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(54) EXTERIOR VENT-LOUVRE ASSEMBLY

(57) An exterior vent-louvre assembly (10) comprising: at least two vertically spaced-apart exterior vent-louvre members (12) which define an exterior air-flow path (16) having a substantially uniform lateral extent therebetween. There is an under-surface (26) of a leading intermediate part (28) of each louvre member having a first lower active-surface portion (30); and an under-surface (26) of a trailing intermediate part (58) of each louvre member having a second lower active-surface portion (64); an upper-surface of a crown part (22) of each louvre member including an unbroken transition (66) to the trailing intermediate part (58) and having an upper active-surface portion (52). A first distance D1 from a leading-edge region (54) of the upper active-surface portion (52) of each vent louvre member to the first lower active-surface portion (30) of an above and adjacent vent-louvre member matches or substantially matches a second distance (D2) from a trailing-edge region (56) of the upper active-surface portion (52) of said vent-louvre member to the second lower active-surface portion 64 of the said above and adjacent vent louvre member, whereby the matching or substantially matching said first and second distances (D1, D2) prevent or reduce air-flow turbulence at or downstream of the crown part (22) to improve entrained moisture removal.

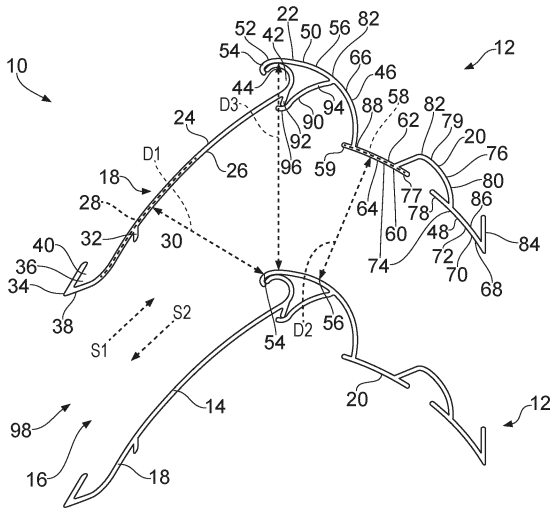

FIG. 1

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Description

[0001] The present invention relates to an exterior vent-louvre assembly for restricting entry of atmospheric water and enablement of airflow with reduced turbulence therethrough.

[0002] It is typically desirable for a building to have permanent or semi-permanent passive ventilation portions. These portions may be the inlet or outlet of an air ventilation duct as part of a heating, ventilation and air conditioning system or for providing natural ventilation to generator rooms. Whilst it is desirable to allow for air and airflow paths to access these portions of the building, it may be undesirable to allow atmospheric water, such as wind driven rain, to enter these areas.

[0003] To prevent the ingress of water, louvres may be used. These are conventionally elongate strips which are laterally aligned with the opening of the portion of the building to be ventilated and waterproofed. Louvres typically have an upwardly directed component, which helps to prevent wind driven rain from entering the opening by creating a barrier to it, and a downwardly directed component to direct water which may overcome this barrier downwards and not into the building.

[0004] However, the transition from the upwardly directed component to the downwardly directed component typically creates a Venturi effect and thus a pressure differential within the airflow path, thus helping to draw more air therethrough.

[0005] Whilst the Venturi effect offers this benefit in increased airflow, in practice it creates turbulence in the airflow, particularly over the uppermost portion of the louvre. This turbulence is detrimental to the effectiveness of the atmospheric water resistance of the louvre. The turbulence can cause the re-entrainment of previously precipitated water back in the airflow and therefore may result in water entering the building.

[0006] The present invention seeks to provide a solution to these problems.

[0007] According to a first aspect of the present invention, there is provided an exterior vent-louvre assembly comprising: at least two vertically spaced-apart exterior vent-louvre members which define an exterior air-flow path having a substantially uniform lateral extent therebetween; an under-surface of a leading intermediate part of each vent-louvre member having a first lower active-surface portion; an under-surface of a trailing intermediate part of each vent-louvre member having a second lower active-surface portion; an upper-surface of a crown part of each vent-louvre member including a unbroken transition to the trailing intermediate part and having an upper active-surface portion; a first distance from a leading-edge region of the upper active-surface portion of each vent-louvre member to the first lower active-surface portion of an above and adj acent vent-louvre member matching or substantially matching a second distance from a trailing-edge region of the upper active-surface portion of said vent-louvre member to the second lower active-surface portion of the said above adjacent vent-louvre member, whereby the matching or substantially matching said first and second distances prevent or reduce air-flow turbulence at or downstream of the crown part to improve entrained moisture removal.

[0008] An exterior vent-louvre is typically used to at least in part cover an opening in a building. This is typically for the effect of preventing ingress of water, such as wind driven rain, into the opening whilst allowing the flow of air therethrough. The exterior vent-louvre may also have the effect of removing or reducing the amount of water in an air-flow. The water that is extracted from the airflow or prevented from entering the opening is typically collected and/or collated and may be distributed away from the opening. A vent-louvre therefore differs in function and form when compared to other types of louvre, such as solar-shading louvres or venetian blinds, which are only designed or substantially only designed to provide shading to the exterior and/or interior of a building.

[0009] The matching or substantially matching of the first and second distances prevents or reduces a Venturi effect from occurring and thus reduces or prevents turbulence from occurring within the exterior air-flow path. The unbroken transition, and lack of a sudden widening or narrowing, from the crown part to the trailing intermediate part similarly prevents or reduces a Venturi effect or turbulence from occurring. Laminar flow of the air is instead promoted. Through a reduction in turbulence and promotion of laminar flow, less water, which may have been precipitated from the air-flow over the crown part downstream of the crown part, is caused to be re-entrained within the airflow. In this way, less water may be carried into the opening of the building which is to be shielded or covered by the exterior vent-louvre assembly.

[0010] Preferably, the exterior air-flow path may be arcuate or may be substantially arcuate. An arcuate exterior air-flow path helps to prevent ingress of water beyond the crown part, thus providing the same benefit as above.

[0011] Advantageously, a third distance between apexes of opposing crown parts may be greater than the first and second distances, so as to provide adequate space for forming the air-flow path having a substantially uniform lateral extent between the first and second distances.

[0012] Beneficially, the unbroken transition of each vent-louvre member may be curvate. In a preferable embodiment, the unbroken transition may face a downstream direction. A curvate unbroken transition which faces the downstream direction ensures that the airflow is smoothly guided from the crown part to the trailing intermediate part and therefore minimises turbulence effects.

[0013] Beneficially, at least part of the leading-edge region of the upper active-surface portion of each vent-louvre member may face an upstream direction. Preferably, at least part of the trailing-edge region of the upper active-surface portion of each vent-louvre member may

face a downstream direction. At least part of the active-surface portion atop of the crown part facing the upstream direction allows for the air-flow to be more gradually guided over the crown part by comparison with a typical arrangement whereby the active-surface portion may not face the upstream direction. This helps to further reduce turbulence. Similarly, part of the same portion facing the downstream direction allows for the air-flow to be gradually directed downwards and towards the building.

[0014] Additionally, each vent-louvre member may further comprise a further upper active-surface portion positioned downstream and vertically spaced apart from the said upper active-surface portion of the crown part, the said upper active-surface portion and the further upper active-surface portion together defining an upper active-surface. A further upper active surface portion assists with guiding the air-flow to the building.

[0015] Preferably, each vent-louvre member further comprises a third lower active-surface portion positioned downstream and vertically spaced apart from the second lower active-surface portion, the second and third lower active surface portions together defining a trailing lower active-surface. A third lower active surface similarly assists with guiding air-flow to the building.

[0016] Preferably, the further upper active surface portion may be provided on a bridging part, and the third lower active surface portion may be provided on a trailing end part, the trailing end part being downstream of the bridging part.

[0017] Advantageously, the upper active-surface and the trailing lower active-surface may be spaced apart in a lateral direction of the air-flow path.

