(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 343 223 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.03.2024 Bulletin 2024/13

(21) Application number: **23198945.0**

(22) Date of filing: **21.09.2023**

(51) International Patent Classification (IPC):
F24F 12/00 *(2006.01)* ***F24F 13/20*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F24F 12/006; F24F 2013/205

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **21.09.2022 NL 2033091**

(71) Applicant: **Groupe Atlantic Nederland B.V.**
3905 PE Veenendaal (NL)

(72) Inventors:
- **TUIJP, Bram**
  AMERSFOORT (NL)
- **KOENDERS, René**
  GENNEP, LIMBURG (NL)
- **BRUIS, Sander**
  EDE (NL)
- **WESTERBEEK, Maarten**
  ZEIST (NL)
- **VAN KESSEL, Britt**
  EERBEEK (NL)

(74) Representative: **Ipsilon**
Le Centralis
63, avenue du Général Leclerc
92340 Bourg-la-Reine (FR)

(54) DUAL FLOW VENTILATION UNIT WITH TILTED FANS

(57) The invention provides a dual-flow ventilation unit (10) for extracting exhaust air from at least one room and blowing fresh air into said at least one room, said dual-flow ventilation unit (10) having a casing (12) comprising a first and a second main walls (22, 24) opposite each other and a plurality of lateral walls (26, 28) extending between said first and second main walls, said casing comprising:
- a thermal exchanger (42),
- a first (21) and a second (17) flow circuits extending at least partially through the thermal exchanger (42),
- ventilation means for moving air through said first and second flow circuits, said ventilation means comprising a fan comprising a fan air inlet for sucking air through the first flow circuit,
characterized in that said fan air inlet is at least partially oriented towards said exchanger air outlet.

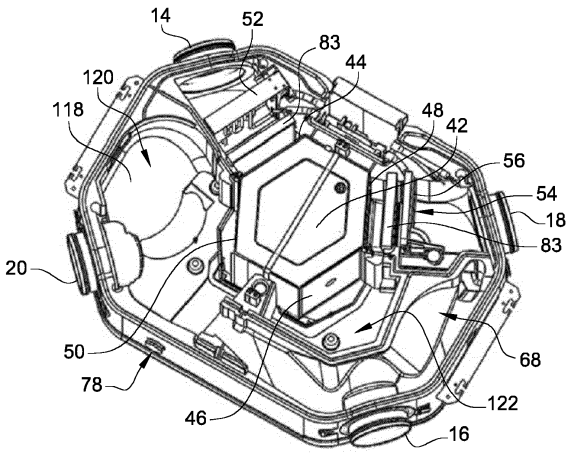

Fig. 2

EP 4 343 223 A1

Description

[0001] The invention concerns a dual flow ventilation system for a room. Particularly, the invention concerns a dual flow ventilation unit which can be operated with different orientations.

[0002] A dual ventilation system aims at extracting exhaust air from one or more rooms, for example from a house or a building, and blowing fresh air into said rooms to renew and thus purify the air of the rooms. The dual ventilation system comprises a fresh air circuit and an exhaust air circuit.

[0003] The dual ventilation system also comprises a thermal exchanger disposed at a junction between the exhaust and fresh air circuits to heat up the fresh air blown into the rooms with the exhaust air extracted from the room. This thermal exchanger is used when the temperature of the outside fresh would interfere with the comfort of the users.

[0004] A dual ventilation system comprises a dual flow ventilation unit having a casing connected to both fresh and exhaust air circuits to form a junction between these two circuits within the casing. A thermal exchanger is disposed within the casing at this junction.

[0005] The casing comprises two main walls opposite to each other and a plurality of lateral walls extending between the two main walls to form an internal cavity. Part of the fresh and exhaust air circuits as well as the thermal exchanger are installed within said internal cavity.

[0006] The known units further comprise two fans disposed within this internal cavity, each disposed through one of the fresh and exhaust air circuits. These fans are commonly centrifugal fans having an air inlet and an air outlet perpendicular to each other. The fans are installed into the casing such that the air outlet is connected to an air outlet of the casing and the air inlet is in fluid communication with an air outlet of the thermal exchanger. Since the air outlets of the casing generally extend through a lateral wall, in a same plane or in a plane parallel to the air outlet of the thermal exchanger, the air inlet of the fans is oriented perpendicularly to the air outlet of the thermal exchanger. The air inlet of the fan is generally perpendicular to the two main walls.

[0007] This orientation of the fans leads to high pressure loss since the air is sucked by the fan perpendicularly to the air outlet of the thermal exchanger. This pressure loss decreases the efficiency of the fan.

[0008] Furthermore, the fans are generally secured to the casing by screwing the fan to a main wall with the air outlet connected to an air outlet of the casing. A main wall is built-up as a casing cover enabling to close the internal cavity of the casing.

[0009] Installing or removing a fan thus implies to first reach a first main wall to screw or unscrew the fan and then reach the second main wall built-up as casing cover to connect or disconnected the fan to or from the air outlet of the casing. Installing or removing a fan from known units thus requires reaching both sides of the casing which is very inconvenient, particularly when the unit if connected to the fresh and exhaust air circuits of the building.

[0010] There is a need for an improved dual flow ventilation unit allowing to increase the efficiency of the fans as well as facilitate the installation or removing operation of the fans.

[0011] To solve this problem, the invention provides a dual-flow ventilation unit for extracting exhaust air from at least one room and blowing fresh air into said at least one room, said dual-flow ventilation unit having a casing comprising a first and a second main walls opposite each other and a plurality of lateral walls extending between said first and second main walls, said casing comprising:

- a thermal exchanger,
- a first and a second flow circuits extending at least partially through the thermal exchanger to transfer heat from air flowing through one of said first and second flow circuits to air flowing through the other one among said first and second flow circuits, said first flow circuit comprising a casing air outlet formed through the casing,
- ventilation means for moving air through said first and second flow circuits, said ventilation means comprising a fan comprising a fan air inlet for sucking air through the first flow circuit and a fan air outlet connected to said casing air outlet for blowing air through said casing air outlet, said fan being disposed between said casing air outlet and an exchanger air outlet of the thermal exchanger,

characterized in that said fan air inlet is at least partially oriented towards said exchanger air outlet.

[0012] Providing the fan with the fan air inlet at least oriented towards the exchanger air outlet allows to facilitate the air flow between the fan and the thermal exchanger thereby decreasing pressure loss. The efficiency of the fan is therefore improved.

[0013] Tilting the fan with the fan air outlet oriented towards the exchanger outlet also allows to reduce the bulkiness of the fan along the length and/or the width of the casing. This allows to have a casing with reduced length and/or width with regard to a same casing with a fan having a fan air outlet oriented perpendicularly to the exchanger air outlet. Even if the bulkiness of the casing 12 along the height needs to be increased with a tilted fan, it allows to install a thermal exchanger with a larger height so as to improve thermal exchange efficiency.

[0014] This orientation of the fan wherein the fan air inlet at least oriented towards the exchanger air outlet thus allows to improve the efficiency of the fan, reduce the dimensions of the casing along the length and/or the width and improve thermal exchange efficiency with a taller thermal exchanger.

[0015] According to an embodiment of the dual flow ventilation unit, said fan air inlet defines a fan sucking

axis along which air is sucked from the first flow circuit, said exchanger air outlet defining an exchanger blowing axis along which air flows through said exchanger air outlet, said fan being oriented such that the fan sucking axis is tilted with regard to a direction perpendicular to the exchanger blowing axis with a tilt angle between the fan sucking axis and said direction being lower than 90°.

[0016] According to an embodiment of the dual flow ventilation unit, said tilt angle between the fan sucking axis and said direction is lower than 60°.

[0017] According to an embodiment of the dual flow ventilation unit, said fan air outlet defines a fan blowing axis along which air is blown out of the fan, said casing air outlet defining a casing blowing axis along which air flowing through said first flow circuit is blown through said casing air outlet, said fan being further oriented such that fan blowing axis is tilted with regard to said casing blowing axis such that air flowing between said fan air outlet and said casing air outlet has a bent trajectory.

[0018] According to an embodiment of the dual flow ventilation unit, it further comprises a vent connector disposed between the casing air outlet and the fan air outlet, said vent connector forming an elbow extending along said bent trajectory.

[0019] According to an embodiment of the dual flow ventilation unit, said vent connector comprises a first connection part for securing the fan air outlet to said vent connector and a second connection part for connecting the vent connector to the casing air outlet.

[0020] According to an embodiment of the dual flow ventilation unit, it further comprises a locking ring configured to fit around the second connection part of the vent connector and lock the vent connector with regard to a wall of the casing.

[0021] According to an embodiment of the dual flow ventilation unit, the casing comprises at least one main wall configured to receive and contact a front surface of the fan, said fan being secured to the casing only by the connection between the fan air outlet and the casing air outlet.

[0022] According to an embodiment of the dual flow ventilation unit, said at least one main wall having at least one receiving surface for receiving the front surface of the fan, said receiving surface being at least complementary shaped with the front surface of the fan.

[0023] According to an embodiment of the dual flow ventilation unit, one of said first and second main walls and said plurality of lateral walls form at least one fan cavity for receiving said fan between said exchanger air outlet and said casing air outlet, said fan cavity having dimensions allowing to remove said fan from said fan cavity without removing said thermal exchanger.

