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(54) **AN AIR SUPPLY UNIT**

(57) The air supply unit (1) comprises:
an enclosure (2) comprising a first part (3) and a second part (4);
an inlet opening (29) arranged on top of the first portion (3);
an outlet opening (18) arranged at the bottom of the enclosure (2) and between the first part (3) and the second part (4); The outlet opening (18) comprises an outer circumference and an inner circumference and is in the form of a continuous endless loop. The air supply unit (1) comprises further:
an airflow guiding element (14) arranged movably in the outlet opening (18);
a displacement unit (13) attached to the enclosure (2) and to the airflow guiding element (14); The airflow guiding element (14) extends in the outlet opening (18) in a circumferential direction for 360°; and the airflow guiding element (14) comprises a surface for guiding air to the sides of the air supply unit (1) and for contact with the first part (3) of the enclosure (2) at the outer circumference of the outlet opening (18), a surface for guiding air-flow downwards under the air supply unit (1) and a portion for contacting with the second part (4) of the enclosure (2) at the inner circumference of the outlet opening (18).

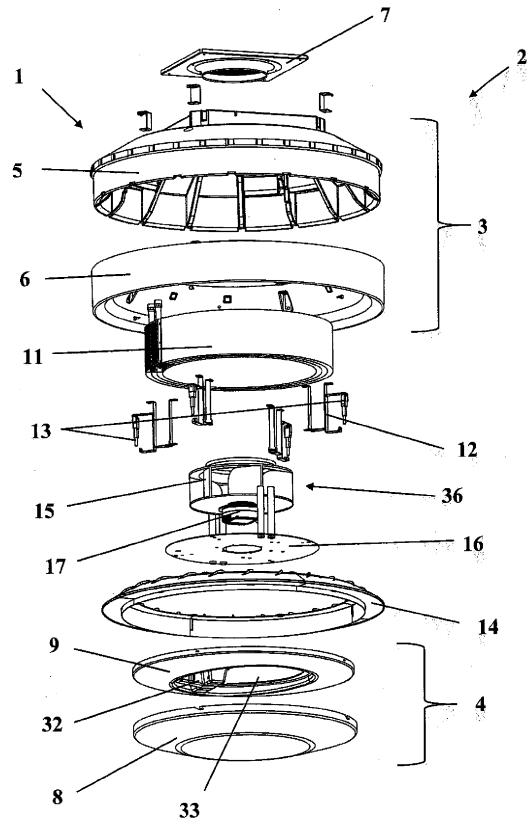


Fig. 1

Description

[0001] The subject of the present invention is an air supply unit, in particular an air supply unit enabling simultaneous and uniform air supply to the sides and downwards.

[0002] From the prior art an air supply unit, which includes an enclosure, is known. The enclosure comprises an inlet opening and an outlet opening. A fan is placed in the enclosure, which forces the airflow from the inlet to the outlet opening. On its way to the outlet opening, the air flows through a heat exchanger where the air can be heated or cooled. This unit includes additional fans, so-called boosters, arranged in the outlet opening and used to regulate the outlet airflow in terms of flow rate.

[0003] From the prior art, another air supply unit that includes an enclosure is also known. The enclosure comprises an air inlet opening and several outlet openings in the lower part of the enclosure, arranged in a square plan. A blade, which is used to change the direction of the air flowing out of this supply unit, is arranged in each of the outlet openings.

[0004] The disadvantages of the prior art solutions are as follows:

- part of the air leaving the air supply unit may be sucked back into the enclosure, that has a negative impact on the operation of the device and the parameters of the outlet airflow;
- the presence of dead zones, especially the zone under the air supply unit, to which the air leaving the air supply unit does not reach;
- the air supply from the air supply unit to the sides is not uniform or there may be additional side dead zones;
- non-uniform and uneven outlet airflow.

[0005] The object of the invention is to develop an air supply unit that allows air to be supplied both sideways and downwards direction.

[0006] Another object of the present invention is to provide an air supply unit that allows smooth adjustment of the outlet airflow between sideways and downwards air supply.

[0007] Another object of the invention is to provide an air supply unit that allows uniform and constant air supply to the sides and outside of the air supply unit, without creating dead zones. In other words, such an air supply unit provides 360° air supply around the unit, both sideways air supply and downwards air supply.

[0008] An air supply unit comprising:

an enclosure comprising a first part and a second part;
an inlet opening arranged on top of the first part;
and an outlet opening arranged at a bottom of the enclosure and between the first part and the second part;

wherein the outlet opening includes an outer circumference and an inner circumference and is in the form of a continuous loop;
according to the invention is characterized in that it further comprises:

an airflow guiding element arranged movably in the outlet opening;
and a displacement unit attached to the enclosure and the airflow guiding element; wherein the airflow guiding element extends in the outlet opening in a circumferential direction for 360°; and the airflow guiding element has a surface for guiding air to the sides of the air supply unit and for contact with the first part of the enclosure at the outer circumference of the outlet opening, a surface for guiding airflow downwards under the air supply unit and a portion for contact with the second part of the enclosure at the inner circumference of the outlet opening.