[0018] To create a system of vent-louvres members defining at least one airflow path having a uniform lateral cross-section, the vent-louvres members being vertically spaced apart but horizontally and/or laterally aligned, it may be necessary to space upper and trailing lower active surfaces apart. A spacing of the upper and trailing lower active-surfaces here enables a uniform, constant or consistent, or substantially uniform, constant or consistent air-flow path, despite the arcuate shape of the vent-louvre members. This assists in a reduction of turbulence. The spacing of the upper and trailing lower active-surfaces can be achieved without thickening the louvre, which otherwise would result in added mass. The added mass can increase the cost of manufacture of the louvre, especially given that louvres are typically made from aluminium. Additionally, the added mass may require additional structural reinforcements of the bracket to enable installation.

[0019] Optionally, the upper active-surface may be discontinuous which reduces the material required to form each vent-louvre member, thus reducing manufacturing costs. Alternatively, the unbroken transition may form part of the upper active-surface, the upper active-surface being continuous to provide a larger active guidance surface for the air-flow path. Optionally, the lower active-surface may be discontinuous for the reasons given above. Alternatively, lower active-surface may be continuous.

[0020] Preferably, the crown part of each vent-louvre member may separate an upwardly directed leading louvre, having the leading intermediate part and leading-edge and trailing edge regions, and a downwardly directed trailing baffle, having the trailing intermediate part and leading edge and trailing edge regions, of the vent-louvre member.

[0021] Beneficially, each vent-louvre member may further comprise an upturned or a substantially upturned nose portion at or adjacent to the leading-edge region of the leading louvre, forming a first channel. An upturned nose portion may help to direct incoming air to the air-flow channel defined by adjacent vent-louvre members. The nose portion provides the additional function of capturing, collecting or collating water which may impact or precipitate on either an upper or under surface of the upwardly directed leading louvre and may enable the horizontal distribution of this water. The nose portion being so formed as a channel allows for the provision of a water distribution means on the leading-edge region of the vent-louvre member without negatively affecting the air-flow guidance characteristics of the vent-louvre member.

[0022] In a preferable embodiment, each vent-louvre member may further comprise a second channel formed at or adjacent to the trailing-edge region of the trailing baffle. A second channel enables the capturing, collecting or collating of water which may impact or precipitate on either an upper or under surface of the downwardly directed trailing baffle and may enable the horizontal distribution of this water.

[0023] Optionally, each vent-louvre member may further comprise a third channel formed between the trailing-edge region of the trailing baffle and the crown part. Additionally, the second and third channels may be spaced apart. Preferably, the third channel may in part be defined by the trailing intermediate part and the unbroken transition. Optionally, the bridging part may be provided between the second and third channels. A third channel spaced apart from the second channel allows for further water to be collected than with only the second channel, as the capacity of the second channel would not be able to be substantially increased without effecting the air-flow guidance characteristics.

[0024] Preferably, each vent-louvre member may further comprise a recurve formed at the trailing-edge region of the leading louvre. Advantageously, the crown part of each vent-louvre member may be laterally aligned with the recurve of the leading louvre, and is laterally and vertically displaced from the remainder of the leading louvre. Air with entrained moisture is typically heavier than air without entrained moisture, and therefore would be positioned vertically lower within the air-flow. This moisture laden air would meet and be returned upstream by the recurve positioned at the downstream end of the leading louvre. Moisture may be precipitate out of this returned air which may run off into the first channel.

[0025] Beneficially, the trailing baffle of each vent-louvre member may be at least in part hollow. Preferably, the trailing baffle may further comprise at least one supporting strut therein. The at least in part hollow trailing baffle having at least one supporting strut reduces the amount of material used to construct the vent-louvre member which reduces the cost of the assembly and stress on the building due to the weight of the assembly, whilst still maintaining structural integrity.

[0026] Optionally, a majority of the trailing baffle of each vent-louvre member may be formed from an alloy of aluminium. Aluminium has a lower density and higher strength than other conventional engineering materials and thus is suitable for applications being suspended from the building.

[0027] Alternatively, a majority of the trailing baffle of each vent-louvre member may be formed from plastics or a polymer-matrix composite. Plastics have a much lower density than other typical engineering materials and may additionally be significantly lower cost. Polymer-matrix composites offer a higher strength alternative to typical plastics.

[0028] In a preferable embodiment, each vent-louvre member may be elongate which ensures that the dimensions of the opening may be entirely covered.

[0029] According to a second aspect of the present invention there is provided a method of forming a uniform or substantially uniform air-flow path between two vertically spaced-apart arcuate exterior vent-louvre members with reduced turbulence, the method comprising the steps of: providing a stepped unbroken transition at or downstream of a crown part thereby vertically separating upper and lower active-surface portions and as such neighbouring flow paths; and providing at least first and second lower active-surface portions and at least one upper active-surface portion, wherein a first distance from a leading-edge region of the upper active-surface portion of each vent-louvre member to the first lower active-surface portion of an above and adjacent vent-louvre member matches or substantially matches a second distance from a trailing-edge region of the upper active-surface portion of said vent-louvre member to the second lower active-surface portion of the said above and adjacent vent-louvre member, the matching or substantially matching said first and second distances preventing or reducing air-flow turbulence at or downstream of the crown part to improve entrained moisture removal.

[0030] According to a third aspect of the present invention, there is provided an exterior vent-louvre assembly for reducing turbulence, the vent-louvre assembly comprising at least three vertically spaced-apart exterior vent-louvre members which define neighbouring exterior air-flow paths, each path having a substantially uniform lateral extent therealong, each said vent-louvre member including a leading louvre element extending to a crown element from a leading edge, and a trailing louvre element which extends from the crown part to a trailing edge, the trailing louvre element having two upwardly-facing surface portions which are in use vertically offset from each other in a lateral direction of the air-flow path and spaced from the trailing edge, at least a portion of an under-surface of the first said upwardly-facing surface portion having a first lower active-surface portion defining at least part of a neighbouring air-flow path, and at least a portion of the second said upwardly-facing surface portion being downstream of the first upwardly-facing surface portion and the trailing edge of the vent-louvre member above defining the or substantially the lateral extent of the air-flow path therebetween, whereby the neighbouring air-flow paths so defined diverge towards their respective trailing edges whilst maintaining a substantially uniform lateral extent between the leading and trailing edges.

[0031] According to a fourth aspect of the present invention there is provided an exterior vent-louvre for reducing turbulence and defining an arcuate air-flow path having a substantially uniform top-to-bottom lateral extent therealong, the vent-louvre including a leading louvre element extending to a crown element from a leading edge, and a trailing louvre element which extends from the crown part to a trailing edge, the trailing louvre element having an undulating surface to define one or more active air-guide portions.

[0032] According to a fifth aspect of the present invention there is provided an arcuate exterior vent-louvre for reducing turbulence and defining an air-flow path having a substantially uniform top-to-bottom lateral extent therealong, the vent-louvre including a leading louvre element extending to a crown element from a leading edge, and a trailing louvre element which extends from the crown part to a trailing edge, the trailing louvre element having offset surfaces to define one or more active air-guide portions.

[0033] The invention will now be more particularly described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a cross-sectional view of two exterior vent-louvre members, defining an exterior air-flow channel therebetween, of a first embodiment of an exterior vent-louvre assembly in accordance with a first, second, third, fourth and fifth aspects of the present invention, with the positioning of a leading intermediate part or portion and a trailing intermediate part or portion shown in dashed line;

Figure 2 shows a perspective representation of a plurality of vertically spaced apart vent-louvre members of Figure 1;

Figure 3 shows a cross-sectional view of a second embodiment of the exterior vent-louvre assembly in accordance with the first, second, third, fourth and fifth aspects of the present invention, with in use exterior air-flow paths being shown by way of a plurality of arrows; and

Figure 4 shows a cross-sectional view of two vent-louvre members, defining an air-flow channel therebetween, of a third embodiment of an exterior vent-louvre assembly in accordance with the first, fourth and fifth aspects of the present invention.

[0034] Referring firstly to Figures 1 and 2 there is provided a first embodiment of an exterior vent-louvre assembly 10, the vent-louvre assembly 10 having at least two spaced-apart exterior vent-louvre members 12. Adjacent vent-louvre members 12 define an air-flow channel 14 therebetween, the air-flow channel 14 in turn forming an exterior air-flow path 16 having a substantially uniform lateral extent. In other words, the exterior air-flow path 16 has a uniform height in a lateral direction.