[0024] According to an embodiment of the dual flow ventilation unit, said fan corresponds to a first fan of the ventilation means, said fan air inlet and outlet corresponding to a first fan air inlet and a first fan air outlet, said first fan being disposed between a first casing air outlet and a first exchanger air outlet of the thermal exchanger, said ventilation means comprising a second fan having a second fan air inlet for sucking air through the second flow circuit and a second fan air outlet connected to a second casing air outlet for blowing air through said second casing air outlet, said second fan being disposed between said second casing air outlet and a second exchanger air outlet of the thermal exchanger, said second fan air inlet being at least partially oriented towards said second exchanger air outlet.

[0025] According to an embodiment of the dual flow ventilation unit, said second fan air inlet defines a second fan sucking axis along which air is sucked from the second flow circuit, said second exchanger air outlet defining a second exchanger blowing axis along which air flows through said second exchanger air outlet, said second fan being oriented such that the second fan sucking axis is tilted with regard to a direction perpendicular to the second exchanger blowing axis with a tilt angle between the second fan sucking axis and said direction being lower than 90°.

[0026] According to an embodiment of the dual flow ventilation unit, said first and second fans are oriented so that said first fan faces said first main wall and said second fan faces said second main wall.

[0027] According to an embodiment of the dual flow ventilation unit, said fan sucking axis defined by said first fan air inlet corresponds to a first fan sucking axis, said first and second fan sucking axes being parallel to each other.

[0028] According to an embodiment of the dual flow ventilation unit, said at least one fan cavity comprises a first fan cavity for receiving said first fan between said first exchanger air outlet and said first casing air outlet, said at least one fan cavity comprises a second fan cavity for receiving said second fan between said second exchanger air outlet and said second casing air outlet, said second fan cavity being arranged to allow said second fan to be removed from said second fan cavity through an exchanger cavity formed by said casing for receiving said thermal exchanger.

[0029] The invention also provides a method for installing a dual flow ventilation unit as described above, comprising the steps of:

- removing said first main wall,
- disposing the fan into the casing between said casing air outlet and said exchanger air outlet,
- securing the fan to said casing air outlet so that said fan air inlet is at least partially oriented towards said exchanger air outlet.

[0030] According to an embodiment of the installing method, said securing step comprises:

- connecting said fan air outlet to said vent connector,
- connecting said vent connector to said casing air outlet,
- locking said vent connector to said casing to secure

said fan with regard to the casing without securing said fan to said main wall.

[0031] In a preferred embodiment, said at least one fan defines a first side forming the fan air inlet and a second side opposite to the first side. The first side and the second sides preferably respectively face one of the first and the second main walls. In doing so, the at least one fan is in a vertical configuration wherein the axis of the fan air inlet intersects one of the first and second main walls. This configuration allows to have a compromise between reducing the bulk of the fans within the casing and the effectiveness of the airflow by orienting the fan air inlet toward the exchanger air outlet.

[0032] The casing is preferably shaped as a rectangle with the main walls being larger than the side walls. The aim of the invention is to limit the height of the side walls with regard to a horizontal configuration while improving the airflow between the fan air inlet and the casing air outlet.

[0033] A vertical configuration of the fan means that the axis of the fan air inlet substantially extends vertically when the first and the second main walls are horizontally oriented. A horizontal configuration of the fan means that the axis of the fan air inlet substantially extends horizontally when the first and the second main walls are horizontally oriented.

Figure 1 shows a perspective view of a casing from a dual flow ventilation unit, said casing comprising a first main wall with a drainage collector fixed thereto.

Figure 2 shows a perspective view of the casing of figure 1 with the drainage collector and the first main wall removed.

Figure 3 shows a perspective view of the casing of figure 1 with only the drainage collector removed.

Figure 4 shows a perspective view of the drainage collector of figure 1.

Figure 5 shows a perspective view of the drainage collector of figure 4 with air and water tightness means.

Figure 6 shows a detail view of an additional drainage collector provided through a lateral wall of the casing.

Figure 7 shows a perspective view of the casing of figure 1 with the drainage collector and the first main wall removed, first and second fans being installed within the casing.

Figure 8 shows a bottom transparent view of the casing with the first and second fans.

Figure 9 shows a perspective detailed view of the first fan connected to the exhaust air outlet of the casing by means of a bent vent connector.

Figure 10 shows a front perspective view of a vent connector.

Figure 11 shows a rear perspective view of the vent connector of figure 10.

[0034] In the description which follows, the drawing figures are not necessarily to scale and certain features may be shown in generalized or schematic form in the interest of clarity and conciseness or for informational purposes. In addition, although making and using various embodiments are discussed in detail below, it should be appreciated that as described herein are provided many inventive concepts that may embodied in a wide variety of contexts. Embodiments discussed herein are merely representative and do not limit the scope of the invention. It will also be obvious to one skilled in the art that all the technical features that are defined relative to a process can be transposed, individually or in combination, to a device and conversely, all the technical features relative to a device can be transposed, individually or in combination, to a process.

[0035] The terms "comprise" (and any grammatical variation thereof, such as "comprises" and "comprising"), "have" (and any grammatical variation thereof, such as "has" and "having"), "contain" (and any grammatical variation thereof, such as "contains" and "containing"), and "include" (and any grammatical variation thereof such as "includes" and "including") are open-ended linking verbs. They are used to specify the presence of stated features, integers, steps or components or groups thereof, but do not preclude the presence or addition of one or more other features, integers, steps or components or groups thereof. As a result, a method, or a step in a method, that "comprises", "has", "contains", or "includes" one or more steps or elements possesses those one or more steps or elements but is not limited to possessing only those one or more steps or elements.

[0036] The present invention provides a dual flow ventilation unit of a dual flow ventilation system.

[0037] A dual flow ventilation system comprises an exhaust air circuit for extracting exhaust air from one or more rooms and a fresh air circuit for blowing fresh air to said one or more rooms. Each of said fresh and exhaust air circuits comprises an air duct extending from said one or more rooms to an outside area.

[0038] The fresh air and exhaust air circuits correspond to a first and a second air circuits.

[0039] As shown on figure 1, the dual flow ventilation unit 10 comprises a casing 12 having a first 22 and a second 24 main walls facing each other and disposed at opposite sides of the casing. The casing 12 further comprises a plurality of lateral walls 26 extending between the first 22 and the second 24 main walls. The casing 12 defines an internal cavity 13 delimited by the first 22 and second 24 main walls as well as the lateral walls 26.

[0040] The casing 12 has three dimensions in space: a width, a length and a height with the length and the width perpendicular to the height. The casing 12 is substantially parallelepipedal with the main walls defining the length and the width and the lateral walls defining the height of the parallelepiped. Particularly, the casing 12 is preferably a perpendicular parallelepiped. The height of the casing 12 is preferably lower than each of the length and width so that the casing is essentially a flat parallel-

epiped.

[0041] In the preferred embodiment shown on figure 1, vertices of the parallelepiped formed by the casing are truncated when observed in a main direction A perpendicular to the first 22 or the second 24 main walls. Hence, four sloping lateral walls 28 are formed at each vertex of the casing 12 when observed in said main direction A perpendicular to the first 22 or the second 24 main walls.

[0042] The casing 12 comprises a fresh air inlet 14 and a fresh air outlet 16 in fluid communication with each other along a fresh air channel 17. The fresh air inlet 14 and outlet 16 are respectively configured to be connected to a first 30 and a second 32 air ducts of a fresh air circuit 34.

[0043] The casing 12 also comprises an exhaust air inlet 18 and an exhaust air outlet 20 in fluid communication with each other along an exhaust channel 21. The exhaust air inlet 18 and outlet 20 are respectively configured to be connected to a first 36 and a second 38 air ducts of an exhaust air circuit 40.

[0044] The fresh air inlet 14 and outlet 16 and the exhaust air inlet 18 and outlet 20 are formed on a lateral wall 26 so that the fresh air 17 and exhaust air 21 channels substantially extend perpendicularly to the main direction A.

[0045] The fresh air inlet 14 and outlet 16 and the exhaust air inlet 18 and outlet 20 are disposed around the casing 12 such that the fresh air 17 and exhaust air 21 channels intersect at a central portion of the casing 12. This central portion is for example centered around the main direction A. In this configuration, the fresh air 17 and exhaust air 21 channels extend to form an X, each end of the X corresponding to one of the fresh air inlet 14 and outlet 16 and the exhaust air inlet 18 and outlet 20.

[0046] In the preferred embodiment wherein the vertices of the casing 12 are truncated, each of the fresh air inlet 14 and outlet 16 and the exhaust air inlet 18 and outlet 20 is disposed at a sloping lateral wall 28.

[0047] As shown on figure 2, the casing 12 further comprises a thermal exchanger 42 disposed at the junction of the fresh 17 and exhaust 21 air channels. The thermal exchanger 42 is particularly disposed at the central portion of the casing 12. The thermal exchanger 42 and the fresh and exhaust air channels are disposed within said internal cavity 13 of the casing 12.

[0048] The thermal exchanger 42 comprises a fresh air entrance opening 44 and a fresh air exit opening 46 as well as an exhaust air entrance opening 48 and an exhaust exit opening 50. The fresh air channel 17 passes through the fresh air entrance opening 44 and the fresh air exit opening 46. The exhaust air channel 21 passes through the exhaust air entrance opening 48 and the exhaust exit opening 50.

[0049] The thermal exchanger 42 allows heat transfer between the exhaust air and the fresh air without mixing it. The thermal exchanger is for example a plate heat exchanger.