[0009] Preferably, the surface for guiding air to the sides of the air supply unit is an inclined surface, the surface for guiding air downwards under the air supply unit is a vertical surface, and the portion for contacting with the second part of the enclosure is a protrusion.

[0010] Preferably, the displacement unit comprises actuators selected from the group consisting of electric actuators, pneumatic actuators, and hydraulic actuators.

[0011] Preferably, the displacement unit comprises stepper motors with leading screws and nuts.

[0012] Preferably, the air supply unit also comprises an internal chamber arranged between and in flow communication with the inlet opening and the outlet opening.

[0013] Preferably, the air supply unit further comprises a fan arranged in the inner chamber.

[0014] Preferably, the air supply unit further comprises a heat exchanger arranged in the inner chamber.

[0015] Preferably, the heat exchanger is arranged downstream of the fan, looking in the direction of airflow through the air supply unit.

[0016] Preferably, the outlet opening and the airflow guiding element are annular in shape.

[0017] Thanks to the use of a continuous, uninterrupted and uncovered outlet opening, the air supply unit according to the invention allows for obtaining a uniform outlet airflow both in the sideways and downwards direction.

[0018] Thanks to the use of a movable airflow guiding element, arranged in the outlet opening, smooth regulation of the outlet airflow between the sideways supply mode and the downwards supply mode is achieved.

[0019] In addition, the use of the continuous outlet opening ensures the elimination of dead zones around the air supply unit, which would not be reached by the outlet airflow. In other words, the outlet airflow leaves the air supply unit around its entire circumference or for 360° around the air supply unit or its longitudinal axis.

[0020] In addition, in the downwards flow mode, the outlet airflow covers the entire space under the air supply unit, without creating dead zones under the unit.

[0021] The possibility of simultaneous air supply to the sides and air supply downwards causes the air supply unit according to the invention to have a very large air supply area while maintaining an even temperature distribution of the supplied air.

[0022] Finally, the air inlet opening and the air outlet opening are arranged on opposite parts of the enclosure, i.e. they are spaced apart, so there is no risk of the air leaving the supply unit being sucked back into the enclosure, thus allowing a uniform outlet airflow to be obtained.

[0023] The object of the invention is illustrated in its embodiments in the drawing, in which:

Fig. 1 shows an exploded view of the air supply unit according to the invention,

Fig. 2 shows a perspective view from below of the air supply unit according to the invention,

Fig. 3 shows a schematic cross-sectional view of the air supply unit according to the invention,

Fig. 4 shows a schematic, partial view of the air supply unit according to the invention in sideways air supply mode,

Fig. 5 shows a schematic, partial view of the air supply unit according to the invention in downwards air supply mode,

Fig. 6 shows a schematic, partial view of the air supply unit according to the invention both in sides and downwards air-supplying modes,

Fig. 7 shows a perspective view of an exemplary heat exchanger that may be used in the air supply unit according to the invention, and

Fig. 8 shows a perspective view of the airflow guiding element.

[0024] Embodiments of the present invention will be described hereinafter. All directional terms, such as up, down, downwards, sideways, vertical, bottom, top, etc., refer to the orientation of the air supply unit when installed in a given room on or under its ceiling, i.e. with the inlet opening directed upwards and the outlet opening directed downwards or as shown in figure 1. Additionally, the flow of the air stream through the air supply unit 1 is marked in the figure with arrows.

[0025] The air supply unit 1 according to the present invention comprises enclosure 2. Enclosure 2 in turn comprises a first or upper part 3 and a second or lower part 4. The first part 3 of enclosure 2 comprises an air inlet opening 29 on its upper surface or top. Handles or brackets can be attached to the first part 3 for installing the air supply unit 1 on the ceiling. The air supply unit 1 does not have to be installed directly on the ceiling, but it can also be installed on various structures attached to the ceiling, such as trusses, threaded studs, or rods.

[0026] The first part 3 of enclosure 2 may comprise several components, namely a top cover 5 and a bottom

cover 6 connected to each other. However, in other embodiments not shown in the drawing, the first part 3 of enclosure 2 may be a uniform one-piece element. In the embodiment shown in the drawing, the inlet opening 29 is made to extend through the top cover 5 and the bottom cover 6. In addition, an outlet opening 18 through which the air leaves the air supply unit 1, is arranged between the first part 3 and the second part 4, preferably at the bottom of enclosure 2. In other words, the first part 3 and the second part 4 are arranged relative to each other at the bottom of the air supply unit 1 so that the spacing between them forms the outlet opening 18. The outlet opening 18 comprises an outer circumference at the first portion 3 of enclosure 2 and an inner circumference at the second portion 4 of enclosure 2.