[0035] Each vent-louvre member 12 is preferably elongate, arcuate and is here formed as a two piece arrangement, firstly comprising an upwardly directed leading louvre 18 and a downwardly directed trailing baffle 20. A crown part 22 is here preferably unitarily formed as a one piece with the trailing baffle 20 and extends from a distal end of the trailing baffle. Whilst each vent-louvre member 12 is shown as being formed as a two piece arrangement, it is appreciated that each vent-louvre member may instead be unitarily formed as a one-piece, or more than two pieces.

[0036] In use, each vent-louvre member 12 is fitted to the exterior of the building such that the trailing baffle 20 is proximal to the building and the leading louvre 18 is distal to the building. A downstream direction S 1 is defined as being from a distal end of the leading louvre 18 to or towards a proximal end of the trailing baffle 20. An upstream direction S2 is defined as being in an opposite direction to the downstream direction. The elongate or horizontal extent of the vent-louvre member 12 extends laterally to both the upstream and downstream directions.

[0037] Additionally, in use, the vent-louvre members 12 of the vent-louvre assembly 10 are typically arranged such that the vent-louvre members 12 are vertically spaced apart from one another but are otherwise laterally aligned. The in use air-flow path 16 is defined at least in part between a pair of adjacent vertically spaced apart vent-louvre members 12, and an upward direction is here considered to be upwards in the above referenced typical arrangement and a downward direction is considered to be downwards in the above referenced typical arrangement.

[0038] The leading louvre 18 is preferably and generally curvate and has a or a substantially convex shaped upper-surface 24 and a or a substantially concave under-surface 26. Whilst the leading louvre 18 is here given as being curvate and having a convex upper surface 24, it is appreciated that the leading louvre may alternatively be straight or may have a concave upper surface and a convex under-surface.

[0039] A leading intermediate part 28, marked in dashed lines, of each vent-louvre member 12 is here preferably defined as being at or adjacent to an upstream end, a distal region or a leading edge regions of a leading louvre 18 of the vent-louvre member 12. Each leading intermediate part 28 has an under-surface which is preferably at least in part concave and forms a first lower active-surface portion 30 on at least part of the under-surface. This positioning of the first lower active-surface portion 30 may preferably be towards the downstream end or leading-edge region of the leading louvre 18. Whilst the first lower active-surface portion 30 is described as being concave, it is appreciated that it may in fact be convex. It is additionally appreciated that the first lower active-surface portion may extend along the whole, or substantially the whole, of the under-surface of the leading louvre. Alternatively, the first lower active-surface portion may in fact be defined as being at or adjacent to an in use upstream or proximal end of the leading louvre.

[0040] The under-surface 26 of the leading louvre 18 has a spur 32 which projects from the under-surface 26 in a downstream or substantially downstream direction. The spur 32 may be positioned here to substantially direct the air-flow path 16 although it is appreciated that the spur may not be present on the leading louvre 18.

[0041] The leading edge or leading edge region of the leading louvre 18 of each vent-louvre member 12 has an elongate upwardly turned nose portion 34 which here takes the form of a V-shaped recurve being directed towards the crown part 22. The nose portion 34 thus has an internal surface 36, which faces the crown part 22 and the downstream direction, and an external surface 38, which faces away from the crown part 22 and the upstream direction. The external and internal surfaces 36, 38 are here substantially facetted, although they may instead be smoothly curved. In a typical arrangement and orientation of the vent-louvre member 12, the internal surface 36 of the nose portion 34 may be considered to form a first channel 40.

[0042] A recurve 42 is formed at or adjacent to a downstream end, proximal end or trailing edge region of the leading louvre 18 of each vent-louvre member 12. The recurve 42 is here preferably curved such that it is substantially unfaceted, although it is appreciated that it may in fact be faceted. The recurve 42 is angled with respect to the leading intermediate part 28 such that, in use, the recurve 42 at least in part projects upwards and that an internal surface 44 of the recurve 42 is directed towards and faces the first channel 40 or upstream direction. The extent of the curvature of the recurve 42 is such that a lateral cross-section here is, or is substantially, semiannular. However, it is appreciated that the recurve 42 may in fact be curved to a lesser extent than this such that it is formed as an elongate upstanding wall or barrier, or may alternatively be curved to a greater extent.

[0043] The trailing baffle 20 of each vent-louvre member 12 is also preferably elongate and curvate with an upper-surface 46 being or being substantially convex and an under-surface 48 being concave.

[0044] The crown part 22 is here unitarily formed at an upstream end, distal end or leading-edge of the trailing

baffle 20. At least part of an upper-surface 50 at a distal end of the crown part 22 preferably faces the upstream direction. Proximal to the distal end, the upper surface 50 of the crown part 22 may face a downstream direction. In this way, the crown part 22 may face both the upstream and the downstream direction.

[0045] An upper active-surface portion 52 of each vent-louvre member 12 is here positioned on the distal end of the upper-surface 50 of the crown part 22 and may face the upstream and/or the downstream direction. The upper active-surface portion 52 preferably is curvate, convex and faces or substantially faces the downstream direction, although it is appreciated that it may alternatively wholly or partly face the upstream direction or wholly or partly face an upwards direction. The overall general direction of the upper active-surface portion 52 is preferably substantially aligned with an overall general direction of the air-flow channel 14 adjacent to the trailing baffle 20 and the in use air-flow path 16 defined by this part of the air-flow channel 14. An apex of the crown part 22 is defined by and positioned on the upper active-surface portion 52

[0046] The upper active-surface portion 52 may here have a leading-edge region 54 and a trailing-edge region 56.

[0047] A trailing intermediate part 58, marked in dashed lines, of each vent-louvre member 12 is preferably connected to and downstream of the crown part 22, via an unbroken transition to be described later. The trailing intermediate part 58 preferably has a concave under-surface 60 and a convex upper-surface 62. A second lower active-surface portion 64 is here defined at least in part on the under-surface 60 of the trailing intermediate part 58.

[0048] The upper active-surface portion 52 and the second lower active-surface portion 64 of each vent-louvre member 12 are preferably spaced apart and stepped from one another in a vertical and lateral direction. This spacing apart is here in a vertical or substantially vertical direction with the second lower active-surface portion 64 being below the upper active-surface portion 52 of any given vent-louvre member 12.

[0049] The spacing apart is preferably greater than the thickness of the component which the trailing baffle 20 is formed from. As such, the crown part 22 may include the unbroken transition 66, which bridges the upper active-surface portion to the trailing intermediate part 58. The unbroken transition 66 is preferably curvate, and more preferably curvate to a steeper degree than the curvature of upper active-surface portion 50, thus forming a step. The unbroken transition 66 preferably connects the trailing intermediate part 58 at a point spaced apart from a leading edge 59 of the trailing intermediate part 58 such that a leading edge region of the trailing intermediate part 58 projects in a preferably upstream direction to at least in part define the air-flow channel 14. It will be appreciated that the leading edge of the trailing intermediate part may meet the unbroken transition such that it does not protrude, if preferred.

[0050] For adjacent vent-louvre members 12 defining an exterior air-flow path 16 therebetween, a first distance D 1 is defined as being from the leading-edge region 54 of the upper active-surface portion 52 of a vent-louvre member 12 to the first lower active-surface portion 30 of an upper/ above and adjacent vent-louvre member 12. A second distance D2 is defined as being from the trailing-edge region 56 of the upper active-surface portion 52 of the said vent-louvre member 12 to the second lower active-surface portion 64 of the said upper/above and adjacent vent-louvre member 12. Here the first and second distances D1, D2 match or substantially match thereby ensuring that the airflow channel 14 and thus the exterior air-flow path 16 defined by the air-flow channel 14 is substantially uniform in the lateral extent. The matching or substantially matching distances and/or the overall uniformity of the air-flow path 16 is such that air-flow turbulence at or downstream of the crown part 22 is reduced or prevented. This improves the entrained moisture retention and removal by preventing moisture from being re-entrained during potential turbulence.

