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(54) **Ventilation grid**

(57) The invention relates to a ventilation grid, comprising an inner grid and an outer grid, the outer grid comprising plurality of horizontal ribs preventing water or solid objects penetrating in, the inner grid fixed detachably or being hinged to the outer grid, equipped with horizontal ribs inclined for draining the drops out, a space between the inner and outer grids for installing a mesh to provide a desired IP classified protection.

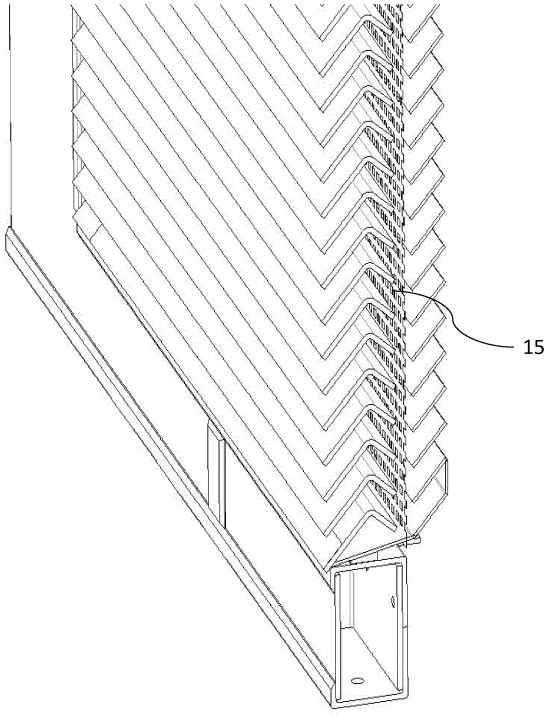

Fig. 2

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to vertical ventilation arrangements.

BACKGROUND OF THE INVENTION

[0002] Enclosed devices like a distribution transformer in an electric distribution substation or an inverter in a solar power substation dissipate a lot of heat. Enclosures typically have at least one opening allowing air to flow, equipped with a grid for preventing small animals passing in and for protecting against normal rain, providing no more than I P23 class protection.

[0003] A better protection against horizontal rain can be achieved by a tight labyrinth structure, but increased air flow resistance decreases ventilation capability.

[0004] In locations placed in areas with high density of insects or reptiles, a higher degree of protection against access to hazardous parts and against solid foreign objects indicated by the first characteristic numeral of the IP code may be needed in order to ensure that no faults will occur in the equipment installed inside the enclosure and/or compartment. In other areas, with a high number of rainy days per year and/or the combination with horizontal wind, a higher degree of protection against ingress of water indicated by the second characteristic numeral of the IP code may be needed to protect the equipment inside the enclosure and/or compartment.

[0005] In order to provide a degree of protection against access to hazardous parts, it is known that depending on the substation location, IP3X (access of objects less than 2.5mm) or IP4X (access of objects less than 1 mm) might be required or necessary to ensure the protection of the equipment. For the ingress of water with horizontal rain driven by high speed wind, the degree of protection of IPX5 (water jet) may be necessary.

SUMMARY

[0006] An object of the present invention is to provide an improved ventilation grid. The object is achieved with an invention, which is defined in the independent claim. Some embodiments are disclosed in the dependent claims.

DRAWINGS

[0007] In the following, the invention will be described in greater detail by means of some embodiments with reference to the accompanying drawings, in which

Figure 1 shows an embodiment of a ventilation grid;
Figure 2 shows another embodiment a ventilation grid with a mesh;
Figure 3 shows a perspective view of back side;
Figure 4 shows a perspective view of front side, an inner grid in open position and a mesh partly taken out;
Figure 5 shows a perspective view of back side, an inner grid in open position and a mesh partly taken out.

DETAILED DESCRIPTION

[0008] Figure 1 shows a cut view on an embodiment of the invention. An outer grid (1) comprises a first frame (2), preferably made of metallic or glass reinforced polyester rectangular tube, shaped as rectangular or square, comprising lower horizontal beam (3) and upper horizontal beam (not shown), fixed together by vertical beams (4). The shape of the first frame may also be different of that, even like round or ellipse.

[0009] The first frame (2) is for fitting the ventilation grid as a one device on an opening of a wall. The ventilation grid may be fitted on a door of the enclosure, as well. The frame of the door may also serve as a first frame for the ventilation grid, or at least some beams of the frames may be common for a door and the first frame.

