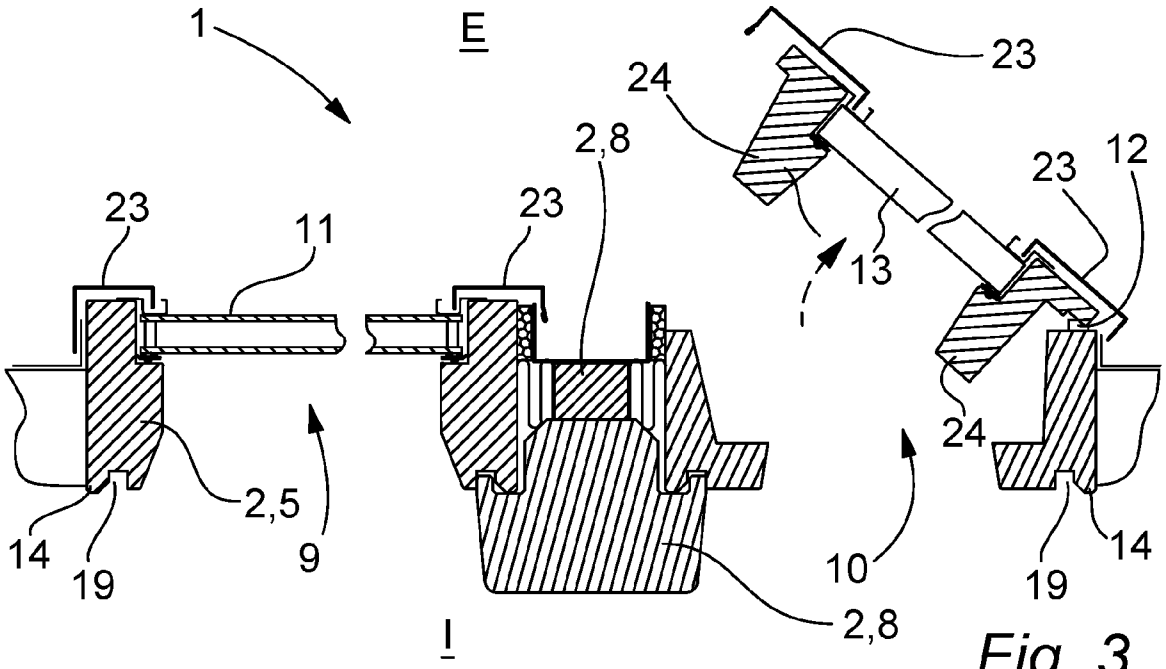

Fig. 3

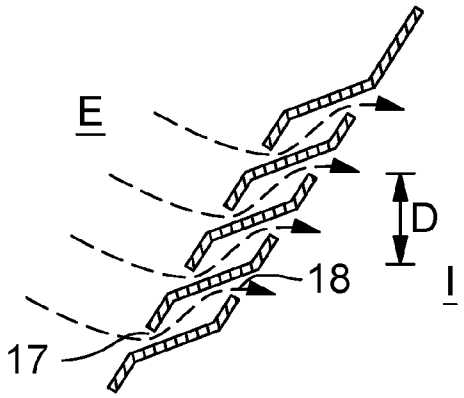

Fig. 4a

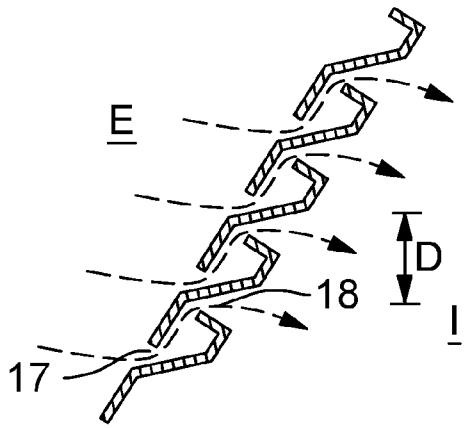

Fig. 4c

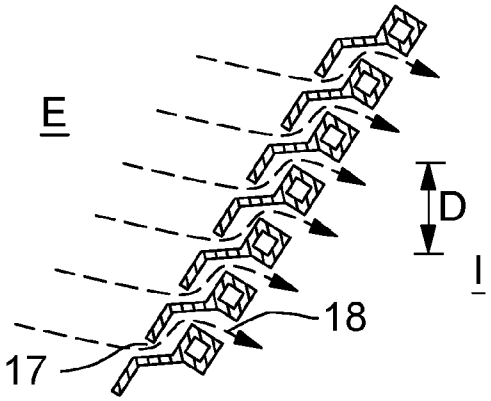