[0051] A third distance D3 is defined as being between the apex of the crown part 22 of the lower vent-louvre member 12 and the apex of the crown part 22 of an adjacent upper vent-louvre member 12. The third distance D3 is here preferably greater than both the first and second distances D1, D2, though it is appreciated that the third distance D3 may in fact be the same as the first and/or second distance D1, D2. Whilst defined above, it is appreciated that a third distance may alternatively be defined between the apex of the crown part of a lower vent-louvre member and a highest point on the lower surface of the upper vent-louvre member.

[0052] Each trailing baffle 20 of each vent-louvre member 12 preferably comprises a trailing end part 68 positioned downstream and spaced apart from the trailing intermediate part 58, and here at a proximal end of the vent-louvre member 12. The trailing end part 68 and the trailing intermediate part 58 are preferably aligned with a direction substantially parallel with the in use air-flow path 16 and spaced apart from each other, here in a substantially downwards direction. The trailing end part 68 preferably has a similar lateral profile as the trailing intermediate part 58 but here is directed downwards to a substantially greater degree than the trailing intermediate part 58. Although described in this way, it is appreciated that the trailing end part 68 may in fact have the same lateral profile as the trailing intermediate part 58. The trailing end part 68 preferably has an under surface 70 and a third lower active-surface portion 72 is here defined on at least part of the under surface 70 of the trailing end part 68. The third lower active-surface portion 72 may here be concave, although it is appreciated that it may in fact be planar or substantially planar.

[0053] Given the spacing of the second and third lower active-surfaces 64, 72 of each vent-louvre member 12, they together preferably form a discontinuous trailing low-

er active-surface 74.

[0054] Although spaced apart from one another, a curvate bridging part 76 connects the trailing end part 68 and the trailing intermediate part 58. The bridging part 76 here does not extend from a proximal edge 77 of the trailing intermediate part 58 and the distal edge 78 of the trailing end part 68, but instead extends from adjacent to these edges 77, 78 such that a proximal edge region of the trailing intermediate part 58 and a distal edge region of the trailing end part 68 project beyond their respective meeting point of the bridging part 76. It will be appreciated that one or both the proximal edge of the trailing intermediate part and the distal edge of the trailing end part may meet the bridging part.

[0055] The bridging part 76 here preferably extends upwards from each of the trailing parts 58, 68. A further upper active-surface portion 79 is defined on a convex upper surface 80 of the bridging part 76. The further upper active-surface portion 79 preferably has the same or substantially the same curvature as that of the upper active-surface portion 52 and extends parallel with the in use air-flow path 16; however, the further upper active-surface portion 79 may be spaced apart from the upper active-surface portion 52 in a downstream, and thus here a downwards, direction. In this way, the further upper active-surface portion 79 and the upper active surface portion 52 together form a discontinuous upper active surface 82.

[0056] Whilst the further upper active-surface portion 79 is herein defined and so named, it is appreciated that the further upper-active surface portion 79 may in fact not actively and/or directly guide the active air-flow. The further upper-active surface portion 79 would nevertheless define a portion of the lateral extent of the air-flow channel 14 and therefore would help to ensure that the lateral extent of the air-flow channel 14 and/or the air-flow path 16 has a uniform cross-section or height.

[0057] The spacing apart of the discontinuous upper and lower active-surfaces 74, 82 of each vent-louvre member 12 here creates the flow guidance characteristics of a virtually thicker trailing baffle 20 than that which would be able to be achieved with the same amount of material and a conventional louvre member design.

[0058] At the proximal end of the trailing end part 68 a preferably upstanding projection 84 is positioned.

[0059] The arrangement of the trailing baffle 20 in the above described manner defines a second channel 86 and a third channel 88. The second channel 86 is defined by the upstanding projection 84, an upper surface of the trailing end part 68 and an adjacent portion of the upper-surface of the bridging part 76. The third channel 88 is defined by the unbroken transition 66, the upper-surface 62 of the trailing intermediate part 58 and the adjacent portion of the upper surface of the bridging part 76.

[0060] In order to join the leading louvre 18 with the trailing baffle 20, each vent-louvre member 12 preferably has a joining means 90. The joining means 90 preferably first comprises an elongate louvre connecting member 92 which projects from the under surface 26 of the leading louvre 18 and adjacent the recurve 42. Similarly, an elongate baffle connecting member 94 preferably projects from the under-surface of the crown part 22. The baffle connecting member 94 is convex and has a hook portion 96 which, together with the leading-edge region 54 of the crown part 22 form jaws for retaining the recurve 42 and the louvre connecting member 92 therebetween.

[0061] Due to the relative displacement of the upper or lower active-surface portions in a vertical direction and/or a direction parallel to the lateral extent of the air-flow path 16, the lateral extent of the trailing baffle 20 can be considered to be undulating.

[0062] This embodiment of the vent-louvre member 12 may preferably be formed substantially or entirely from aluminium or an alloy of aluminium. Alternatively, at least a majority of the trailing baffle 20 may be formed from aluminium or an alloy of aluminium.

[0063] In order to install the exterior vent-louvre assembly 10, a bracket may be fixed to, or adjacent to, the opening to be protected by the exterior vent-louvre assembly 10. The bracket may have a plurality of vertically spaced apart sets of arms, each set having of at least two laterally spaced apart arms. Each arm may project outwardly from the building and a vent-louvre member 12 may be attached to each set of arms forming a plurality of spaced apart vent-louvre member 12. It may be that only the leading louvre 18 of each vent-louvre member 12 is attached to the bracket. Each vent-louvre member 12 is orientated as initially described.

[0064] In use, to attach the trailing baffle 20 to the leading louvre 18, the crown part 22 and the baffle connecting member 94 may be temporarily deformed, pivoted or extended so as to be angled away from one another such that the space between the crown part 22 and the baffle connecting member 94 is widened or increased. The crown part 22 is the positioned such that it abuttably engages an edge portion of the recurve 42 of the leading louvre 18. The baffle connecting member 94 is similarly positioned such that the hook portion 96 is able to abuttably engage the louvre connecting member 92. The crown part 22 and/or the baffle connecting member 94 are then released so that they revert to their original spacing and the leading louvre 18 is gripped by the crown part 22 and the baffle connecting member 94. The crown part 22 and the baffle connecting member 94 can be considered to form jaws which grip the leading louvre 18. The trailing baffle 20 and the leading louvre 18 are thus secured together. It will be appreciated that if the leading louvre and the trailing baffle are integrally formed as one piece, then one or more parts of the joining means may be dispensed with.

[0065] Having been installed, two adjacent vertically spaced apart vent-louvre members 12, one upper vent-louvre member 12 and one lower vent-louvre member 12, define the air-flow channel 14 therebetween which in turn at least in part defines an air-flow path 16. The lateral extent of the airflow path 16 between the upper active-

surface portion 52 of the lower vent-louvre member 12 and the second lower active-surface portion 64 of the upper vent-louvre member 12 is consistent with the lateral extent of the flow path between the further upper active-surface portion 79 portion of the lower vent-louvre member and the third lower active-surface portion 72 of the upper vent-louvre member 12. In this way, the lateral extent of the exterior air-flow path 16 along the trailing baffle 20 has a constant or a substantially constant cross section across its lateral extent.

[0066] An inlet 98 of the exterior air-flow path 16 is defined between the upstream or distal ends of the leading louvres 18 through which air is able to enter. The air may be caused to enter the exterior air-flow path 16 by the presence of a pressure gradient or differential. This pressure gradient may be lower towards a downstream end or proximal end than an upstream end of the air-flow path 16, and the pressure at the upstream end may be lower that the pressure external to the exterior vent-louvre assembly. The pressure gradient along the exterior air-flow path 16 may be generated by fans which may be positioned downstream of the louvres and within the opening of the building.

[0067] Having entered the inlet 98 of the exterior air-flow path 16, the air is guided upwards by the first lower active-surface portion 30 of the leading louvre 18 of the upper vent-louvre member 12 and the upper surface 24 of the leading louvre 18 of the lower vent-louvre member. The curvate shape of the upper surfaces 24 reduces turbulence effects as the air is directed upwards and promotes laminar flow.