[0050] The dual flow ventilation unit 10 may further comprise an additional heating device 52 disposed in the fresh air channel 17. The additional heating device 52 is for example disposed between the fresh air inlet 16 and the fresh air entrance opening 44.

[0051] The dual flow ventilation unit 10 may also comprise a bypass device 54 allowing the exhaust air to bypass the thermal exchanger 42. The bypass device 54 comprises a movable flap 56 directing the exhaust air either through the thermal exchanger 42 or through a bypass channel 58 which is in fluid communication with the exhaust air outlet 20. Hence, the exhaust air does not flow through the thermal exchanger 42 when the thermal exchanger is bypassed. This bypass functionality allows not to heat the fresh air blown into the one or more rooms with the thermal exchanger 42 if the temperature inside said rooms is considered to be sufficient. It is particularly useful when the dual ventilation system is operated in summer.

[0052] The bypass channel 58 is preferably running along a peripheral portion of the casing 12, between one of the first 22 or second 24 main walls and the fresh air channel 17. The bypass channel 58 is distinct from and thus not in fluid communication with the fresh air channel 17.

[0053] The dual flow ventilation unit 10 comprises ventilation means 100 for moving air through said fresh air 17 and exhaust air 21 channels. Ventilation means 100 comprise at least one fan disposed within the fresh air 17 or exhaust air 21 channels. Ventilating means are preferably air fans disposed within said fresh air 17 and exhaust air 21 channels. Particularly, ventilation means 100 comprise a first fan 102 disposed within the exhaust air channel 21 and a second fan 104 disposed within the fresh air channel 17. The first fan 102 is disposed between the exhaust air outlet 20 and the exhaust air exit opening 50. The second fan 104 is disposed between the fresh air outlet 16 and the fresh air exit opening 46. The ventilation means 100 are more precisely described in relation with figures 7 to 11.

[0054] The dual flow ventilation unit 10 comprises a drainage collector 60 for collecting by gravity water generated by condensation on the thermal exchanger 42 as well as conducting said water outside the casing 12. The drainage collector 60 is disposed below the thermal exchanger 42 to be able to collect water by gravity.

[0055] The drainage collector 60 is removably fixed to one of said first 22 and second 24 main walls. Particularly, as shown on figure 3, each of said first 22 and second 24 form a receiving slot 62 configured to receive said drainage collector 60. Hence, each of the first 22 and second 24 main walls is configured to receive said drainage collector 60 so that said drainage collector 60 is selectively fixed to either one of said first 22 and second 24 main walls depending on the desired orientation of the casing 12.

[0056] The drainage collector 60 is for example screwed to either the first 22 or the second 24 main walls.

[0057] Providing each of the first 22 and second 24

main walls, i.e. each opposite side of the casing 12, with the receiving slot 62 associated with a removable drainage collector 60 allows to fix the removable drainage collector 60 to either of the two opposite first 22 and second 24 main walls. The casing 12 may be thus disposed in at least two orientations: a first orientation wherein the first main wall 22 is facing downwards and a second position wherein a second main wall 24 opposite to the first one is facing downwards. In other words, the orientation of the casing 12 may be reversed to lean on either of the main walls while ensuring that the condensates generated onto the thermal exchanger 42 may be collected into the drainage collector 60 by gravity.

[0058] In these first and second orientations of the casing, the main direction A extends vertically to allow water collection by gravity using the drainage collector 60.

[0059] This ability to reverse the orientation of the casing 12 onto either of the first 22 and second 24 main walls improves the number of connecting configurations of the casing to the fresh 34 and exhaust 40 air circuits. The installation of the dual flow ventilation unit 10 is therefore made more flexible.

[0060] As shown on figure 4, the drainage collector 60 comprises a water retention cavity 64 formed to extend below the thermal exchanger when the casing is oriented with drainage collector facing downwards. Particularly, the water retention cavity 64 may be formed to encompass at least two openings among the fresh air entrance 44 and exit 46 openings and the exhaust air entrance 48 and exit 50 openings when observed along the main direction A. Most particularly, the water retention cavity 64 may be formed to encompass at least the fresh air exit opening 46 and the exhaust air exit opening 50 when observed along the main direction A so that condensates generated onto said fresh air 46 and exhaust air 50 exit openings can be collected by gravity.

[0061] The drainage collector 60 may further comprise a drainage duct 66 extending perpendicular to the main direction A and in fluid communication with the water retention cavity 64 to allow condensates to evacuate the casing 12. The drainage duct 66 extends in a plane perpendicular to the main direction A.

[0062] Each of said first 22 and second 24 main walls may comprise a duct imprint 68 to receive said drainage duct 66 when said drainage collector 60 is received within the receiving slot 62. The duct imprint 68 extends from the central portion of the casing 12 towards a lateral wall of the casing 12. The drainage duct 66 is preferably removably fixed to a collector body 67 of the drainage collector 60. The drainage duct 66 may be fixed to the duct imprint by friction.

[0063] In a preferred embodiment shown on figures 1, 3 and 4, the drainage collector 60 is a cover forming at least a part of an external surface of the casing when received into said receiving slot 62. In other words, the drainage collector 60 is at least partly in the form of a plate removably fixed to either the first 22 or the second 24 main walls.

[0064] Each receiving slot of the first 22 or the second 24 main walls forms a through-hole 70 intended to face said thermal exchanger 42 in the main direction A. The drainage collector 60 is disposed within said through-hole 70 when received into said receiving slot 62. In other words, the through-hole 70 is covered by the drainage collector 60.

[0065] Said through-hole 70 preferably has dimensions allowing the thermal exchanger 42 to be removed through said through-hole 70. In other words, an edge 72 defining the outline of the through-hole 70 extends beyond the outline of the thermal exchanger 42 when observed along the main direction A. It allows to ease extraction of the thermal exchanger 42, for example for the maintenance or replacement of the thermal exchanger 42.

[0066] The drainage collector 60 comprises an internal surface 74 in contact with said thermal exchanger 42 to form an abutment for said thermal exchanger 42 when said drainage collector 60 is received within said receiving slot 62. This abutment is formed along the main direction A, i.e. in a direction perpendicular to the first 22 and second 24 main walls. As shown on figure 5, the drainage collector 60 comprises air and water tightness means between said internal surface of the drainage collector 60 and said thermal exchanger 42. The air and water tightness means are for example in the form of a seal plate 76 intended to abut against the thermal exchanger 42 when said drainage collector 60 is received within said receiving slot 62.

[0067] The air and water tightness means allow to provide an air and water seal between the thermal exchanger 42 and the drainage collector 60. Furthermore, the air and water tightness means, e.g. the seal plate 76, also provide thermal insulation and noise reduction. The air and water means may be made with foam. The air and water tightness means preferably obturate the through-hole 70 when the drainage collector 60 is received within the receiving slot 62 to improve thermal insulation and noise reduction.

[0068] The drainage collector further comprises air tightness means between the collector body 67 and the first 22 or the second 24 main walls. Said air tightness means extend around the through-hole 70 when said drainage collector 60 is received within the receiving slot 62. Said air tightness means are for example a sealing strip 77. Said airtightness means extend around the water retention cavity 64.

[0069] Said dual flow ventilation unit 10 comprises an additional drainage collector 78 providing at a lateral wall 26 of the casing 12. This additional drainage collector 78 is configured to collect by gravity water generated by condensation on the thermal exchanger 42 and conduct said water outside the casing 12 when the casing 12 is in a third orientation where the main direction A is horizontal. The additional drainage collector 78 allows to change the orientation of the main direction A such that the installation of the casing 12 is further flexible.

[0070] The additional drainage collector 78 is preferably formed by a drainage through-hole 80 within a lateral wall 26 facing the fresh air 46 and exhaust air 50 exit openings of the thermal exchanger 42 to allow water generated by condensation onto the thermal exchanger 42 to flow by gravity through said drainage through-hole 80.

[0071] The dual flow ventilation unit 10 further comprise a covering plate (not shown) intended to be fixed to one of the receiving slot 62 of the first 22 or second 24 main walls, particularly the main wall onto which the drainage collector is not fixed to. Hence, the covering plate allows to close the through-hole 70 of the receiving slot 70 when the drainage collector 60 is fixed to the other main wall. The covering plate is also configured to contact the thermal exchanger 42 when disposed within the receiving slot 62. This covering plate also comprises air and water tightness means to provide an air and water seal between the thermal exchanger 42 and the covering plate as well as between the covering plate and the receiving slot 62. These air and water tightness means may comprise a seal plate 76 dimensioned to both contact the thermal exchanger 42 when the covering plate is fixed to the receiving slot 62 and contact the receiving slot 62.

[0072] The drainage collector 60 may comprises two cut-out portions 82 configured to each face an air filter 83 disposed through the fresh air 17 and exhaust air 21 channels. These cut-out portions 82 allows to remove these air filters 83 without removing one of the first 22 and second 24 main walls or the drainage collector 60. Said cut-out portions 82 are dimensioned and positioned so that an air filter 83 can be removed from the casing 12 through the corresponding cut-out portion 82 without removing the drainage collector 60. The maintenance of the air filters 83 is thus facilitated. One air filter is preferably disposed between the fresh air inlet 14 and the fresh air entrance opening 44 of the thermal exchanger 42. Another air filter is preferably disposed between the exhaust air inlet 18 and the exhaust air entrance opening48 of the thermal exchanger 42.