Fig. 4b

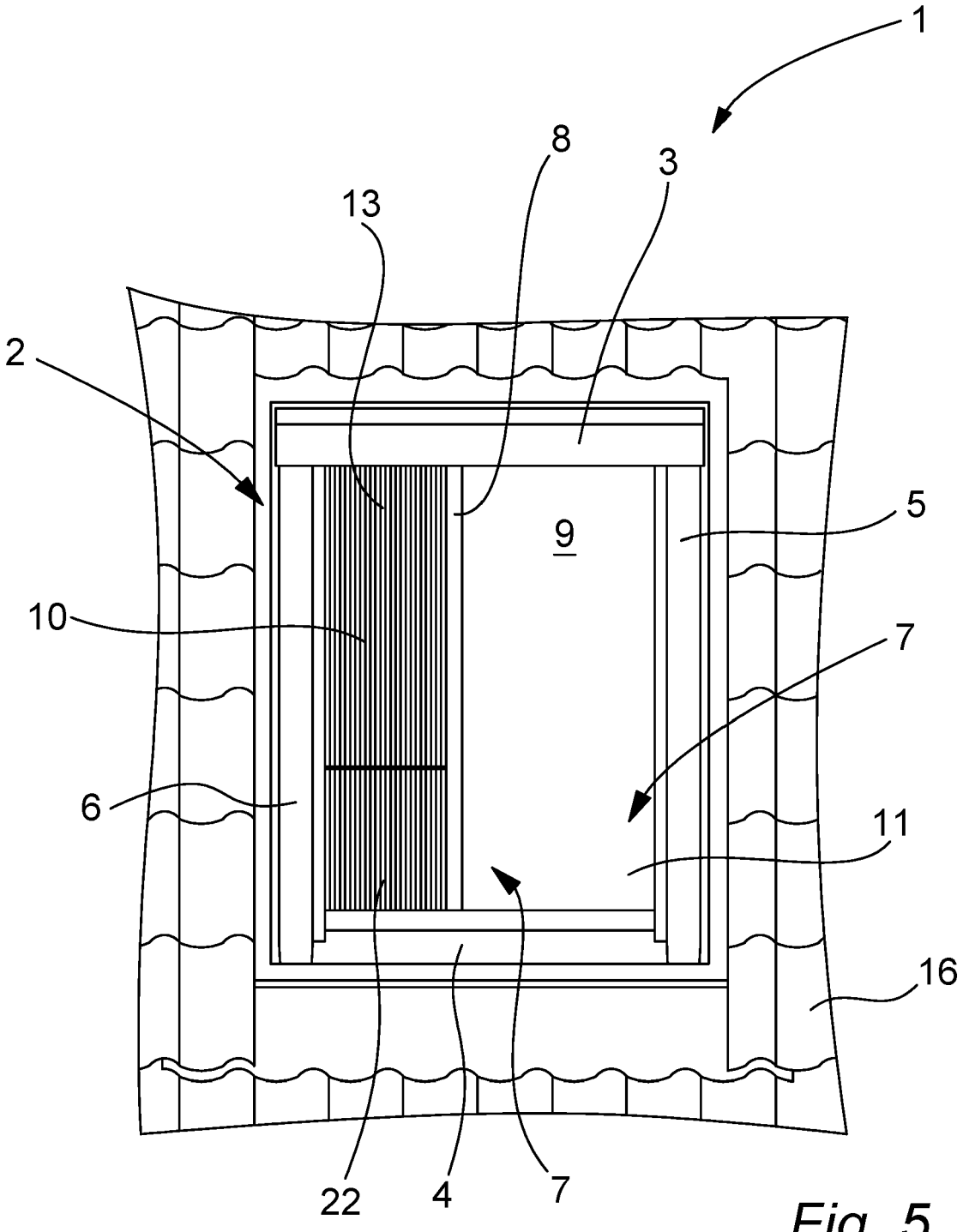

Fig. 5

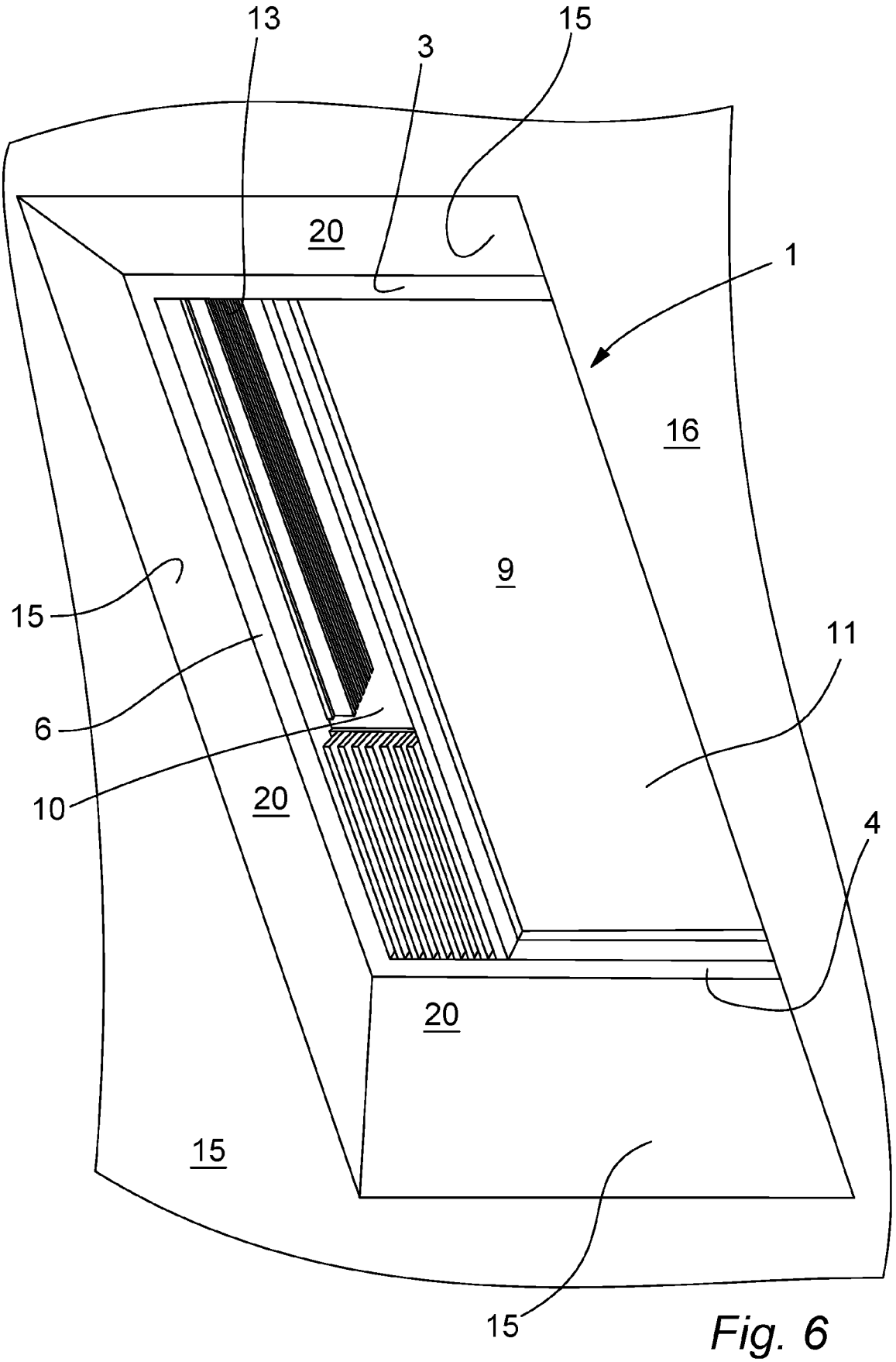

Fig. 6

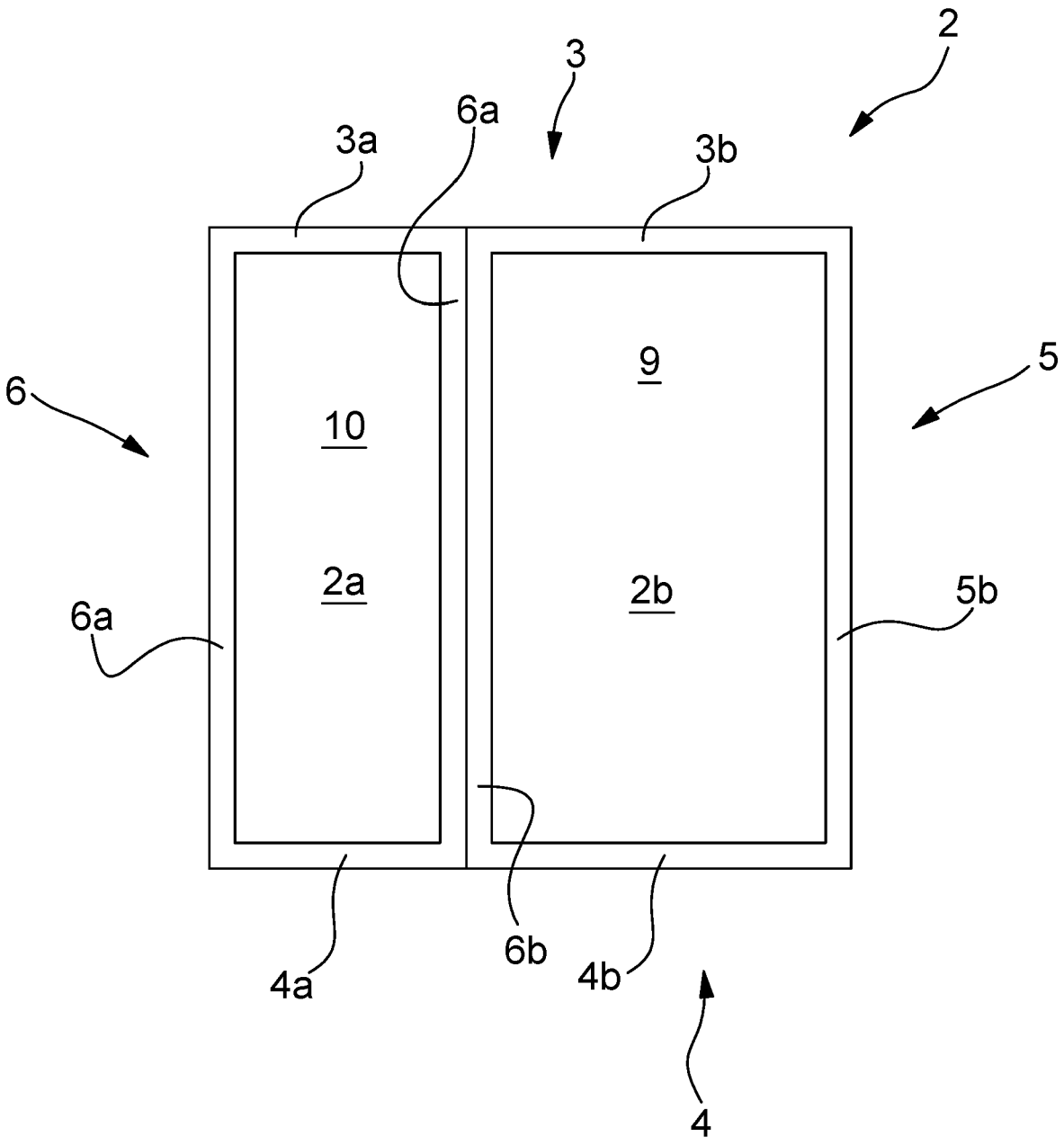

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 21 9343

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 4 257 772 A1 (VKR HOLDING AS [DK]) 11 October 2023 (2023-10-11) * paragraphs [0012], [0029]; figures 4-12 *	1-17	INV. E04D13/03 E04D13/035 E06B7/08
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 May 2024	Leroux, Corentine

CATEGORY OF CITED DOCUMENTS

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