[0027] The second part 4 of enclosure 2 comprises an outer cover 8 and a condensate drip pan 9. The outer cover 8 has a decorative function and covers the various control and drive systems, which will be described in more detail below, and the condensate drip pan 9 is intended to collect any condensate that may be formed during the operation of the air supply unit 1.

[0028] In the embodiment shown in the drawing, the first part 3 and the second part 4 have a circular shape in cross-section to the longitudinal axis X of the air supply unit 1.

[0029] Inside the air supply unit 1, namely inside enclosure 2, between the first part 3 and the second part 4, an internal chamber 10 for other components of the air supply unit 1 is arranged. In other words, the first part 3 and the second part 4 form the inner chamber 10 between them when the air supply unit 1 is assembled. The inner chamber 10 can also be defined as the space which is arranged inside the air supply unit 1 between the inlet opening 29 and the outlet opening 18.

[0030] In the inner chamber 10 a fan 36, preferably radial, with an impeller 15 and an engine 17 for driving the impeller 15, is arranged. Fan 36 is arranged downstream of the inlet opening 29, looking in the direction of the airflow through the air supply unit 1. In the inner chamber 10, downstream of the fan 36, looking in the direction of the airflow through supply unit 1, a heat exchanger 11 is also arranged. In order to facilitate the suction of air into the air supply unit 1 by fan 36, a suction nozzle 7, which function is to direct the air to fan 36, can be arranged on the inlet opening 29. The heat exchanger 11 may be, for example, a water finned heat exchanger.

[0031] Fan 36 can be mounted by means of a base 16 on the second part 4 of enclosure 2, for example on the condensate drip pan 9, if it is used.

[0032] In the embodiment shown in the figure, fan 36 is a radial fan, i.e. air enters fan 36 from the top from the side of the inlet opening 29 along the longitudinal axis X, and the fan 36 itself distributes this air sideways, transversely and radially with respect to the longitudinal axis X, towards the heat exchanger 11. For this purpose, heat exchanger 11 has an annular shape in cross-section to the longitudinal axis X and is arranged around fan 36,

i.e. within 360° around fan 36. After passing through heat exchanger 11, the air flows towards outlet opening 18.

[0033] The inlet opening 29, the inner chamber 10, and the outlet opening 18 are in fluid/flow communication with each other. This means that the air supplied to the air supply unit 1 through the inlet opening 29 flows first into the internal chamber 10, from where it flows further to the outlet opening 18 and then outside the air supply unit 1.

[0034] The first part 3 of enclosure 2 is attached to the second part 4 of enclosure 2. For this purpose, the air supply unit 1 comprises brackets 12 having arms 24. The brackets 12 are attached by their arms 24 to the first part 3 and the second part 4. The heat exchanger 11 is also attached to some of the arms 24 of bracket 12.

[0035] As mentioned above, between the first part 3 and the second part 4, at the bottom of the air supply unit 1, outlet opening 18 is arranged. In the present embodiment, outlet opening 18 is annular in shape and is arranged around inner chamber 10, fan 36, and heat exchanger 11. The outlet opening 18 extends around the second part 4 of enclosure 2 and around the longitudinal axis X of air supply unit 1. Additionally, outlet opening 18 is continuous and unobstructed opening, i.e. its lumen is not obstructed by any structural element and outlet opening 18 itself extends for the entire 360° in the circumferential direction around the longitudinal axis X. In other words, outlet opening 18 is in the form of an unobstructed continuous endless loop. In addition, outlet opening 18 is arranged downstream of the heat exchanger 11, looking in the direction of the airflow through air supply unit 1.

[0036] In outlet opening 18 an airflow guiding element 14 is arranged. Preferably and like the outlet opening 18, the airflow guiding element 14 is circumferentially continuous (i.e. forms a continuous endless loop), i.e. it comprises no interruptions or openings on its guiding surfaces as described below and extends in the outlet opening 18 for 360° in the circumferential direction around the longitudinal axis X of the air supply unit 1. As shown in the drawings, the airflow guiding element 14 is annular in shape. The airflow guiding element 14 is arranged movably in outlet opening 18, i.e. it can move between a sideways air-supplying mode and a downwards air-supplying mode, which will be described in more detail below. For this purpose, the air supply unit 1 comprises a displacement unit 13 attached to the enclosure 2 and the airflow guiding element 14 and displacing the airflow guiding element 14 in outlet opening 18. Preferably, displacement unit 13 is attached to enclosure 2 by means of a bracket 12 on which it is mounted. In the embodiment shown in the figure, displacement unit 13 comprises pneumatic, hydraulic, or electric actuators, one end of which, preferably fixed, is attached to bracket 12, and the other end, preferably extendable, is attached to airflow guiding element 14. Of course, the opposite arrangement of the ends of the actuators of displacement unit 13 is also possible. In order not to interrupt the continuity of the outlet opening 18 in its circumferential direction,