[0010] The outer grid comprises plurality of substantially horizontal outer ribs (5) arranged between the vertical beams (4) of the first frame. In a case that the outer ribs (5) are made of steel, they may preferably be fixed to vertical beams (4) by welding. In a case that the outer ribs (5) are of any type of plastic material like glass reinforced polyester, the set of outer ribs (5) may have vertical ribs for fixing the ribs together. The set of outer ribs may also be injection-molded as a whole with supporting vertical beams and/or its own plastic frame for fixing the ribs to the first frame (2). The outer ribs (5) may even be injection-molded with a frame to serve as the first frame (2). The outer ribs (5) preferably have unequal legs, cross-section being shaped as a letter "L" upside down with two substantially straight legs (6,7) substantially perpendicular to each other, extending from the connecting point (8). The angle between the legs (6,7) is preferably about 90 degrees, but may vary from that angle within the scope of the invention. If significantly a smaller angle, the flow resistance may increase because the space between two adjacent ribs is getting smaller. If the angle is significantly bigger than 90 degrees, the capability to prevent water penetrating may be not so good. The inner and outer radius of the corner of "L" may vary from very small diameter like sharp "L" to a more rounded one. The first leg (6) of the outer rib (5) is preferably longer than the second leg (7). The outer ribs (5) are aligned on a way that a connecting point (8) connecting the legs (6,7) to each other is on most of the top and both side legs are downwards for draining rain water down. The connecting point constitutes a longitudinal corner of the L-shaped rib. The outermost first leg (6) is preferably longer than the innermost second leg (7). The outermost first leg (6) is for receiving a rain and preventing the water or sand or snow penetration significantly through the outer grid

(1). The innermost second leg (7) is directing water etc. downwards but also preventing any thick rigid object to be pushed through the outer grid (1). The outer ribs (5) of the outer grid (1) are preferably arranged close each other so that not even any thin straight object could be pushed through the outer grid. According to the requirement of the standard IEC 60529, a diameter for a rigid straight object to be able to enter is maximum 12,5 mm for IP2X, 2,5 mm for IP3X and 1 mm for IP 4X. Still the spacing of the outer ribs (5) may be bigger than aforesaid measures because of the L-shape of the outer ribs. The distance between the straight line drawn through the outer edge of the first leg (6) and the outer edge of the second leg (7) of one rib, and the outer surface of the connecting point (8) of the adjacent rib below defines the maximum straight object diameter to be able to be pushed in.

[0011] The outer grid (1) with inclined legs of the outer ribs (5) may as such provide IPX3 class protection against a rain falling as a spray at any angle up to 60° from the vertical.

[0012] The ventilation grid according to the invention further comprises an inner grid (9), adjacent to the outer grid (1). The inner grid (9) comprises substantially horizontal inner ribs (10).

[0013] The inner ribs (10) of the inner grid (9) are preferably shaped flat, like a letter "I" of their cross-section, just being straight sheet of metal or plastic, like glass reinforced polyester. The inner ribs are preferably inclined downward i.e. the outermost edge (11) of the inner rib is nethermost for preventing the water drops draining in the enclosure. Tilt angle of the inner ribs (10) of inner grid (9) is preferably 45 degrees providing air flowing easily, but the angle can be steeper or less steep of that. The nethermost inner rib (12) on the bottom may preferably extend at least to the outer surface level of the outer grid (1) to be able to drain the water finally out from the interior of the ventilation grid.

[0014] In an embodiment on Figure 1, the nethermost inner rib (12) and the adjacent inner rib (13) to that are connected by a vertical portion (14) between the innermost edges of the inner ribs (12,13) to avoid dropping water drops entering inside the enclosure. Preferably the nethermost inner rib (12), the adjacent inner rib (13) and the vertical portion (14) are bent of one sheet metal or injection-molded of plastic to be as a one rib.

[0015] Figure 2 shows another embodiment of the ventilation grid with a mesh (15) arranged on a vertical direction in between the outer grid (1) and the inner grid (9). The mesh (15) extends on vertical and horizontal directions on the space of openings of the frames of the grids. The mesh (15) may have its own frame to keep the mesh on a planar shape. Depending of the measures of the mesh openings, different protection class can be fulfilled. Class IP3X means maximum apertures of 2,5 mm and class IP4X means maximum apertures of 1 mm. Different measures, smaller or larger of the mesh may be used depending of the need. The mesh (15) prevents bees or other type of insects to pass the ventilation grid. Another benefit is that the mesh may brake the water into smaller drops, thus hindering them to pass through the ventilation grid. The mesh may be fabricated by punching openings on a sheet of metal or plastic, preferably of stainless steel for hard environmental requirements, like close to the sea with corrosive salt water. A wire mesh of thin wires may have the lowest flow resistance.