[0073] A method for is also provided for installing the dual-flow ventilation unit 10 in a local or a building comprising an exhaust air circuit 40 and a fresh air circuit 34. Said method comprises a step of determining the position of the exhaust 40 and fresh air 34 circuits. Particularly, the position of the first 30 and second 32 air ducts of the fresh air circuit 34 and the first 36 and second 38 air ducts of the exhaust air circuit 40.

[0074] Then, the orientation of the casing 12 is determined depending on the position of the exhaust 40 and fresh 34 air circuits. Particularly, the orientation of the casing 12 is determined among the first orientation, wherein the first main wall 24 is facing downwards, the second orientation, wherein the second main wall 24 is facing downwards, and the third orientation wherein the lateral wall 26 comprising the additional drainage collector 78 is facing downwards.

[0075] The orientation is preferably determined so that all or as many inlets and outlets of the casing as possible can be easily connected to the air ducts of the exhaust 40 and fresh 34 air circuits. For example, if the first air duct 30 of the fresh air circuit 34 is short or not sufficiently accessible, the installer may choose an orientation of the casing 12 allowing to bring the fresh air inlet 14 closer to said first air duct 30. In other example, the installer may determine that the space available in the local where the casing 12 is installed requires that the casing 12 is installed vertically, i.e. with the main direction A extending horizontally.

[0076] The casing 12 may further comprise fastening means to fasten the casing to a support or a wall. In the first and second orientation, the casing 12 may lie onto the floor and in the third orientation the casing 12 may be fixed to a wall.

[0077] Once the orientation of the casing 12 is determined, the drainage collector 60 is fixed to the receiving slot 62 of the main wall intended to face downwards. If the drainage collector 60 is already fixed onto a receiving slot 62, both the covering plate and the drainage collector 60 are removed from the respective receiving slots 62. The covering plate and the drainage collector 60 are interchanged to fix the drainage collector 60 onto the main wall intended to face downwards. The covering plate is fixed onto the opposite main wall.

[0078] As shown on figure 7, the first fan 102 comprises a first fan air inlet 108 for sucking air through the exhaust flow circuit 21 and a first fan air outlet 106 connected to the exhaust air outlet 20 for blowing air through said exhaust air outlet 20. The first fan 102 is disposed between the exhaust air exit opening 50 of the thermal exchanger 42 and the exhaust air outlet 20.

[0079] The first fan air inlet 108 is at least partially oriented towards said exhaust air exit opening 50. By "at least partially oriented towards said exhaust exit opening 50", it means that the first fan air inlet 108 tends to at least partially face the exhaust air exit opening 50 with regard to a referential position of the first fan air inlet 108 wherein the first fan air inlet 108 is oriented perpendicularly to the exhaust exit opening 50. In other words, the first fan 102 is oriented so that the first fan air inlet 108 is not perpendicular to the exhaust exit opening 50, as the known dual flow ventilation units.

[0080] Providing the first fan 102 with the first fan air inlet 108 at least oriented towards the exhaust air exit opening 50 allows to facilitate the air flow between the first fan 102 and the thermal exchanger 42 thereby decreasing pressure loss. The efficiency of the first fan 102 is therefore improved.

[0081] Tilting the first fan 102 with the fan air inlet 108 oriented towards the exhaust air exit opening 50 also allows to reduce the bulkiness of the first fan 102 along the length and/or the width of the casing 12. This allows to have a casing 12 with reduced length and/or width with regard to a same casing with a fan having a fan air outlet oriented perpendicularly to the exchanger air exit opening. Even if the dimension of the casing 12 along the height needs to be increased with a tilted fan, it allows

to install a thermal exchanger 42 with a larger height so as to improve thermal exchange efficiency.

[0082] This orientation of the first fan 102 wherein the first fan air inlet 108 at least oriented towards the exchanger air exit opening 50 thus allows to improve the efficiency of the first fan 102, reduce the dimensions of the casing along the length and/or the width and improve thermal exchange efficiency with a taller thermal exchanger.

[0083] As shown on figures 7, 8 and 9, the first fan air inlet 108 defines a first fan sucking axis s1 along which air is sucked from the exhaust flow circuit 21. The exhaust air exit opening 50 defines a first exchanger blowing axis e1 along which air flows through said exhaust air exit opening 50.

[0084] The first fan 102 is oriented such that the first fan sucking axis s1 is tilted with regard to a direction perpendicular to the first exchanger blowing axis e1 with a first tilt angle a1 between the fan sucking axis s1 and said direction being lower than 90°. In other words, the first fan 102 is oriented so that the first fan sucking axis s1 is not perpendicular to the first exchanger blowing axis e1, as the known dual flow ventilation units.

[0085] The first exchanger blowing axis e1 may extend perpendicularly to the main direction A of the casing 12. Hence, in this embodiment, the first fan sucking axis s1 is tilted with said first tilt angle a1 with regard with regard to the main direction A.

[0086] This first tilt angle a1 between the fan sucking axis s1 and said direction perpendicular to the exchanger blowing axis e1 may be lower than 60°. This greater first tilt angle a1 further reduces pressure loss et thus improves the efficiency of the first fan 102. More generally, the advantages described above with regard to the tilted orientation of the first fan 102 are improved.

[0087] The first fan air outlet 106 also defines a first fan blowing axis b1 along which air is blown out of the first fan 102. The exhaust air outlet 20 defines a first casing blowing axis o1 along which air flowing through said exhaust flow circuit 21 is blown through said exhaust air outlet 20.

[0088] The first fan 102 is further oriented such that the first fan blowing axis b1 is tilted with regard to said casing blowing axis o1 such that air flowing between said first fan air outlet 106 and said exhaust air outlet 20 has a bent trajectory. In other words, the first fan blowing axis b1 is tilted with regard to said casing blowing axis o1 with a second tilt angle a2. In doing so, the first fan 102 is oriented with a double tilt with regard to the known dual flow ventilation units which have the fan air outlet perpendicular to exhaust air exit opening 50 and the fan air outlet aligned with exhaust air outlet 20. Hence, the first fan 102 is oriented with a tilt along two axes. More generally, the first fan 102 is tilted along at least one axis, preferably at least two axes, with the first fan air inlet 108 oriented towards the exhaust air exit opening 50.

[0089] This bent trajectory allows a smooth transition of the airflow from the first fan 102 to the exhaust air outlet 20 while ensuring the orientation of the first fan air inlet 108 with regard to the thermal exchanger 42.

[0090] The dual flow ventilation unit 10 further comprises a vent connector 112 disposed between the exhaust air outlet 20 and the first fan air outlet 106. This vent connector 112 forms an elbow extending along said bent trajectory.

[0091] The vent connector 112 comprises a first connection part 114 for securing the first fan air outlet 106 to said vent connector 112. The vent connector 112 further comprises a second connection part 116 for connecting the vent connector 112 to the exhaust air outlet 20. The first connection part 114 is tilted with regard to the second connection part 116 with the second tilt angle a2. This vent connector 112 allows the first fan air outlet 106 to misaligned with regard to exhaust air outlet 20. It allows to tilt the first fan 102 while maintaining the orientation of the exhaust air outlet 20. Particularly, it allows to keep the casing blowing axis o1 perpendicular to the main direction A of the casing A. The geometry of the casing 12 can thus be kept simple and practical to use for an installer.

[0092] As shown on figures 10 and 11, the first connection part 114 may be a truncated cylinder with a front face 115 intended to be oriented towards the first fan air outlet 106 when the vent connector 112 is connected to the first fan 102. An indexing element 117 may be provided to the first connection part 114 to set the orientation of the vent connector 112 with regard to the first fan 102. The second connection part 116 may be a portion of a cylinder configured to fit the exhaust air outlet 20 when the vent connector 112 is connected to the first fan 102.

[0093] The dual flow ventilation unit 10 further comprises a locking ring 116 configured to fit around the second connection part of the vent connector and lock the vent connector 112 with regard to a wall of the casing. The locking ring 116 may be secured to the casing by a snap-fit connection or a magnetic connection.

[0094] As described above, the ventilation means 100 further comprise a second fan 104 disposed within the fresh air channel 17. Particularly, the second fan 104 is disposed between the fresh air exit opening 46 and the fresh air outlet 16.

[0095] All the features described in relation with the first fan 102 also apply to the second fan 104 the fresh air exit opening 46 and the fresh air outlet 16. Particularly, the second fan 104 comprises a second fan air inlet 110 for sucking air through the fresh flow circuit 17 and a second fan air outlet 112 connected to the fresh air outlet 16 for blowing air through said fresh air outlet 16.

[0096] The second fan air inlet 110 is at least partially oriented towards said fresh air exit opening 46. The same advantages as those described above for the first fan 102 are obtained with the second fan 104.

[0097] Said first 102 and second 104 fans are oriented so that the first fan air inlet 108 of said first fan 102 faces said first main wall 22 and the second fan air inlet 110 said second fan 104 faces said second main wall 24. The

orientation of the first 102 and second 104 fans is thus reversed with each other to be able to keep the arrangement in the form of an X of the casing 12.

[0098] The second fan air inlet 110 is at least partially oriented towards said fresh air exit opening 46. By "at least partially oriented towards said fresh air exit opening 46", it means that the second fan air inlet 110 tends to at least partially face the fresh air exit opening 46 with regard to a referential position of the second fan air inlet 110 wherein the second fan air inlet 110 is oriented perpendicularly to the fresh air exit opening 46. In other words, the second fan 104 is oriented so that the second fan air inlet 110 is not perpendicular to the fresh air exit opening 46, as the known dual flow ventilation units.