both bracket 12 and the displacement unit 13 are arranged in the inner chamber 10, upstream of the outlet opening 18 looking in the direction of the airflow through the air supply unit 1.

[0037] The airflow guiding element 14 comprises a surface for guiding the air to the sides of the air supply unit 1 and a surface for guiding the air downwards under the air supply unit 1. Preferably, the surface for guiding air to the sides of the air supply unit 1 is an inclined surface 22, and the surface for guiding air downwards under the air supply unit 1 is a vertical surface 23. The inclined surface 22 is inclined relative to the longitudinal axis X of the air supply unit 1, and the vertical surface 23 is parallel to the longitudinal axis X of the air supply unit 1. The inclined surface 22 is directed towards the first portion 3 of enclosure 2 and is in contact with the first portion 3 at the outer circumference of the outlet opening 18, for example in contact with the bottom cover 6, the contact between the inclined surface 22 and the first portion 3 is continuous over the entire circumference of the inclined surface 22, i.e. there are generally no major gaps through which a significant amount of air could flow between the inclined surface 22 and the first portion 3. The vertical surface 23 faces the second part 4 of enclosure 2. The airflow guiding element 14 comprises also a portion intended to be in contact with the second portion 4 of enclosure 2 at the inner circumference of the outlet opening 18, for example for contact with the condensate drip pan 9, the contact between this portion and the second portion 4 is continuous around the entire circumference of this portion, i.e. there are essentially no major gaps through which a significant amount of air could flow between this portion and the second portion 4. Preferably, the portion intended to be in contact with the second part 4 is a protrusion 30. As described earlier, displacement unit 13 is attached to the airflow guiding element 14. In particular, displacement unit 13 is attached to protrusion 30.

[0038] In the embodiment shown in the drawing, the protrusion 30 is an extension of the inclined surface 22 and projects towards the inner chamber 10. In another embodiment, the protrusion 30 may protrude from the vertical surface 23.

[0039] The inclined surface 22, the vertical surface 23, and the protrusion 30, as well as the airflow guiding element 14, are continuous, i.e. there are no interruptions or openings in their construction and they extend for the entire 360° around the longitudinal axis X.

[0040] Several air swirlers 19 may be arranged on the inclined surface 22 of the airflow guiding member 14 as shown in Figure 8. The swirlers 19 have a form of curved protrusions extending from the inclined surface 22. The swirlers 19 are designed to create a swirling motion of air when supplying air to the sides of the air supply unit 1.

[0041] An exemplary heat exchanger 11 that can be used in the air supply unit 1 according to the invention is shown in figure 7. The heat exchanger 11 has a cross-section in an annular shape and comprises a working area 25 through which air flows and in which the air is

treated, i.e. heated or cooled by the working medium. The working area 25 does not extend circumferentially for the entire 360° around the longitudinal axis but is interrupted at area 31. An inlet port 26 and an outlet port 27 for the working medium (heating or cooling) which flows through the working area 25 are arranged in area 31. The inlet port 26 is attached to one circumferential end 35 of the working area 25 and the outlet port 27 is attached to the other opposite end of the circumferential 35 of the working area 25. Both circumferential ends 35 of the working area 25 are connected to each other by means of reinforcing element 34, such as bars or a rigid mesh with holes, to ensure the rigidity of the heat exchanger 11. This construction allows air to flow through heat exchanger 1 all the way around its circumference, both through working area 25 and through area 31.

[0042] When the air flowing through heat exchanger 11 is cooled, condensate forms on heat exchanger 11. This condensate then drops into the condensate drip pan 9, which is arranged under heat exchanger 11. The condensate drip pan 9 is shaped and sized to collect all condensate dropping from the heat exchanger 11. The condensate drip pan 9 comprises a recess 32, the bottom of which is lower than the other points of the condensate drip pan 9. The recess 32 is a space in which all condensate is ultimately collected, from where the condensate can be discharged outside the air supply unit 1, for example by a separate pipe or by means of a pump.