[0016] Figure 3 shows an embodiment of the inner grid (9). The inner grid (9) comprises a second frame (16) comprising beam elements corresponding to the shape of the beams of the first frame (2) of the outer grid (1). The inner grid (9) beams of the second frame (16) may be more light structure because the inner grid (9) is protected against vandalism by the outer grid (1).

[0017] The inner grid (9) comprises substantially horizontal inner ribs (10) located between the vertical beams (17), which inner ribs (10) are fixed to the vertical beams (17) of the second frame e.g. by welding or gluing.

[0018] In another embodiment the inner ribs (10) may pass through openings (18) on the vertical beams (17) making easier to fix the inner ribs on a right position, having an equal space from rib to the adjacent rib with an equal and desired angle. The inner ribs (10) may be fixed by welding or be glued to the vertical beams (17). The inner ribs (10) may pass through the openings (18) and be bent by the outer edge of the openings (18) of the vertical beams, preventing the ribs move on a horizontal direction.

[0019] In another embodiment the vertical beams (17) have a cross-shape of U-beam or rectangular, where the openings are on the inner legs thus the outer legs are preventing or at least limiting the horizontal movement of the inner ribs (10).

[0020] The inner grid (9) may be fixed detachable to outer grid (1) from its second frame (16) by screws, or the inner grid (9) may be hinged allowing turning around the axis of rotation axle of the hinges (19). The hinged inner grid (9) may be lockable by at least one screw or any type of quick locking members, like a latch, allowing easy opening.

[0021] When opened the inner grid (9), the surfaces of the outer ribs (5) and inner ribs (10) are easy to be cleaned. The mesh (15) could be installed between inner and outer grids and be taken out for cleaning or may be replaced to another one.

[0022] Figure 3 shows fixing members (20), preferably metal sheet strips of the outer grid (1), attached to the inner side of the first frame (2) of the outer grid (1), allowing to fix the ventilation grid from the inner side of the wall or a door, preventing to remove the ventilation grid from outside of the enclosure by vandals or by children.

[0023] The vertical inner beams (17) of the inner grid (9) may extend lower than the nethermost inner rib. Apertures (21) may be punched close to the end of the vertical beam (17) for receiving a bolt (22) of a hinge (19) for allowing turning the inner grid (9) from a closed position to an open position. A bracket (23) of the hinge (19) may be fixed directly to the inner side of the wall or a

door, or to the first frame (2) of the outer grid (1), or the fixing member (20) of the outer grid (1). A hinge (19) may have two brackets (23) and two bolts (22) or one long bolt (22) extending through the both vertical beams (17) of the inner grid (9).

[0024] Figure 4 shows a ventilation grid arranged on a door of a cabinet. The inner grid (9) is on an open position, the mesh (15) being partly taken out. The nethermost inner rib (12) of the inner grid (9), extends on the horizontal level to the outer side of the lower horizontal beam (3) of the outer grid (1), for draining the water drops out. On an opened position of the inner grid (9) as shown in Figure 4, the nethermost inner rib (12) is on a withdrawn position and not extending to the outer surface level of the outer grid (1).

[0025] Figure 5 shows the ventilation grid from the inner side of a cabinet door. The inner grid (9) is on an open position and the mesh (15) is partly taken out.

[0026] It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. A ventilation grid for ventilation of an enclosure, comprising an outer grid (1), having a plurality of horizontal outer ribs (5) for preventing water or solid foreign objects to enter the interior of the enclosure, an inner grid (9) adjacent to the outer grid in interior of the enclosure having a plurality of horizontal inner ribs (10) for directing water that enters the interior of the outer grid (1), **characterized in that** at least one of the horizontal outer ribs (5) of the outer grid has a cross-section having two legs (6,7) connected to each other in a connection point (8) and arranged to an angle with respect to each other, each of the legs (6,7) extending downwards from the connection point of the two sides.