[0099] As shown on figures 7, 8 and 9, the second fan air inlet 110 defines a second fan sucking axis s2 along which air is sucked from the fresh flow circuit 17. The fresh air exit opening 46 defines a second exchanger blowing axis e2 along which air flows through said fresh air exit opening 46.

[0100] The second fan 104 is oriented such that the second fan sucking axis s2 is tilted with regard to a direction perpendicular to the second exchanger blowing axis e2 with a first tilt angle a1 between the fan sucking axis s2 and said direction being lower than 90°. In other words, the second fan 104 is oriented so that the second fan sucking axis s2 is not perpendicular to the second exchanger blowing axis e2, as the known dual flow ventilation units.

[0101] The second exchanger blowing axis e2 may extend perpendicularly to the main direction A of the casing 12. Hence, in this embodiment, the second fan sucking axis s2 is tilted with said first tilt angle a1 with regard with regard to the main direction A.

[0102] This first tilt angle a1 between the fan sucking axis s2 and said direction perpendicular to the second exchanger blowing axis e2 may be lower than 60°. This greater first tilt angle a1 further reduces pressure loss et thus improves the efficiency of the second fan 104. More generally, the advantages described above with regard to the tilted orientation of the second fan 104 are improved.

[0103] The second fan air outlet 112 also defines a second fan blowing axis b2 along which air is blown out of the second fan 104. The fresh air outlet 16 defines a second casing blowing axis o2 along which air flowing through said fresh flow circuit 17 is blown through said fresh air outlet 16.

[0104] The second fan 104 is further oriented such that the second fan blowing axis b2 is tilted with regard to said second casing blowing axis o2 such that air flowing between said second fan air outlet 112 and said fresh air outlet 16 has a bent trajectory. In other words, the second fan blowing axis b2 is tilted with regard to said second casing blowing axis o2 with a second tilt angle a2. In doing so, the second fan 104 is oriented with a double tilt with regard to the known dual flow ventilation units which have the fan air outlet perpendicular to fresh air exit opening 46 and the fan air outlet aligned with fresh air outlet 16. Hence, the second fan 104 is oriented with a tilt along two axes. More generally, the second fan 104 is tilted along at least one axis, preferably at least two axes, with the second fan air inlet 110 oriented towards the fresh air exit opening 46.

[0105] This bent trajectory allows a smooth transition of the airflow from the second fan 104 to the fresh air outlet 16 while ensuring the orientation of the second fan air inlet 110 with regard to the thermal exchanger 42.

[0106] The second fan 104 is also connected to the fresh air outlet 16 with a vent connector 112 disposed between the fresh air outlet 16 and the second fan air outlet 112. This vent connector 112 forms an elbow extending along said bent trajectory.

[0107] In a preferred embodiment, said first s1 and second s2 fan sucking axes are parallel to each other to have a symmetric arrangement of the first 102 and second 104 fans.

[0108] As shown on figure 2, the second main wall 24 and said plurality of lateral walls 26 form a first 120 and a second 122 fan cavities for respectively receiving said first 102 and second 104 fans.

[0109] The first fan cavity 120 has dimensions allowing to remove the first fan 102 from said first fan cavity 120 without removing said thermal exchanger 42. Hence, the first fan 102 may be installed into or removed from said first fan cavity 120 only by removing the first main wall 22.

[0110] The second fan cavity 122 has dimensions allowing to remove the second fan 104 from said second fan cavity 122 through a cavity receiving said thermal exchanger 42. Hence, the second fan 104 may be installed into or removed from said second fan cavity 122 by only removing the first main wall 22 and the thermal exchanger 42. Furthermore, there is no need to reach each side (the first and second main walls) of the casing 12 to install or remove the fans to or from the casing 12.

[0111] As shown on figure 2, said second main wall 24 and at least one lateral wall 26 form at least one first receiving surface 118 for receiving a first front surface (not shown) of the first fan 102. This first front surface is disposed at the opposite of the first fan inlet 108 with regard to the body of the first fan 102. Said at least one first receiving surface 118 is at least partially complementary shaped with the front surface of the first fan 102. Preferably, this at least one first receiving surface 118 is fully complementary shaped with the front surface of the first fan 102.

[0112] The at least one first receiving surface 118 and the vent connector 112 contribute at supporting the first fan 102 and maintaining the orientation thereof.

[0113] Similarly, said second main wall 24 and at least one lateral wall 26 form at least one second receiving surface (not shown) for receiving a second front surface (not shown) of the second fan 104. This second front surface is disposed at the opposite of the second fan inlet 110 with regard to the body of the second fan 104. Said at least one second receiving surface is at least partially

complementary shaped with the second front surface of the second fan 104. Preferably, this at least one second receiving surface is fully complementary shaped with the second front surface of the second fan 104.

[0114] The at least one second receiving surface and the vent connector 112 contribute at supporting the second fan 104 and maintaining the orientation thereof.

[0115] No securing means are provided between the second main wall 24 and the first 102 or second 104 fans. Hence, the first 102 and second 104 fan are secured to the casing 12 only by the connection between the first fan air outlet 106 and the exhaust air outlet 20, for the first fan 102, and between the second fan air outlet 112 and the fresh air outlet 16, for the second fan 104. This facilitates the installing and removing operations of the first 102 and second 104 fans.

Claims

1. Dual-flow ventilation unit (10) for extracting exhaust air from at least one room and blowing fresh air into said at least one room, said dual-flow ventilation unit (10) having a casing (12) comprising a first and a second main walls (22, 24) opposite each other and a plurality of lateral walls (26, 28) extending between said first and second main walls, said casing comprising:

    - a thermal exchanger (42),
    - a first (21) and a second (17) flow circuits extending at least partially through the thermal exchanger (42) to transfer heat from air flowing through one of said first (21) and second (17) flow circuits to air flowing through the other one among said first (21) and second (17) flow circuits, said first flow circuit (21) comprising a casing air outlet formed through the casing (12),
    - ventilation means for moving air through said first and second flow circuits, said ventilation means comprising a fan comprising a fan air inlet for sucking air through the first flow circuit and a fan air outlet connected to said casing air outlet for blowing air through said casing air outlet, said fan being disposed between said casing air outlet and an exchanger air outlet of the thermal exchanger,

    characterized in that said fan air inlet is at least partially oriented towards said exchanger air outlet.

2. Dual flow ventilation unit (10) according to claim 1, wherein said fan air inlet defines a fan sucking axis (s1) along which air is sucked from the second flow circuit (21), said exchanger air outlet defining an exchanger blowing axis (e1) along which air flows through said exchanger air outlet, said fan being oriented such that the fan sucking axis (s1) is tilted with regard to a direction perpendicular to the exchanger blowing axis (e1) with a tilt angle between the fan sucking axis (s1) and said direction being lower than 90°.

3. Dual flow ventilation unit (10) according to claim 1 or 2, wherein said tilt angle between the fan sucking axis (s1) and said direction is lower than 60°.

4. Dual flow ventilation unit (10) according any one of claims 1 to 3, wherein said fan air outlet defines a fan blowing axis (b1) along which air is blown out of the fan, said casing air outlet defining a casing blowing axis (o1) along which air flowing through said second flow circuit (21) is blown through said casing air outlet, said fan being further oriented such that fan blowing axis (b1) is tilted with regard to said casing blowing axis (o1) such that air flowing between said fan air outlet and said casing air outlet has a bent trajectory.

5. Dual flow ventilation unit (10) according to claim 4, further comprising a vent connector disposed between the casing air outlet and the fan air outlet, said vent connector forming an elbow extending along said bent trajectory.

6. Dual flow ventilation unit (10) according to claim 5, wherein said vent connector comprises a first connection part for securing the fan air outlet to said vent connector and a second connection part for connecting the vent connector to the casing air outlet.

7. Dual flow ventilation unit (10) according to claim 6, further comprising a locking ring configured to fit around the second connection part of the vent connector and lock the vent connector with regard to a wall of the casing.

8. Dual flow ventilation unit (10) according to any one of the preceding claims, wherein the casing comprises at least one main wall (22, 24) configured to receive and contact a front surface of the fan, said fan being secured to the casing (12) only by the connection between the fan air outlet and the casing air outlet.

9. Dual flow ventilation unit (10) according to any one of the preceding claims, wherein said at least one main wall having at least one receiving surface for receiving the front surface of the fan, said receiving surface being at least complementary shaped with the front surface of the fan.

10. Dual flow ventilation unit (10) according to any one of the preceding claims, wherein one of said first and second main walls (22, 24) and said plurality of lateral walls (26) form at least one fan cavity for receiving

said fan between said exchanger air outlet and said casing air outlet, said fan cavity having dimensions allowing to remove said fan from said fan cavity without removing said thermal exchanger.

11. Dual flow ventilation unit (10) according to any one of the preceding claims, wherein said fan corresponds to a first fan of the ventilation means, said fan air inlet and outlet corresponding to a first fan air inlet and a first fan air outlet, said first fan being disposed between a first casing air outlet and a first exchanger air outlet of the thermal exchanger, said ventilation means comprising a second fan having a second fan air inlet for sucking air through the first flow circuit (17) and a second fan air outlet connected to a second casing air outlet for blowing air through said second casing air outlet, said second fan being disposed between said second casing air outlet and a second exchanger air outlet of the thermal exchanger, said second fan air inlet being at least partially oriented towards said second exchanger air outlet.