[0043] A control and drive system can be arranged inside enclosure 2 to control the operation of individual components of the air supply unit 1, such as the fan 36, the displacement unit 13, or a pump for draining the condensate, all of these components being connected (electrically, hydraulically or pneumatically, depending on the type of elements used) to the control and drive system. The control and drive system may be mounted on the underside of the base 16 for fan 36. In addition, the condensate drip pan 9 comprises a central opening 33 through which the control and drive system can protrude. In this way, the user can gain easy access to the control and drive system, for example for repair or maintenance, simply by removing the outer cover 8. A user interface device, such as a touch panel or remote control with buttons, used to control the operation of the air supply unit 1 by the user, can be connected to the control and drive system. The connection between the control and drive system and the user interface device can be wired (electrical cable) or wireless (radio frequency), allowing the user interface device to be easily installed outside of the air supply unit 1.

[0044] The operation of the air supply unit 1 according to the present invention is as follows. Air is supplied to the air supply unit 1 through the inlet opening 29, more specifically fan 36 sucks air into the internal chamber 10 through the inlet opening 29 and the suction nozzle 7. Fan 36 distributes the air further to heat exchanger 11. The air flowing through the heat exchanger 11 can be heated or cooled as required. The air then flows to the

outlet opening 18. The airflow guiding element 14, movably arranged in outlet opening 18, allows the air from the air supply unit 1 to be directed sideways and downwards, as will be described in more detail below.

[0045] The various modes of operation of the air supply unit 1 will now be described with reference to figures 4-6. The airflow guiding element 14 is moved by means of displacement unit 13. In particular, when displacement unit 13 comprises actuators, the extension and shortening of the actuators move the airflow guiding element 14. Figure 4 shows the sideways air-supplying mode. The airflow guiding element 14 is moved downwards so as to be in contact with the second part 4 of enclosure 2, in particular, the protrusion 30 is in contact with the condensate drip pan 9 all around the inner circumference of the outlet opening 18. In this way, the air can leave the inner chamber 10 through outlet opening 18 only between the first part 3 of enclosure 2 and the inclined surface 22, whereby the air is directed to the sides of air supply unit 1. In figure 5, the airflow guiding element 14 is moved so that its inclined surface 22 is in contact with the first part 3 of enclosure 2, in particular the inclined surface 22 is in contact with the bottom cover 6 around the entire outer circumference of the outlet opening 18. In this way, the air can leave the inner chamber 10 through outlet opening 18 only between the second part 4 and the vertical surface 23, whereby the air is directed downwards under the air supply unit 1. This is called the downwards air-supplying mode. Finally, figure 6 shows the sideways and downwards air-supplying modes or a mixed air-supplying mode. Here, the air guiding element 14 is arranged in outlet opening 18 such that both the inclined surface 22 and the protrusion 30 are not in contact with the first part 3 and the second part 4 of enclosure 2. In this way, air can leave the inner chamber 10 through the outlet opening 18 both between the first part 3 and the inclined surface 22 and also between the second part 4 and the vertical surface 23.

[0046] The above-described preferred embodiment is not the only embodiment of the present invention. In another embodiment, displacement unit 13 need not include electric, pneumatic, or hydraulic actuators. In this embodiment, displacement unit 13 comprises stepper motors with a leading screw and nut. The stepper motor is attached to one of the first part 3 and the second part 4, and the nut is attached to the airflow guiding element 14, or vice versa. The rotation of the stepper motor causes the rotation of the leading screw, which further forces the nut to move along the leading screw, and the nut itself pulls the element 14 that guides the airflow. In yet other embodiments, displacement unit 13 may include servos or linkage assemblies.

[0047] In another embodiment, the air supply unit 1 need not include a heat exchanger 11. In such embodiment, the air supply unit 1 is installed in the air conditioning system of the building which already supplies heated or cooled air to the air supply unit 1 so that the air supply unit 1 no longer needs to treat this air, whereby the heat

exchanger 11 and even the condensate drip pan 9 is not needed. In addition, since the building's air conditioning system provides a proper airflow rate, which then flows through the air supply unit 1, using fan 36 is also not necessary.

[0048] In addition, the fan 36 used does not have to be a radial fan, it is possible to use an axial fan that forces airflow in a straight line, for example, from top to bottom. In this case, the heat exchanger 11, if it is to be used, should be installed not around the fan 36, but below it, whereby the heat exchanger 11 need not be annular in cross-section, but may be a flat element so as to "catch" the airflow falling on it that is generally cylindrical or cone-shaped. However, in the case of an axial fan, the annular heat exchanger 11 around fan 36 may still be used. In this case, it is sufficient to shape the inner chamber 10 so that the air from fan 36 is directed to the annular heat exchanger. Of course, a person skilled in the art could easily use other types of fan 36 or heat exchanger 11 without departing from the substance of the invention.