2. A ventilation grid according to claim 1, **characterized in that** the ventilation grid comprises a hinge (19) for connecting the inner grid (9) and the outer grid (1) hinged to each other.

3. A ventilation grid according to any preceding claim, **characterized in that** the inner grid (9) is detachably attached to the outer grid (1).

4. A ventilation grid according to any preceding claim, **characterized in that** the ventilation grid comprises a mesh (15) arranged between the inner grid (9) and the outer grid (1).

5. A ventilation grid according to any preceding claim, **characterized in that** the mesh (15) comprises openings that are dimensioned based on a desired IP protection class.

6. A ventilation grid according to claim 4, **characterized in that** the openings of the mesh (15) are sized equal or smaller than 2,5 mm for providing IP3X classified protection.

7. A ventilation grid according to claim 4, **characterized in that** the openings of the mesh (15) are sized equal or smaller than 1 mm for providing IP4X classified protection.

8. A ventilation grid according to any preceding claim, **characterized in that** the mesh (15) is a metal wire mesh.

9. A ventilation grid according to any preceding claim, **characterized in that** the mesh (15) is a plastic wire mesh.

10. A ventilation grid according to any preceding claims, **characterized in that** the ventilation grid comprises an elastic sealing arranged between the inner grid frame and the outer grid frame.

11. A ventilation grid according to any preceding claims, **characterized in that** the legs (6,7) of the outer ribs (5) of the outer grid (1) have a different length, the longer of the legs being arranged closer to the exterior of the enclosure.

12. A ventilation grid according to any preceding claims, **characterized in that** outer ribs (5) of the outer grid (1) have cross-section of a shape of letter "L".

13. A ventilation grid according to any preceding claims, **characterized in that** the nethermost inner rib (12) of the inner grid (9) extends on the outer side of lower horizontal beam (3) of the first grid (1) for draining the water out and the adjacent inner rib (13) for the nethermost rib (12) and the nethermost rib (12) are connected with each other by a vertical portion (14).

14. A ventilation grid according to claim 13, **characterized in that** other inner ribs (10) of the inner grid (9) have a substantial cross section of a shape of letter "I".

15. An electric distribution substation, **characterized in that** it comprises a ventilation grid according to any preceding claims.