12. Dual flow ventilation unit (10) according to claim 10, wherein said second fan air inlet defines a second fan sucking axis (s2) along which air is sucked from the first flow circuit (17), said second exchanger air outlet defining a second exchanger blowing axis (e2) along which air flows through said second exchanger air outlet, said second fan being oriented such that the second fan sucking axis (s2) is tilted with regard to a direction perpendicular to the second exchanger blowing axis (e2) with a tilt angle between the second fan sucking axis (s2) and said direction being lower than 90°.

13. Dual flow ventilation unit according to claim 10 or 11, wherein said first and second fans are oriented so that said first fan faces said first main wall (22) and said second fan faces said second main wall (24).

14. Dual flow ventilation unit (10) according to any one of claims 10 to 12 in combination with claim 2, wherein said fan sucking axis (s1) defined by said first fan air inlet corresponds to a first fan sucking axis (s1), said first (s1) and second (s2) fan sucking axes being parallel to each other.

15. Dual flow ventilation unit (10) according to any one of the preceding claims, wherein said at least one fan cavity comprises a first fan cavity for receiving said first fan between said first exchanger air outlet and said first casing air outlet, said at least one fan cavity comprises a second fan cavity for receiving said second fan between said second exchanger air outlet and said second casing air outlet, said second fan cavity being arranged to allow said second fan to be removed from said second fan cavity through an exchanger cavity formed by said casing for receiving said thermal exchanger.

16. Method for installing a dual flow ventilation unit (10) according to any one of the preceding claims, comprising the steps of:

- removing said first main wall,
- disposing the fan into the casing (12) between said casing air outlet and said exchanger air outlet,
- securing the fan to said casing air outlet so that said fan air inlet is at least partially oriented towards said exchanger air outlet.

17. Method according to claim 16 in combination with 5, wherein said securing step comprises:

- connecting said fan air outlet to said vent connector,
- connecting said vent connector to said casing air outlet,
- locking said vent connector to said casing to secure said fan with regard to the casing without securing said fan to said main wall.

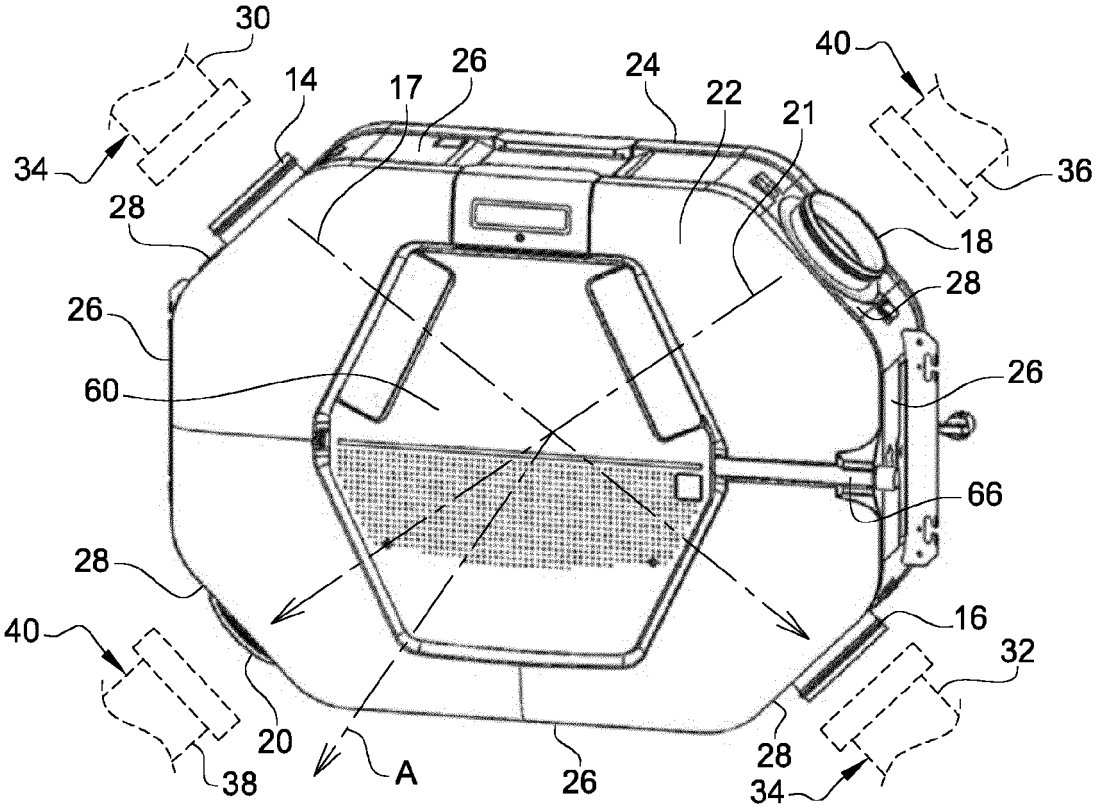
30
14
17
26
24
22
21
40
34
36
28
18
28
26
26
60
66
28
16
32
40
20
A
26
28
34
38

Fig. 1

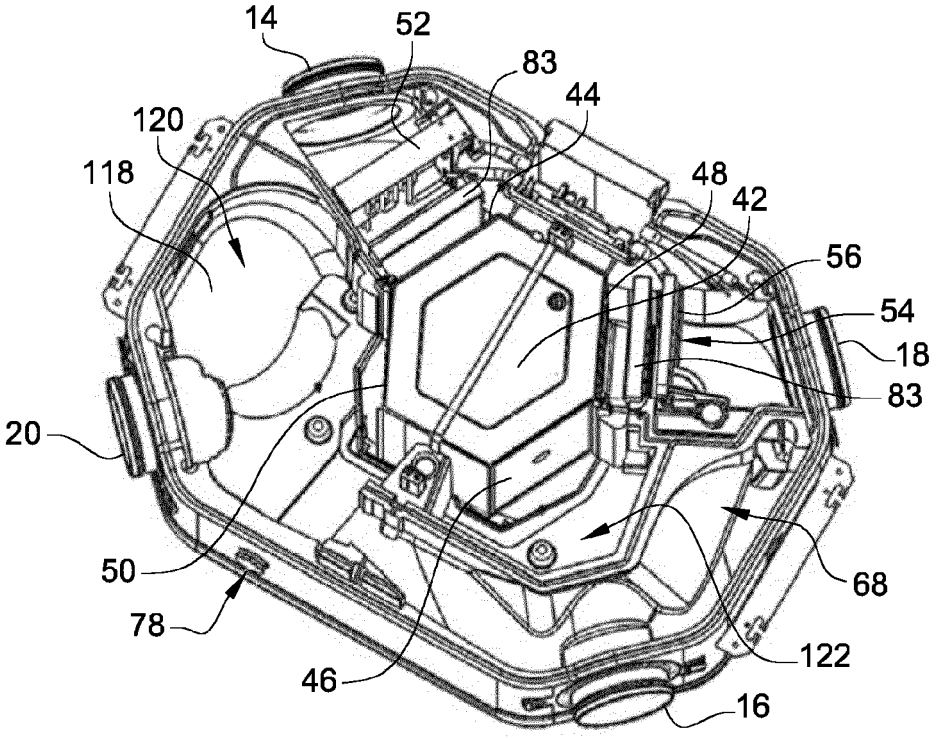
14
52
83
44
120
118
48
42
56
54
18
83
20
50
68
78
122
46
16