[0049] In the above description, it has been indicated that the individual components of the air supply unit 1, such as the first part 3, the second part 4, the outer cover 8, or the condensate drip pan 9, have a circular cross-section. However, depending on the needs and the particular application, these components may have other cross-sectional shapes, such as square or oval. Similarly, the outlet opening 18 and the airflow guiding element 14 need not have the shapes described above. The outlet opening 18 and the airflow guiding element 14 may be oval or even square in shape with rounded corners when viewed in cross-section to the longitudinal axis X. It is important that the outlet opening 18 and the airflow guiding element 14 form a continuous endless loop extending for 360° around the longitudinal axis X.

[0050] The above description also indicates that the individual components of the air supply unit 1 are connected to each other by means of separate brackets 12. However, in other embodiments, there is no need for separate brackets 12. The individual components of the air supply unit 1 may be provided with integral connecting elements, such as posts, straps, holes, clamps, or flanges, which can be used to connect a given component to another component.

[0051] Further, the control and drive system as well as the user interface need not be installed inside or on the air supply unit 1. The control and drive system and the user interface may be units external to the air supply unit 1, which are only connected (electrically, hydraulically, or pneumatically) to the components of the air supply unit 1, whereby the size of the air supply unit 1 can be reduced.

Claims

1. An air supply unit (1) comprising:

an enclosure (2) comprising a first part (3) and a second part (4);

an inlet opening (29) arranged on top of the first portion (3); and

an outlet opening (18) arranged at the bottom of the enclosure (2) and between the first part (3) and the second part (4);

wherein the outlet opening (18) comprises an outer circumference and an inner circumference and is in the form of a continuous loop;

characterized in that it further comprises:

an airflow guiding element (14) arranged movably in the outlet opening (18); and
a displacement unit (13) attached to the enclosure (2) and to the airflow guiding element (14);

wherein the airflow guiding element (14) extends in the outlet opening (18) in a circumferential direction for 360°;

and the airflow guiding element (14) comprises a surface for guiding air to the sides of the air supply unit (1) and for contact with the first part (3) of the enclosure (2) at the outer circumference of the outlet opening (18), a surface for guiding airflow downwards under the air supply unit (1) and a portion for contacting with the second part (4) of the enclosure (2) at the inner circumference of the outlet opening (18).

2. The air supply unit (1) according to claim 1, **characterized in that** the surface for guiding air to the sides of the air supply unit (1) is an inclined surface (22), the surface for guiding air downwards under the air supply unit (1) is a vertical surface (23), and a portion for contacting with the second part (4) of the enclosure (2) is a protrusion (30).
3. The air supply unit (1) according to claim 1 or 2, **characterized in that** the displacement unit (13) comprises actuators selected from the group consisting of electric actuators, pneumatic actuators, and hydraulic actuators.
4. The air supply unit (1) according to claim 1 or 2, **characterized in that** the displacement unit (13) comprises stepper motors with leading screws and nuts.
5. The air supply unit (1) according to any one of claims 1 to 4, **characterized in that** it further comprises the inner chamber (10) arranged between and in flow communication with the inlet opening (29) and the outlet opening (18).
6. The air supply unit (1) according to claim 5, **characterized in that** it further comprises the fan (36) arranged in the inner chamber (10).

7. The air supply unit (1) according to claims 5 or 6, **characterized in that** it further comprises the heat exchanger (11) arranged in the inner chamber (10).
8. The air supply unit (1) according to claim 7, **characterized in that** the heat exchanger (11) is arranged downstream of the fan (36), looking in the direction of the airflow through the air supply unit (1). 5
9. The air supply unit (1) according to any one of the preceding claims, **characterized in that** the outlet opening (18) and the airflow guiding element (14) are annular in shape. 10