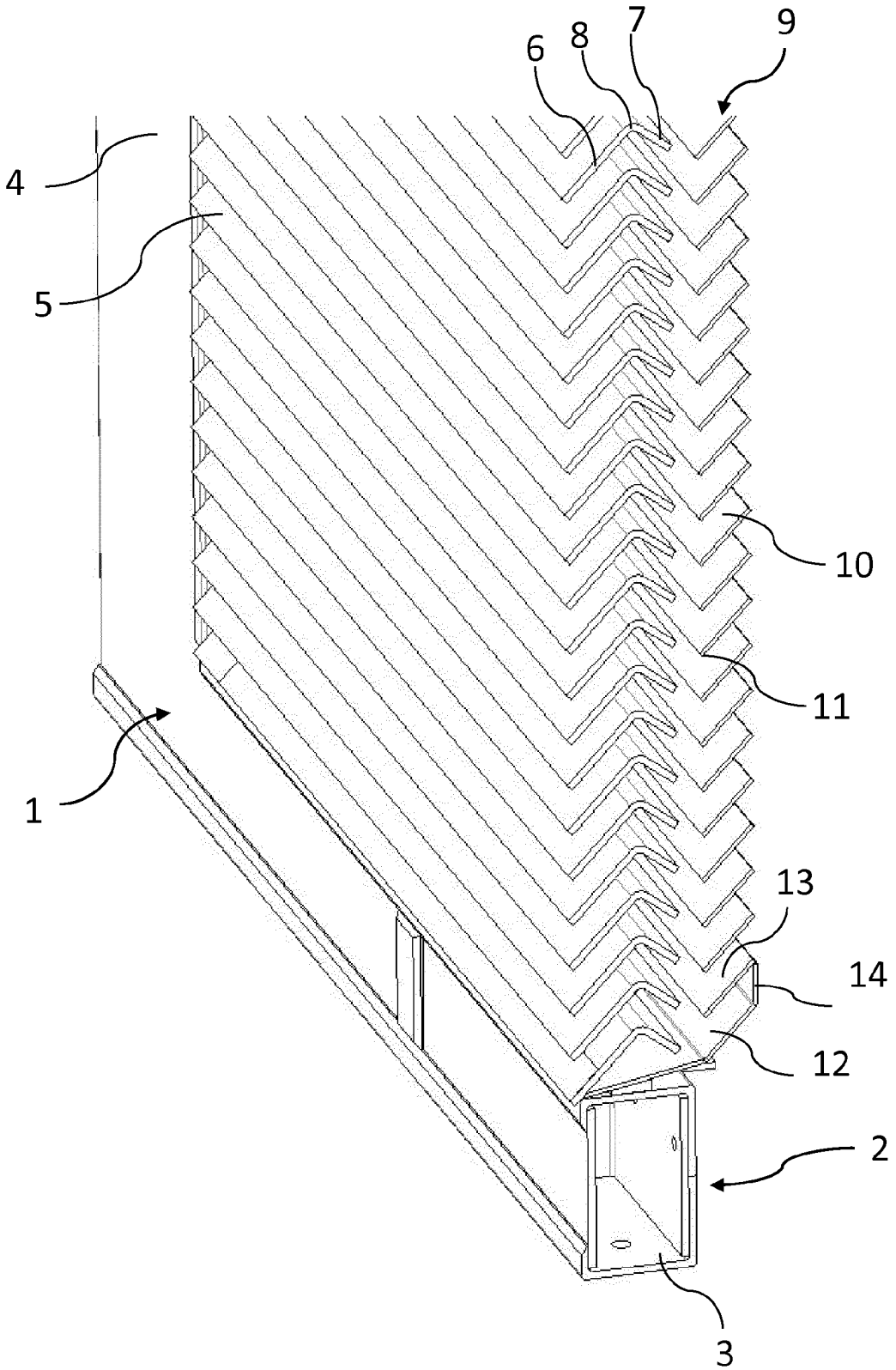

Fig. 1

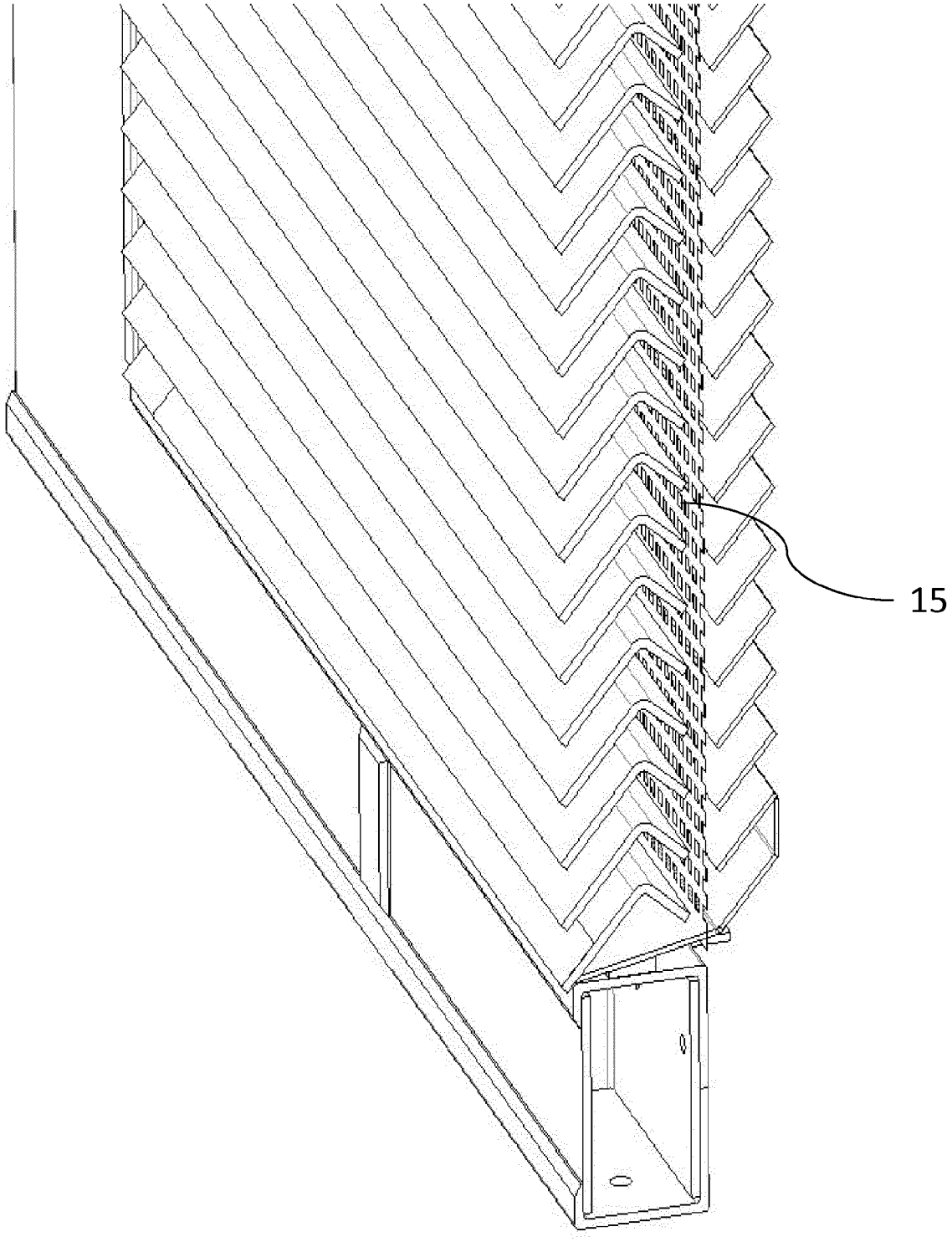

Fig. 2

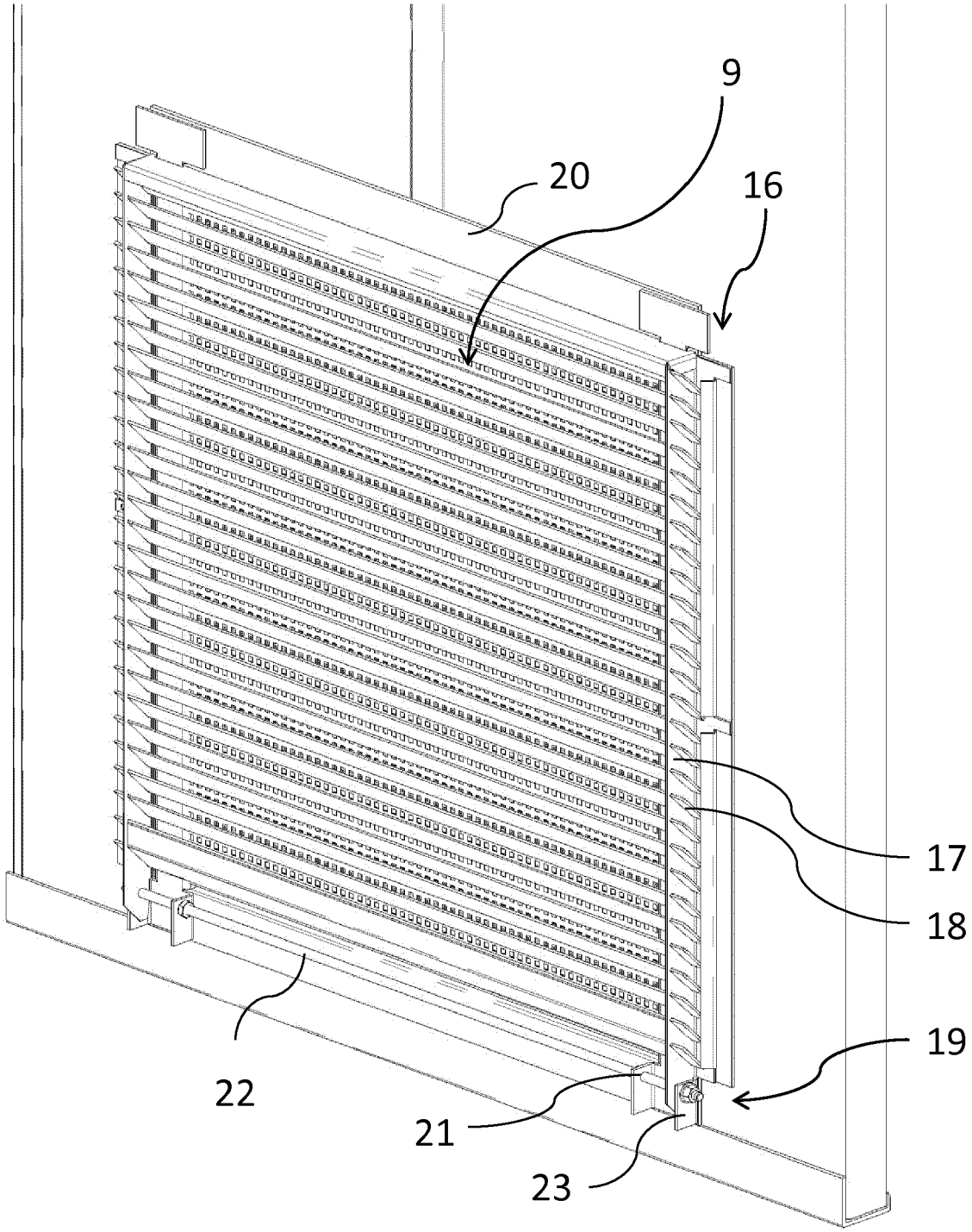