[0068] Un-entrained atmospheric moisture, such as wind driven rain, which may have entered through the inlet 98 of the exterior air-flow path 16, would be prevented from following the exterior airflow path 16 upwards due to the barrier provided by the leading louvre 18; the pressure differential within the exterior air-flow path 16 would be insufficient to draw un-entrained moisture over the leading louvre 18 of the lower vent-louvre member 12. This moisture would instead impact the upper surface 24 of the lower louvre and run off down into the first channel 40.

[0069] Additionally, air with entrained moisture is typically heavier than air without entrained moisture, and therefore would be positioned vertically lower within the air-flow. This moisture laden air would meet and be returned upstream by the recurve 42 positioned at the downstream or proximal end of the leading louvre 18 of the lower louvre. Moisture may be precipitated out of this returned air which may run off into the first channel 40.

[0070] Air with less moisture is guided upwards and over the crown part 22 of the lower louvre.

[0071] Figure 3, which although shows a second embodiment of the exterior vent-louvre assembly which will be described below, illustrates the exterior air-flow 16 applicable to all embodiments in accordance with the first, second, third, fourth and fifth aspects of the present invention. As illustrated, active air-flow would be unable to reach the under-surface of the downstream end or proximal end of the leading louvre 18 of the upper vent-louvre member 12 as well being unable to reach the under-surface of the crown part 22 and the bridging part 76. The volume of air adjacent to these under-surfaces may be considered to be relatively stationary by comparison with the active air-flow path and may form an area of high pressure. The lateral cross-section of the air-flow path therefore preferably does not include the cross-section of this volume of air.

[0072] Having passed the crown part 22, the air at or adjacent to the bottom of the exterior air-flow path 16 is gradually directed and/or guided downwards by the convex nature of the upper active-surface portion 52. The air towards the top of the exterior air-flow path 16 is similarly directed and/or guided downwards by the concave nature of the second lower active-surface portion 64 of the upper vent-louvre member 12. In this way, the whole airflow is gradually guided downwards from the crown part 22. The cross section of the air flow remains constant in the lateral direction in the region adjacent to and downstream of the crown part 22 and thus there is no Venturi effect formed which reduces turbulence around this region as compared to if there was a variation in the lateral cross-section. Laminar flow of the air is instead promoted. The lack of turbulence ensures that water which may have been precipitated out of the airflow is not re-entrained and thus less moisture may be included in the airflow directed towards the building than in a conventional louvre arrangement.

[0073] Having been directed downwards by the upper active-surface portion 52 and the second lower active-surface portion 64, the airflow may not enter the third channel 88 of the lower vent-louvre member 12 or the volume below the bridging part 76 of the upper vent-louvre member 12 louvre. These volumes instead may be occupied by high pressure and the airflow is guided towards the building. Moisture which may have precipitated on contact with the second lower active-surface portion 64 and the upper active-surface portion 52 may collect or collate within the third channel 88. The third lower active-surface portion 72 and the further upper active-surface portion 79 may now gradually guide the airflow further downwards, out of the air-flow channel 14, and towards the building. Water which may have precipitated over or at the third lower active-surface portion 72 and the further upper active-surface portion 79 may collect or collate within the second channel 86.

[0074] The extent of the air-flow path 16 adjacent to the trailing baffle 20 may be considered to be firstly defined by the second lower active-surface portion 64, a portion of which may be referred to as an under-surface of a first said upwardly-facing surface portion, which is previously referred to as the leading ledge of the trailing intermediate part 58. The extent of the air-flow path 16 adjacent to the trailing baffle 20 may additionally be considered to be defined by the spacing of at least a portion of the further upper active-surface portion 79, which may

alternatively be referred to as the second upwardly-facing surface portion, and the trailing edge, or proximal edge of the trailing end part 68, of an above and adjacent vent-louvre member 12.

[0075] The trailing extent of neighbouring and/or adjacent air-flow paths 16 as defined may be considered to diverge from one another towards their respective trailing edges, or proximal edge of their respective trailing end parts 68, whilst maintaining a substantially uniform lateral extent between the leading and trailing edges of the vent-louvre members 12.

[0076] Whilst the leading louvre 18 and trailing baffle 20 are described and shown as being attached and used in conjunction with one another, it is appreciated that they may in fact be used separately. In particular, a plurality of leading louvres 18 may be installed and used without corresponding trailing baffles 20. In the event that corresponding trailing baffles 20 are desired to be installed subsequently and in addition to the leading louvres 18, a trailing baffle 20 may be retrofitted to each leading louvre 18 in the way previously described.

[0077] Figure 3 shows the second embodiment of the exterior vent-louvre assembly 110 with in use airflow flowing between adjacent pairs of vent-louvre members 112. Elements which are similar or identical to those of the preceding embodiment are denoted by the same or similar reference number with one hundred added, and further detailed description is omitted.

[0078] The second and first embodiments differ only in that the leading edge region of the trailing intermediate part 158 beyond the unbroken transition 166 projects further upstream in the second embodiment than in the first embodiment. This representation illustrates the constant or substantially constant exterior air-flow path 116 created by the second embodiment of the present invention in use. Given the similarity between the first and second embodiments, Figure 3 serves as evidence of the constant or substantially exterior air-flow of the first embodiment, as well as the second embodiment.

[0079] Referring to Figure 4 there is shown a third embodiment of the exterior vent-louvre assembly 210 having a continuous upper active-surface 282 and a continuous trailing lower active-surface 274. Elements which are similar or identical to those of the first embodiment are denoted by the same or similar reference number with two hundred added, and further detailed description is omitted.

[0080] The leading louvre 218 of this embodiment is similar and/or identical to the previous two embodiments.

[0081] The trailing baffle 220 of the third embodiment retains a similar or the same air-flow path 216, with the exception that the lateral profile of the trailing baffle 220 is adjusted to form an air-flow channel 214 which further guides the air-flow path 216.

[0082] The unbroken transition 266 here directly extends from the upper active-surface portion 252 to the bridging part 276. The unbroken transition 266 is thus contiguous with both the crown part 222 and the bridging part 276. Preferably the unbroken transition 266 here is or is substantially not curvate and is thus preferably planar. This arrangement forms a continuous trailing upper member 300. The upper active-surface portion 252, the further upper active-surface portion 279 and the unbroken transition 266 are thus joined to form the single continuous upper active-surface 282.

[0083] Similarly, a lower joining portion 302 preferably extends from a trailing edge of the trailing intermediate part 258 to the trailing end part 268 and is therefore contiguous with these parts. The lower edge of the trailing intermediate part 258 is additionally extended in an upstream direction and is joined to the baffle connecting member 294. This arrangement forms a continuous trailing lower member 304. The second and third lower active-surfaces 264, 272 are thus joined to form the single continuous trailing lower active-surface 274. The continuous trailing lower active-surface 274 is here preferably curvate and more preferably concave.

[0084] As before, the upper and lower active surfaces 274, 282 are spaced apart in a vertical direction with respect to the exterior air-flow path 216.

[0085] A first strut 306 and a second strut 308 may be provided and may preferably extend from an upper-surface of the trailing lower member 304 to a lower-surface of the trailing upper member 300, providing structural integrity thereto. The first and second struts 306, 308 are here preferably spaced apart and are here elongate such that they define three internal channels within a body of the trailing baffle 220. In this way, the trailing baffle 220 is at least in part hollow. Although described as having two struts, it is appreciated that there may in fact be fewer than two struts or more than two struts. Similarly, although the trailing baffle is described as being hollow, it is appreciated that it may in fact be substantially solid.

[0086] An upstanding projection 284 is positioned at an end of the trailing end part 268 of the trailing baffle 220 in the same way as the first embodiment and a second channel 286 is defined similarly as the first embodiment.

[0087] In use, the third embodiment may be installed in a similar or the same way to the first and second embodiments. An air-flow channel 214 is defined between adjacent upper and lower vent-louvre members 212 and an exterior air-flow path 216 defined by at least part of the air-flow channel 214. The air-flow channel 214 at the trailing baffle 220 is here defined as being between the continuous lower active-surface 274 of the upper vent-louvre member 212 and the continuous upper active-surface 282 of the lower vent-louvre member 212. Air in use flows through the air-flow channel 214 to form the exterior air-flow path 216 in the same way as air in use flows through the initially described embodiment.