Fig. 2

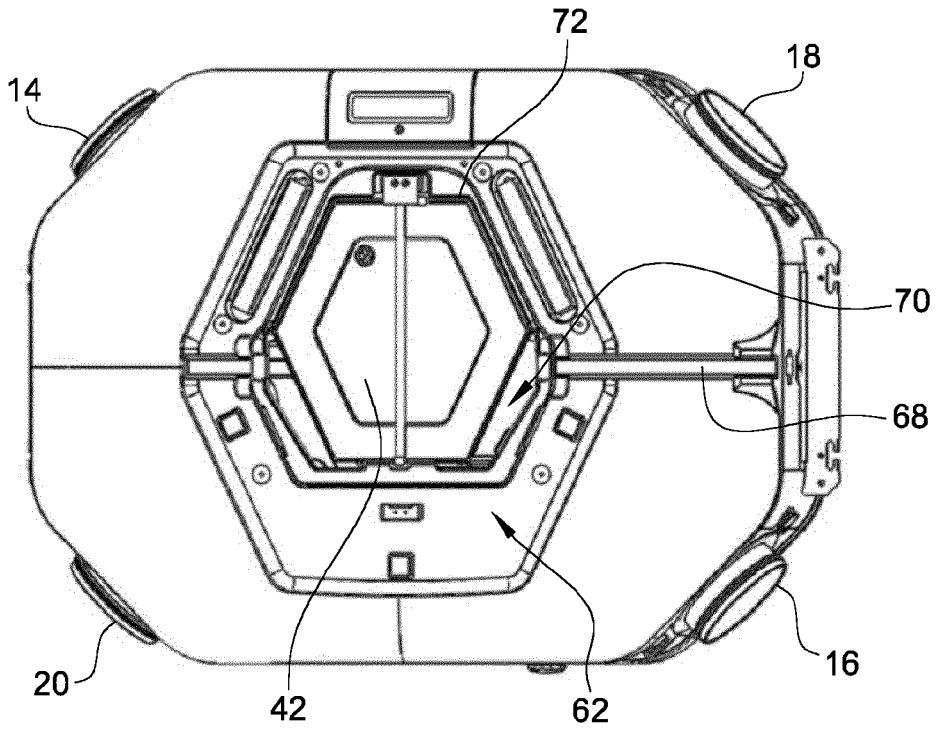

Fig. 3

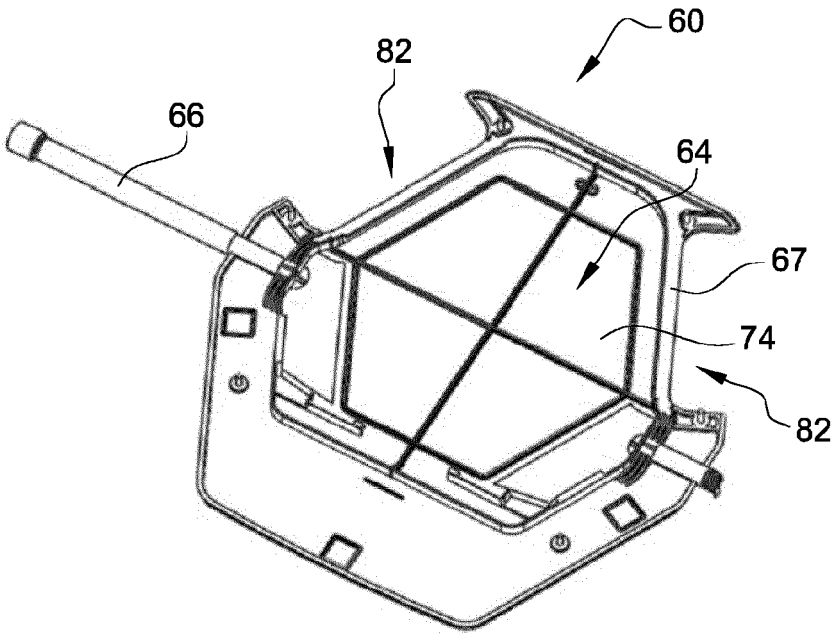

Fig. 4

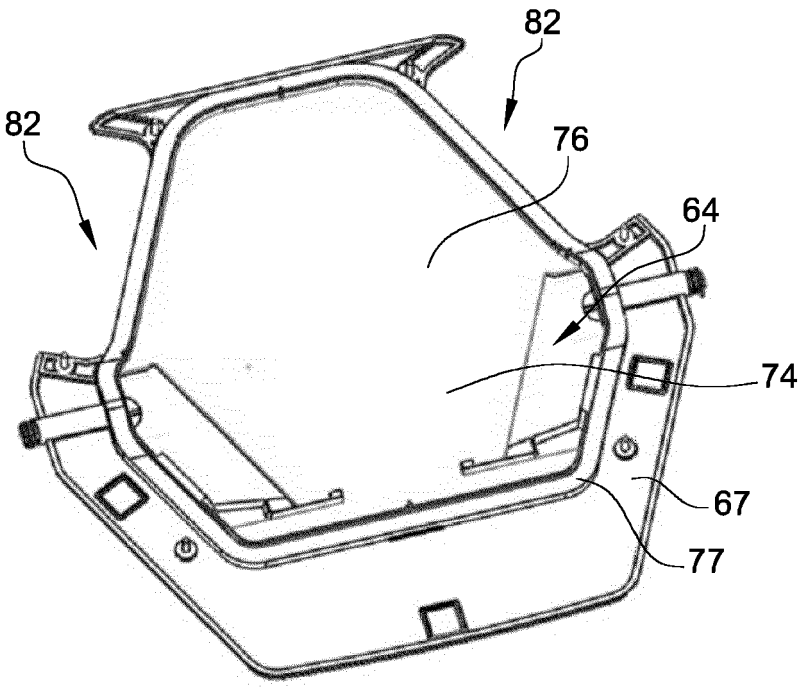

Fig. 5

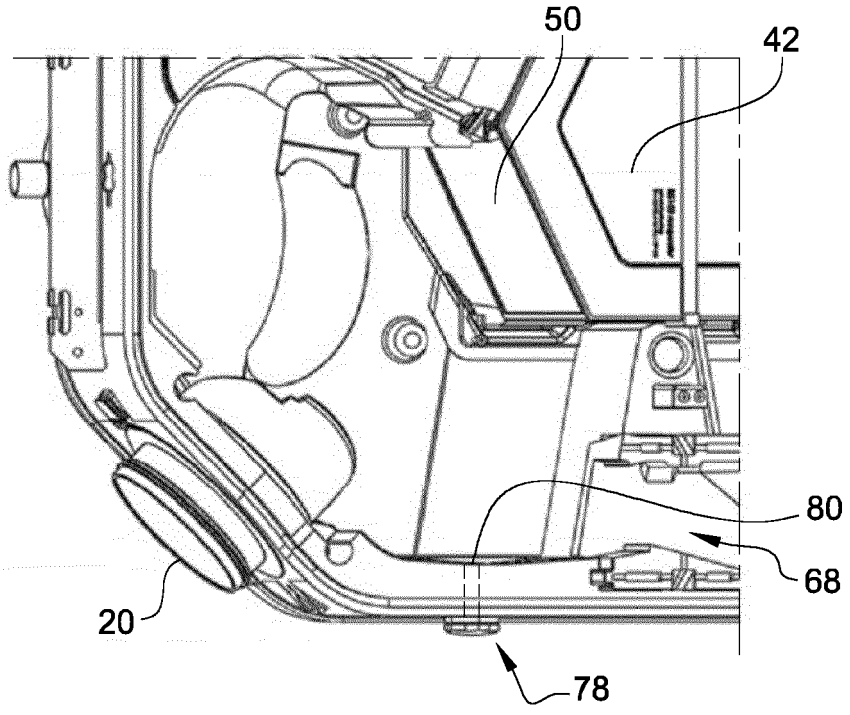

Fig. 6

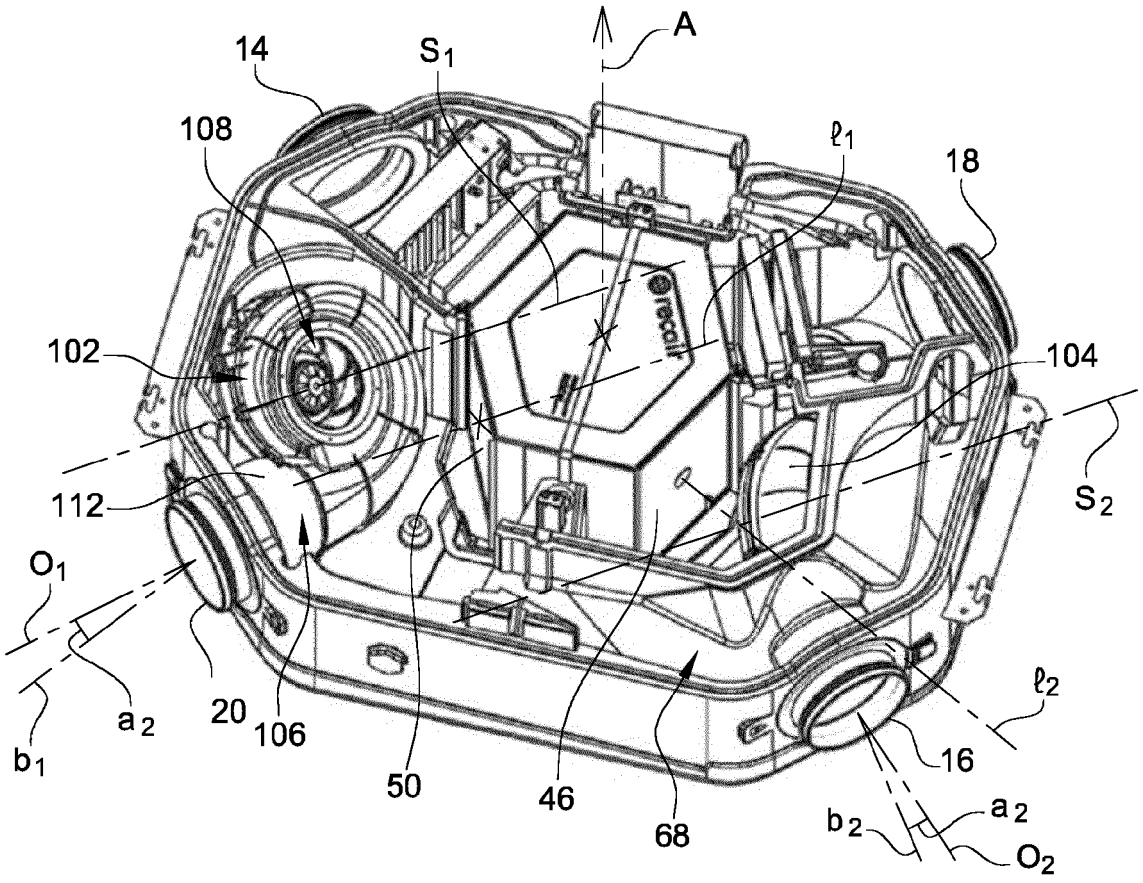
A
14
S1
108
ℓ1
18
102
104
112
S2
O1
a2
20
106
50
46
68
ℓ2
16
b1
b2
a2
O2