Fig. 3

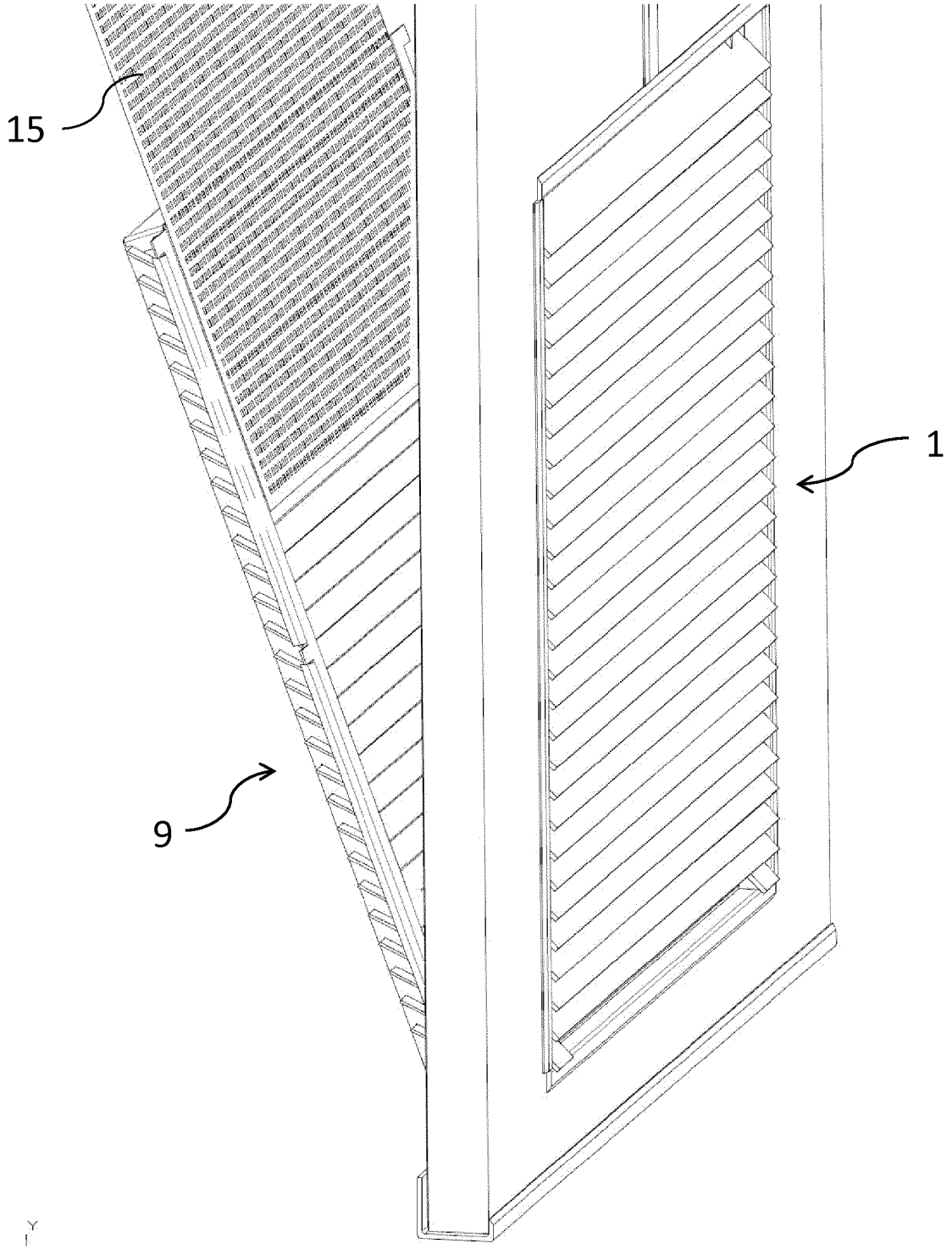

Fig. 4

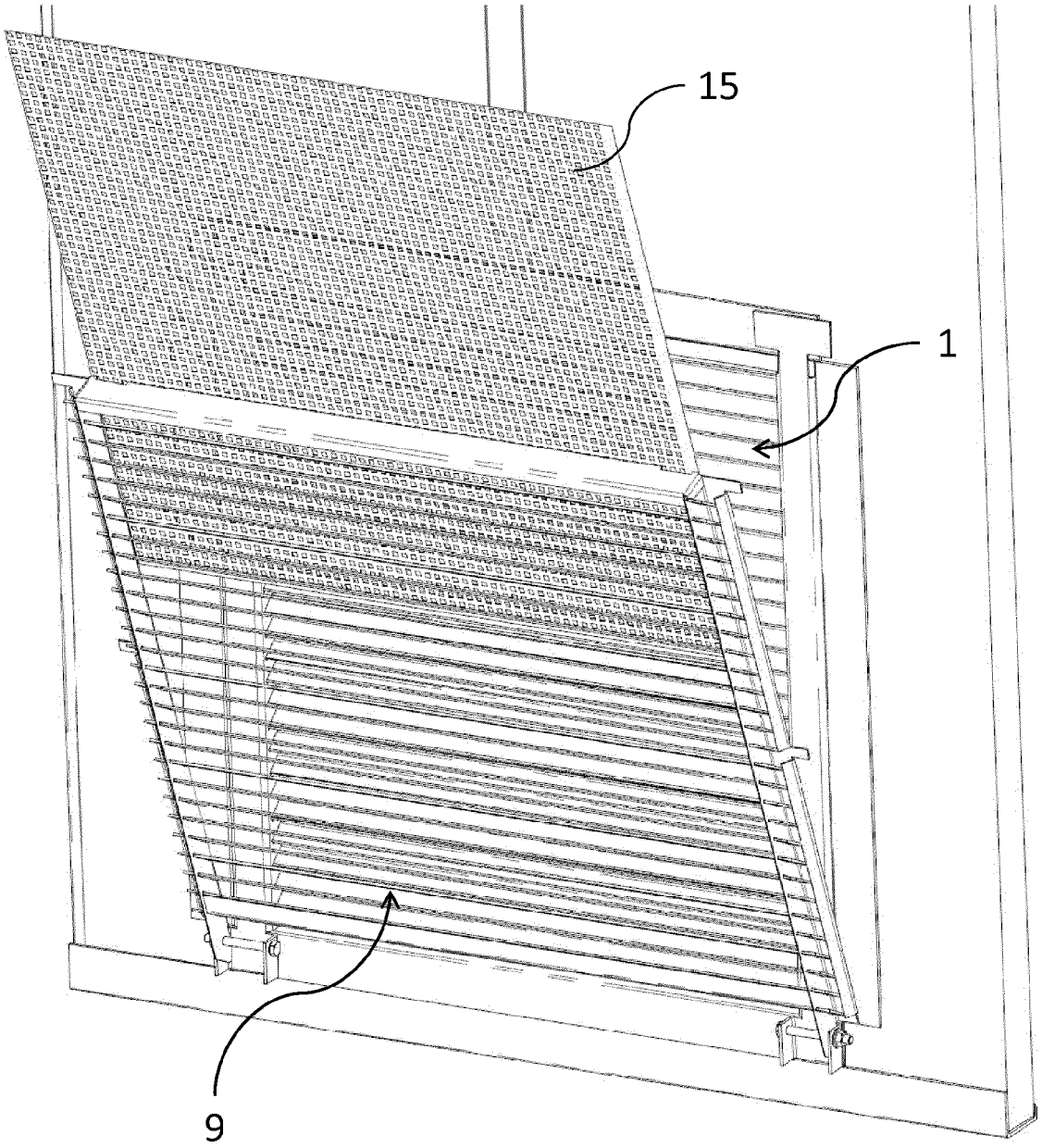

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 8643

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 February 2015	Weißbach, Mark

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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