[0088] The third embodiment is particularly suited to being formed from plastics or a polymer-matrix composite as the trailing baffle provides the structural integrity required and thus the exterior vent-louvre assembly may be formed from materials that are lighter in weight than

aluminium. Alternatively, at least a majority of the trailing baffle of the first, second or third embodiments may be formed from plastics or a polymer-matrix composite.

[0089] The trailing baffle, or the entire vent-louvre member, of the first, second or third embodiments may be formed via an extrusion process.

[0090] Whilst the vent louvre assembly is described as being exterior to a building and having an exterior air-flow path, it is appreciated that the vent louvre assembly may at least in part be positioned inside and thus have an, at least in part, interior air-flow path.

[0091] The embodiments illustrated may be considered to have a plurality of exterior vent-louvres for reducing turbulence and defining an arcuate air-flow path having a substantially uniform top-to-bottom lateral extent therealong, the vent-louvre including a leading louvre element extending to a crown element from a leading edge, and a trailing louvre element which extends from the crown part to a trailing edge, the trailing louvre element having offset surfaces to define one or more active air-guide portions.

[0092] The illustrated embodiments may also be considered to have a plurality of exterior vent-louvres for reducing turbulence and defining an arcuate air-flow path having a substantially uniform top-to-bottom lateral extent therealong, the vent-louvre including a leading louvre element extending to a crown element from a leading edge, and a trailing louvre element which extends from the crown part to a trailing edge, the trailing louvre element having an undulating surface to define one or more active air-guide portions.

[0093] It is therefore possible to provide an exterior vent-louvre assembly which may be comprised of a plurality of vent-louvre members which here delimit an air-flow. Each vent-louvre member has an upwardly directed portion and a downwardly directed portion with the downwardly directed portion having spaced apart upper and lower flow guidance surfaces which maintain a constant or substantially constant lateral cross section of the air-flow path. This minimises turbulence of airflow therethrough.

[0094] The words 'comprises/comprising' and the words 'having/including' when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps or components, but do not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

[0095] It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination.

[0096] The embodiments described above are provided by way of examples only, and various other modifications will be apparent to persons skilled in the field without departing from the scope of the invention as defined herein.

PREFERRED EMBODIMENTS OF THE DIVISIONAL APPLICATION FORMING PART OF THE DESCRIPTION ONLY

[0097] An exterior vent-louvre assembly (10; 110; 210) comprising:

at least two vertically spaced-apart exterior vent-louvre members (12) which define an exterior air-flow path (16) having a substantially uniform lateral extent therebetween;
an under-surface (26) of a leading intermediate part (28) of each vent-louvre member (12) having a first lower active-surface portion (30);
an under-surface of a trailing intermediate part (58) of each vent-louvre member (12) having a second lower active-surface portion (64);
an upper-surface (50) of a crown part (22) of each vent-louvre member (12) including an unbroken transition (66) to the trailing intermediate part (58) and having an upper active-surface portion (52);
a first distance (D1) from a leading-edge region (54) of the upper active-surface portion (52) of each vent-louvre member (12) to the first lower active-surface portion (30) of an above and adjacent vent-louvre member (12) matching or substantially matching a second distance (D2) from a trailing-edge region (56) of the upper active-surface portion (52) of said vent-louvre member (12) to the second lower active-surface portion (64) of the said above and adjacent vent-louvre member (12), whereby the matching or substantially matching said first and second distances (D1, D2) prevent or reduce air-flow turbulence at or downstream of the crown part (22) to improve entrained moisture removal.

[0098] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the exterior airflow path (16) is or is substantially arcuate.

[0099] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein a third distance (D3) between apexes of opposing crown parts (22) is greater than the first and second distances (D1, D2).

[0100] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the unbroken transition (66) of each vent-louvre member (12) is curvate.

[0101] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the unbroken transition (66) faces a downstream direction.

[0102] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein at least part of the leading-edge region (54) of the upper active-surface portion (52) of each vent-louvre member (12) faces an upstream direction.

[0103] An exterior vent-louvre assembly (10; 110; 210)

as defined above, wherein at least part of the trailing-edge region (56) of the upper active-surface portion (52) of each vent-louvre member (12) faces a downstream direction.

[0104] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein each vent-louvre member (12) further comprises a further upper active-surface portion (79) positioned downstream and vertically spaced apart from the said upper active-surface portion (52) of the crown part (22), the said upper active-surface portion (52) and the further upper active-surface portion (79) together defining an upper active-surface (74).

[0105] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein each vent-louvre member (12) further comprises a third lower active-surface portion (72) positioned downstream and vertically spaced apart from the second lower active-surface portion (64), the second and third lower active surface portions (64, 72) together defining a trailing lower active-surface (74).

[0106] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the further upper active-surface portion (79) is provided on a bridging part (76), and the third lower active surface portion (72) is provided on a trailing end part (68), the trailing end part (68) being downstream of the bridging part (76).

[0107] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the upper active-surface and the trailing lower active-surface (74) are spaced apart in a lateral direction of the air-flow path (16).

[0108] An exterior vent-louvre assembly (10; 110) as defined above, wherein the upper active-surface (82) is discontinuous.

[0109] An exterior vent-louvre assembly (210) as defined above, wherein the unbroken transition (266) forms part of the upper active-surface (282), the upper active-surface (282) being continuous.

[0110] An exterior vent-louvre assembly (10; 110) as defined above, wherein the trailing lower active-surface (74) is discontinuous.

[0111] An exterior vent-louvre assembly (210) as defined above, wherein the trailing lower active-surface (274) is continuous.

[0112] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the crown part (22) of each vent-louvre member (12) separates an upwardly directed leading louvre (18), having the leading intermediate part (28) and leading-edge and trailing edge regions (54,56), and a downwardly directed trailing baffle (20), having the trailing intermediate part (58) and leading edge and trailing edge regions (59), of the vent-louvre member (12).

[0113] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein each vent-louvre member (12) further comprises an upturned or a substantially upturned nose portion (34) at or adjacent to the leading-edge region (54) of the leading louvre (18), forming a first channel (40).

[0114] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein each vent-louvre member (12) further comprises a second channel (86) formed at or adjacent to the trailing-edge region of the trailing baffle (20).

[0115] An exterior vent-louvre assembly (10; 110) as defined above, wherein each vent-louvre member (12) further comprises a third channel (88) formed between the trailing-edge region of the trailing baffle (20) and the crown part (22).

[0116] An exterior vent-louvre assembly (10; 110) as defined above, wherein the second and third channels (86, 88) are spaced apart.

[0117] An exterior vent-louvre assembly (10; 110) as defined above, wherein the third channel (88) is in part defined by the trailing intermediate part (58) and the unbroken transition (66).

[0118] An exterior vent-louvre assembly (10; 110) as defined above, wherein the bridging part (76) is provided between the second and third channels (86, 88).

[0119] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein each vent-louvre member (12) further comprises a recurve (42) formed at the trailing-edge region (56) of the leading louvre (18).

[0120] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein the crown part (22) of each vent-louvre member (12) is laterally aligned with the recurve (42) of the leading louvre (18), and is laterally and vertically displaced from the remainder of the leading louvre (18).

[0121] An exterior vent-louvre assembly (210) as defined above, wherein the trailing baffle (220) of each vent-louvre member (212) is at least in part hollow.

[0122] An exterior vent-louvre assembly (210) as defined above, the trailing baffle (220) further comprising at least one supporting strut (306, 308) therein.

[0123] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein a majority of the trailing baffle (20) of each vent-louvre member (12) is formed from an alloy of aluminium.

[0124] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein a majority of the trailing baffle (20) of each vent-louvre member (12) is formed from plastics or a polymer-matrix composite.

[0125] An exterior vent-louvre assembly (10; 110; 210) as defined above, wherein each vent-louvre member (12) is elongate.