Fig. 7

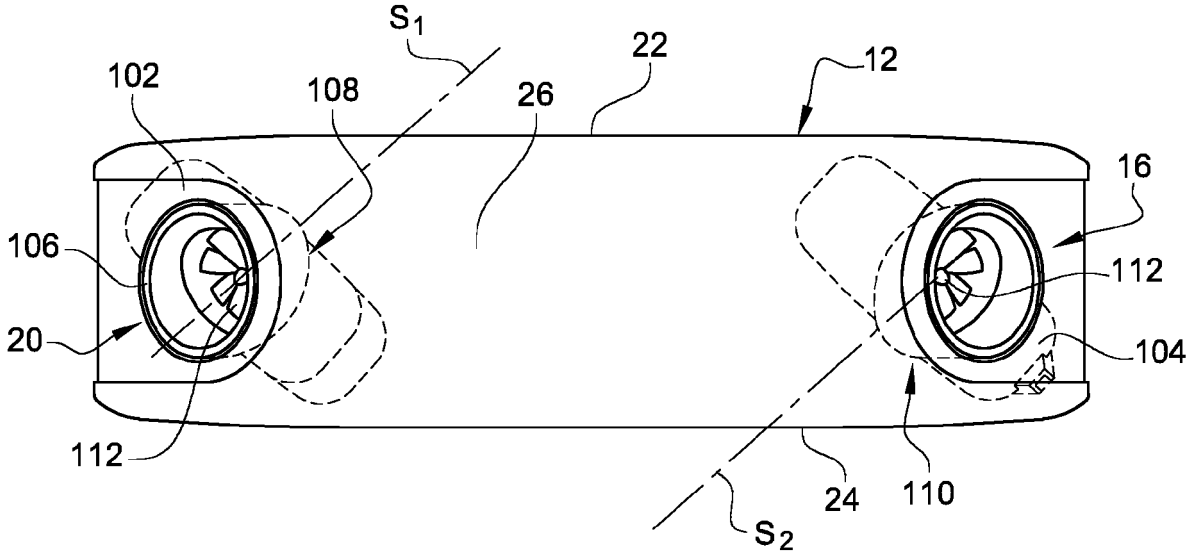
S1
22
12
102
108
26
16
106
112
20
104
112
24
110
S2

Fig. 8

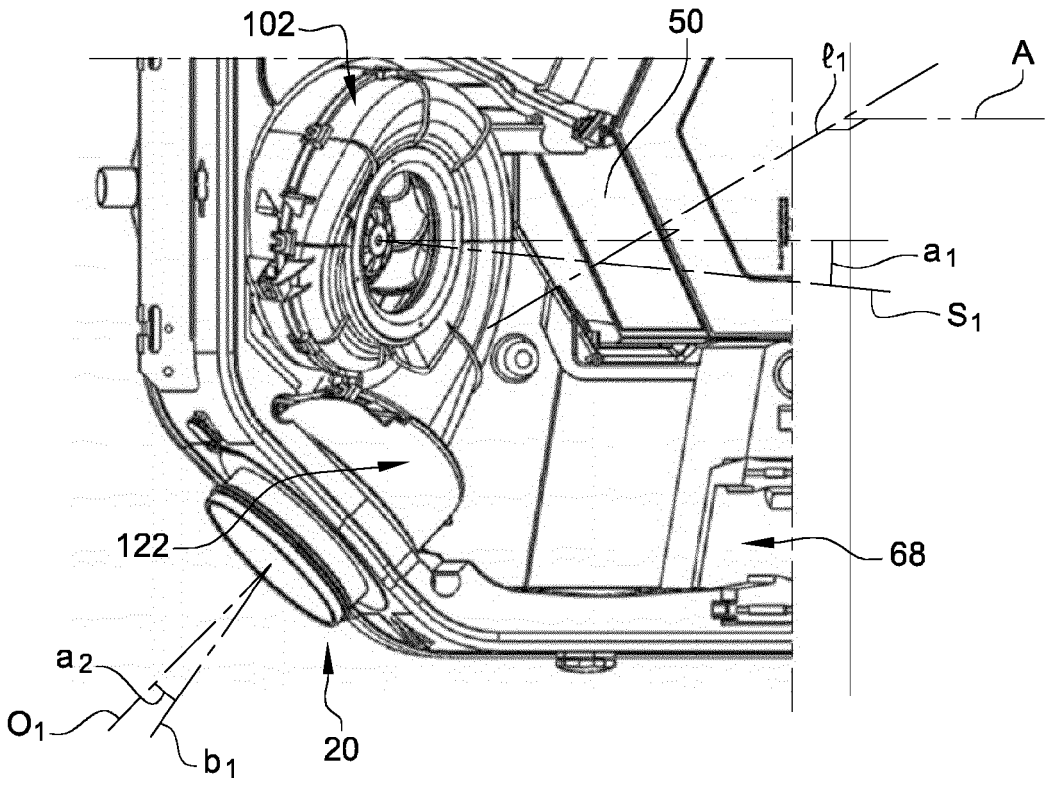

Fig. 9

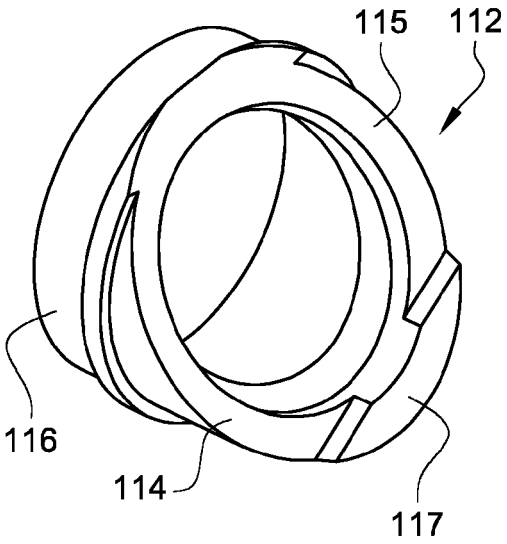

Fig. 10

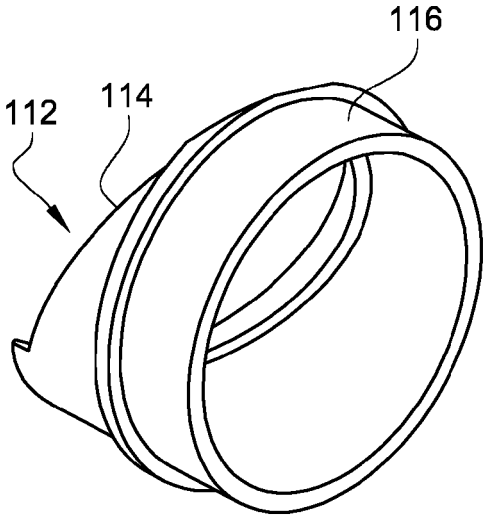

Fig. 11

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 19 8945

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2009/090395 A2 (TITON HARDWARE [GB]; HOWLETT NICHOLAS CHARLES [GB] ET AL.) 23 July 2009 (2009-07-23) * the whole document *	1-17	INV. F24F12/00 F24F13/20
X	US 9 845 959 B2 (LUNOS LUFTUNGSTECHNIK GMBH FUR RAUMLUFTSYSTEME [DE]) 19 December 2017 (2017-12-19) * column 3, line 9 - line 23 * * column 5, line 52 - column 6, line 56 * * figure 1 *	1	
X	EP 4 001 788 A1 (MITSUBISHI ELECTRIC CORP [JP]) 25 May 2022 (2022-05-25) * paragraph [0046] - paragraph [0047] * * figure 10 *	1	
X	US 4 462 459 A (SCHMIDLIN HANS [CH]) 31 July 1984 (1984-07-31) * column 3, line 25 - column 4, line 60 * * figures *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	WO 2022/018021 A1 (ZEHNDER GROUP INT AG [CH]) 27 January 2022 (2022-01-27) * abstract; figures *	1-17	F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 November 2023	Mattias Grenbäck

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 19 8945

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-11-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009090395 A2	23-07-2009	CN 101970943 A	09-02-2011
		EP 2242959 A2	27-10-2010
		GB 2469254 A	06-10-2010
		GB 2470331 A	17-11-2010
		GB 2470528 A	24-11-2010
		GB 2470684 A	01-12-2010
		GB 2471406 A	29-12-2010
		GB 2491516 A	05-12-2012
		WO 2009090395 A2	23-07-2009
US 9845959 B2	19-12-2017	DE 202014003368 U1	23-07-2014
		EP 2894412 A1	15-07-2015
		US 2015198342 A1	16-07-2015
EP 4001788 A1	25-05-2022	EP 4001788 A1	25-05-2022
		JP 7237160 B2	10-03-2023
		JP WO2021014491 A1	25-11-2021
		WO 2021014491 A1	28-01-2021
US 4462459 A	31-07-1984	DE 3112394 A1	08-07-1982
		EP 0044560 A2	27-01-1982
		JP S57501144 A	01-07-1982
		US 4462459 A	31-07-1984
		WO 8200337 A1	04-02-1982
WO 2022018021 A1	27-01-2022	CA 3181879 A1	27-01-2022
		EP 4185821 A1	31-05-2023
		US 2023272939 A1	31-08-2023
		WO 2022018021 A1	27-01-2022

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82