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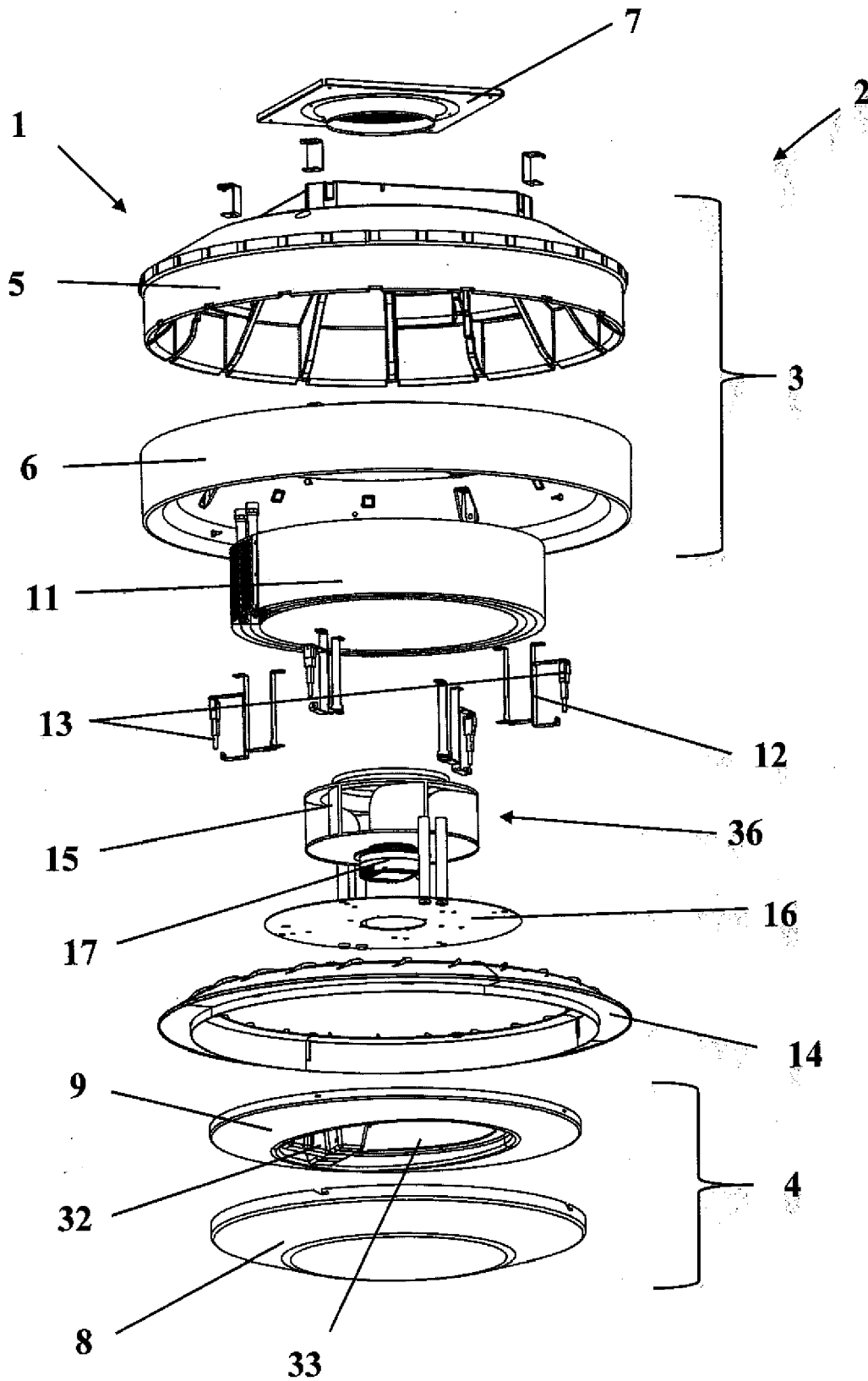