[0126] A method of forming a uniform or substantially uniform air-flow path (16) between two vertically spaced-apart arcuate exterior vent-louvre members (12) with reduced turbulence, the method comprising the steps of:

a) providing a stepped unbroken transition (66) at or downstream of a crown part (22) thereby vertically separating upper and lower active-surface portions (30, 64) and as such neighbouring flow paths (16); and

b) providing at least first and second lower active-surface portions (30, 64) and at least one upper active-surface portion (52), wherein a first distance

(D1) from a leading-edge region (54) of the upper active-surface portion (52) of each vent-louvre member (12) to the first lower active-surface portion (30) of an above and adjacent vent-louvre member (12) matches or substantially matches a second distance (D2) from a trailing-edge region (56) of the upper active-surface portion (52) of said vent-louvre member (12) to the second lower active-surface portion (64) of the said above and adjacent vent-louvre member (12), the matching or substantially matching said first and second distances (D1, D2) preventing or reducing air-flow turbulence at or downstream of the crown part (22) to improve entrained moisture removal.

[0127] An exterior vent-louvre assembly (10; 110; 210) for reducing turbulence, the vent-louvre assembly (10; 110; 210) comprising at least three vertically spaced-apart exterior vent-louvre members (12) which define neighbouring exterior air-flow paths (16), each path (16) having a substantially uniform lateral extent therealong, each said vent-louvre member (12) including a leading louvre element (18) extending to a crown element (22) from a leading edge, and a trailing louvre element (20) which extends from the crown part (22) to a trailing edge, the trailing louvre element (20) having two upwardly-facing surface portions which are in use vertically offset from each other in a lateral direction of the airflow path (16) and spaced from the trailing edge, at least a portion of an under-surface of the first said upwardly-facing surface portion (58) having a first lower active-surface portion (64) defining at least part of a neighbouring air-flow path (16), and at least a portion of the second said upwardly-facing surface portion being downstream of the first upwardly-facing surface portion (58) and the trailing edge of the vent-louvre member (12) above defining the or substantially the lateral extent of the air-flow path (16) therebetween, whereby the neighbouring air-flow paths (16) so defined diverge towards their respective trailing edges whilst maintaining a substantially uniform lateral extent between the leading and trailing edges.

[0128] An exterior vent-louvre (10; 110; 210) for reducing turbulence and defining an arcuate airflow path (16) having a substantially uniform top-to-bottom lateral extent therealong, the vent-louvre (10; 110; 210) including a leading louvre element (18) extending to a crown element (22) from a leading edge, and a trailing louvre element (20) which extends from the crown part (22) to a trailing edge, the trailing louvre element (20) having an undulating surface to define one or more active air-guide portions.

[0129] An exterior vent-louvre (10; 110; 210) for reducing turbulence and defining an arcuate airflow path (16) having a substantially uniform top-to-bottom lateral extent therealong, the vent-louvre (10; 110; 210) including a leading louvre element (18) extending to a crown element (22) from a leading edge, and a trailing louvre element (20) which extends from the crown part (22) to a trailing edge, the trailing louvre element (20) having offset surfaces to define one or more active air-guide portions.

Claims

1. An exterior vent-louvre (10; 110; 210) comprising:

   a leading louvre element (18) extending to a crown element (22) from a leading edge; and
   a trailing louvre element (20) which extends from the crown element (22) to a trailing edge;
   characterised by the trailing louvre element (20) having offset surfaces to define one or more active air-guide portions (74, 82) to enable flow guidance characteristics of a virtually thicker trailing louvre element.

2. An exterior vent-louvre (10; 110; 210) as claimed in claim 1, wherein the offset surfaces are formed by the trailing louvre element (20) having a discontinuous or broken under-surface (48, 64).

3. An exterior vent-louvre (10; 110; 210) as claimed in claim 1 or claim 2, wherein the offset surfaces are formed by the trailing louvre element (20) having an undulating under-surface (48, 64).

4. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein the offset surfaces are formed by the trailing louvre element (20) having an irregular upper-surface (82).

5. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein the offset surfaces are formed by the trailing louvre element (20) having a sharply undulating under-surface (48, 64).

6. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein the trailing louvre element (20) includes two lower active-surface portions (64, 72) which are spaced apart by an offset bridging element (76).

7. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein an or the said offset bridging element (76) interconnects a trailing intermediate part (58) and a trailing end part (68) of the trailing louvre element (20).

8. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein two said active air-guide portions (64, 72) are spaced-apart by a channel formed by the or a bridging element (76) therebetween, the said two active air-guide portions (64, 72) overhanging the channel.

9. An exterior vent-louvre (10; 110; 210) as claimed in any one of claims 6 to 8, wherein a proximal edge region of the or a trailing intermediate part (58) and a distal edge region of the or a trailing end part (68) project beyond respective meeting points of the bridging element (76).

10. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein a first one of the said offset surfaces is or is substantially flat or has a minor radius of curvature, and a second one of the said offset surfaces has a major radius of curvature.

11. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein upper and lower active air-guide portions (74, 82) are discontinuous and laterally spaced-apart.

12. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein a proximal end of the or a trailing end part (68) includes an upstanding projection (84), the one or more active air-guide portions (74, 82) being spaced therefrom and towards the crown element (22).

13. An exterior vent-louvre (10; 110; 210) as claimed in any one of the preceding claims, wherein an upper active air-guide portion (82) has upstream and downstream channels (86, 88) either side thereof.

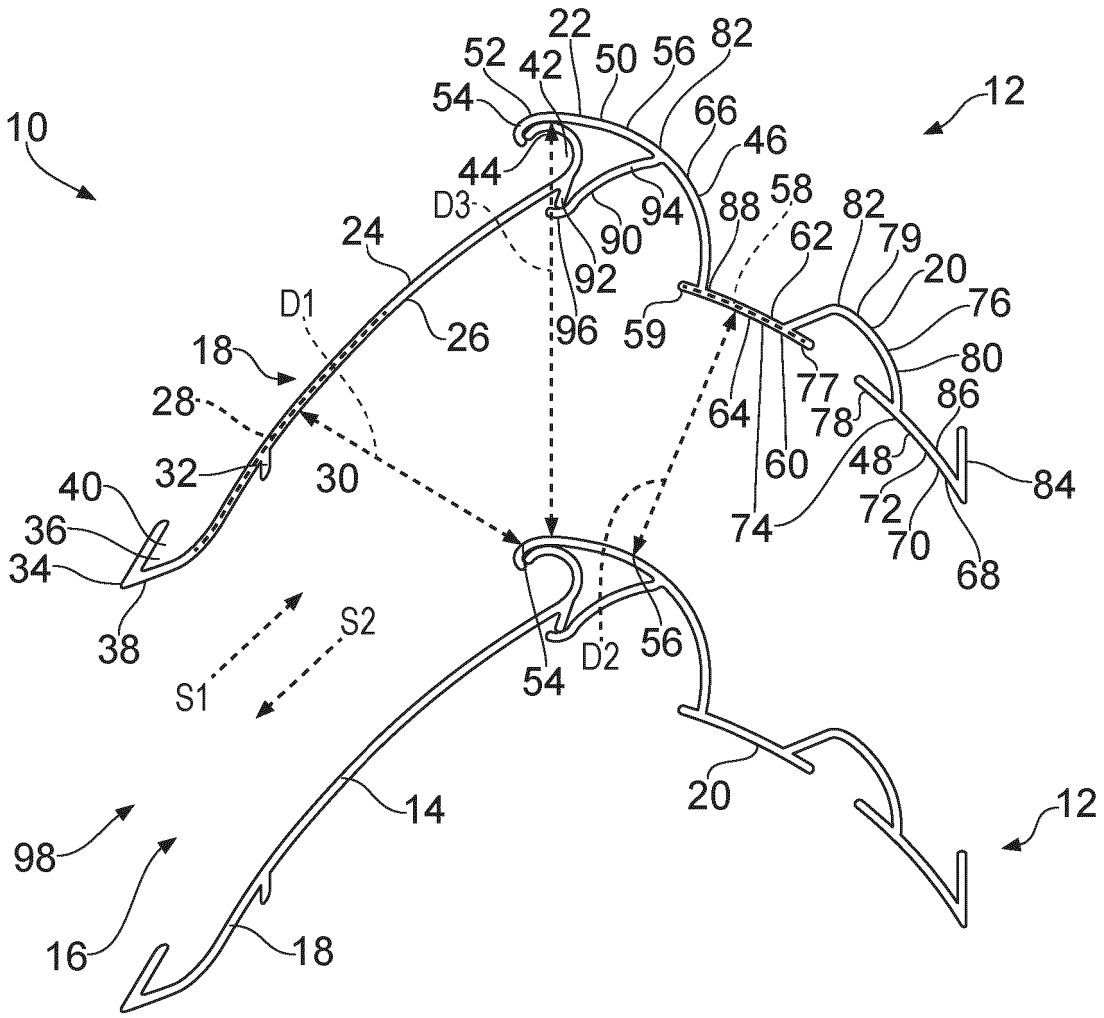
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FIG. 1

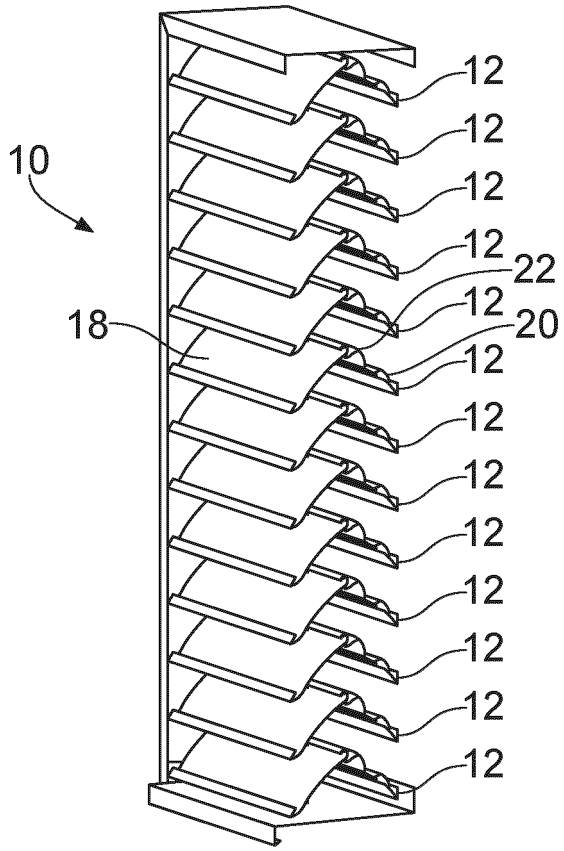
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FIG. 2

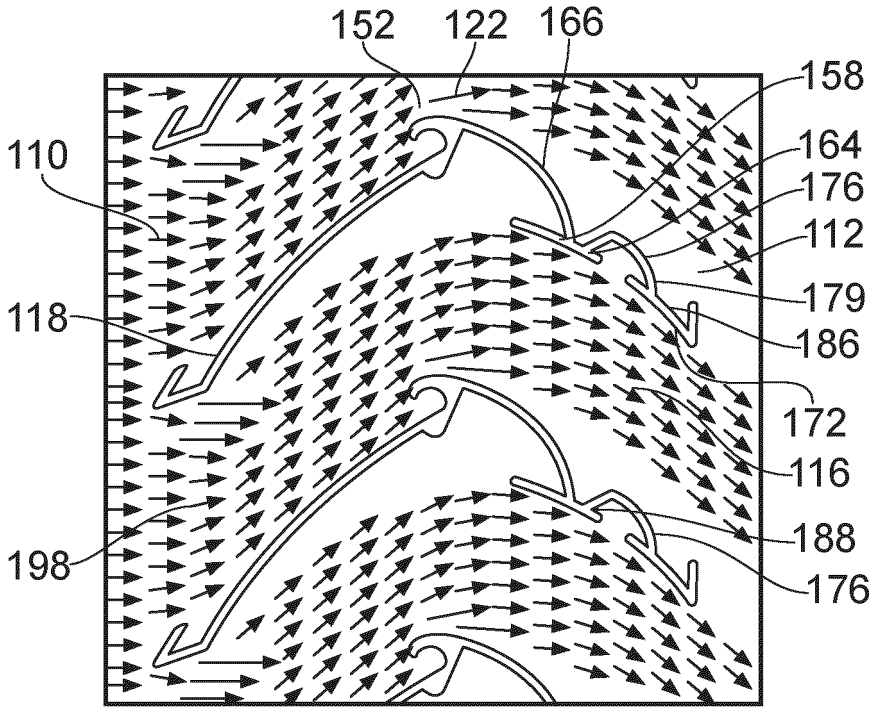
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FIG. 3

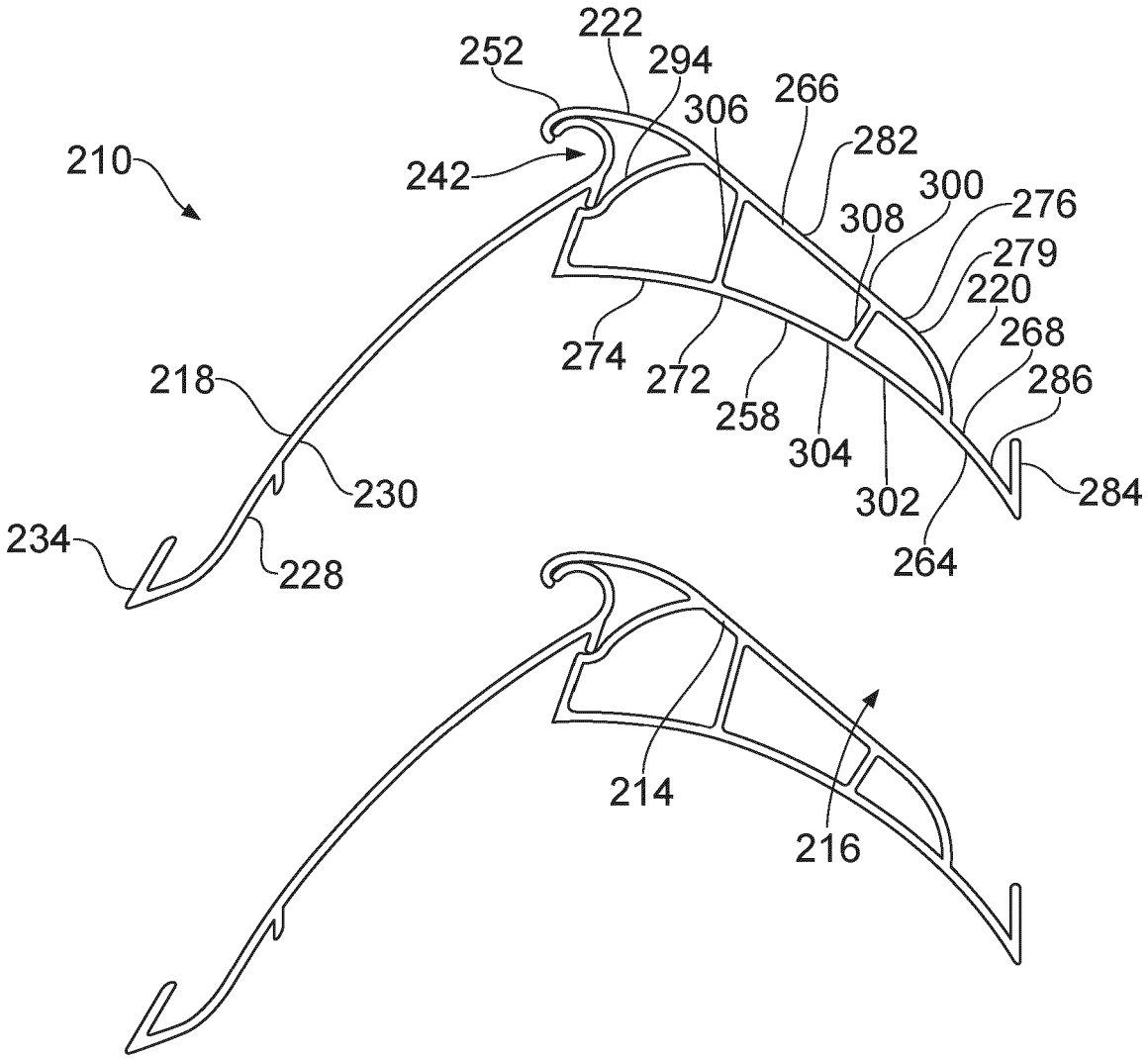
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FIG. 4