Fig. 1

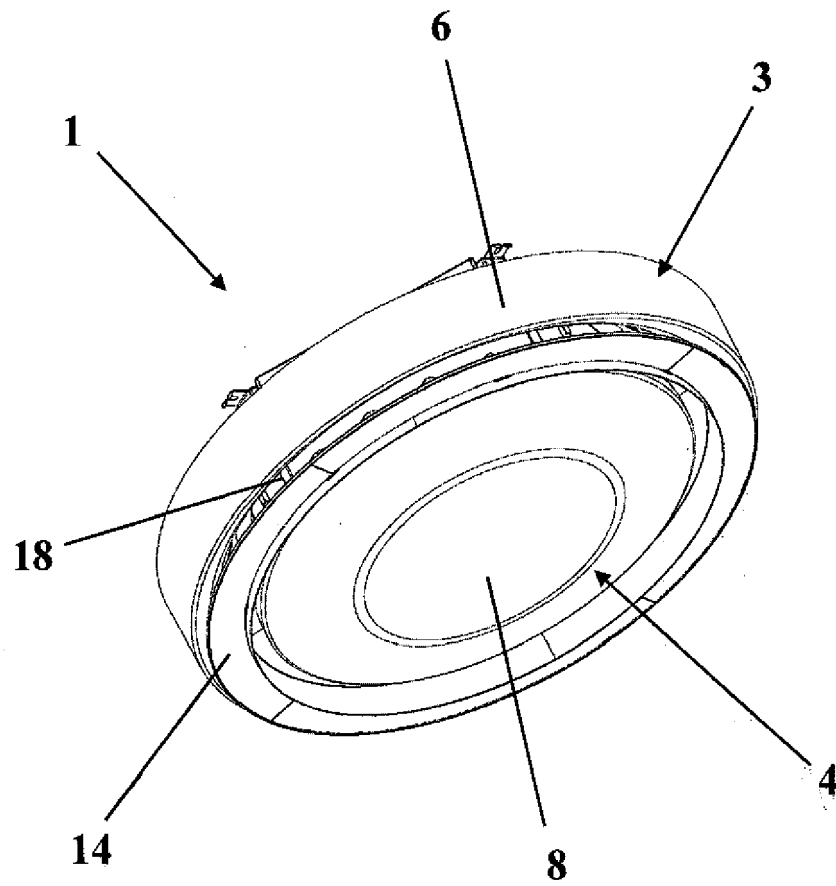


Fig. 2

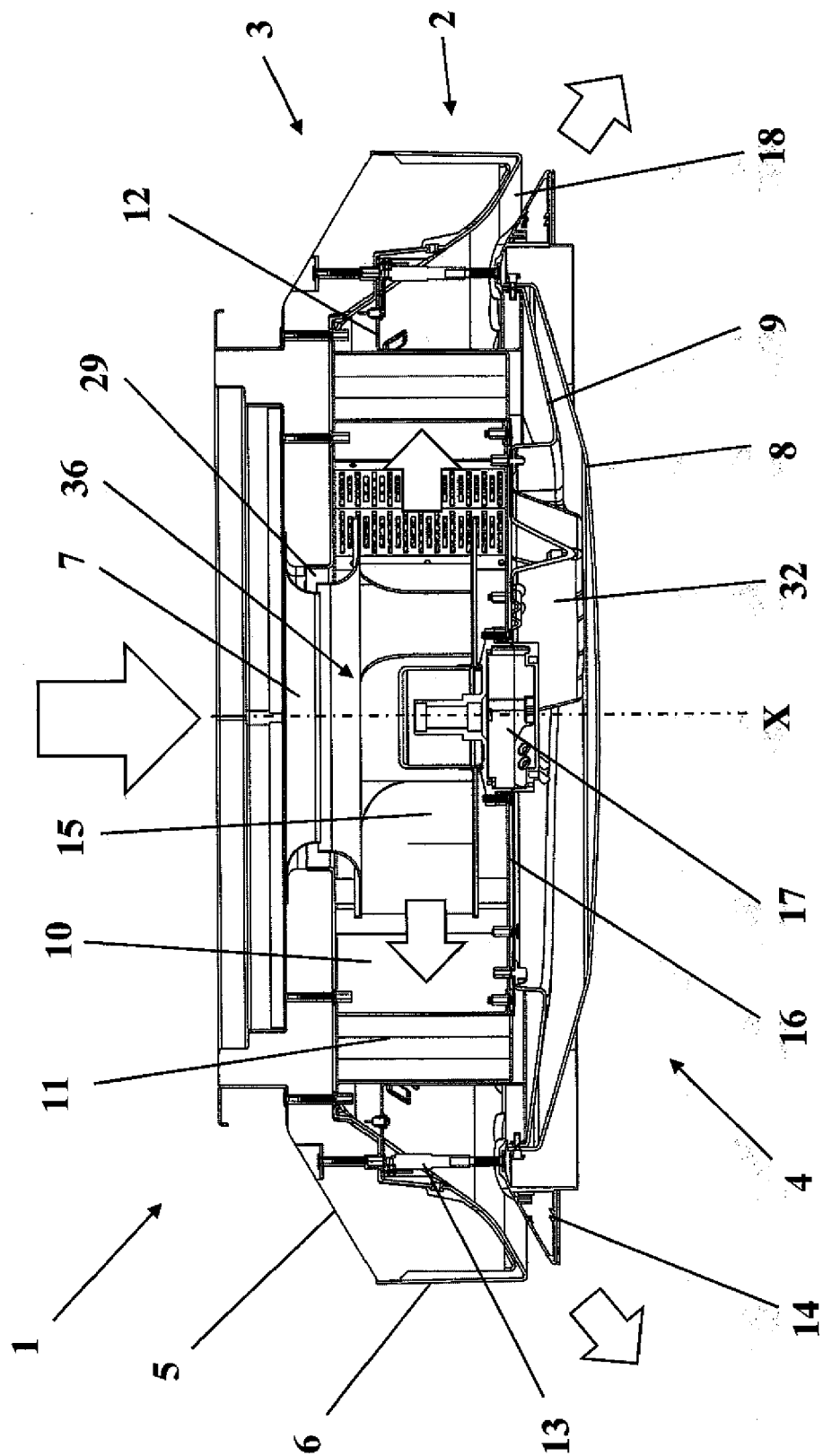


Fig. 3

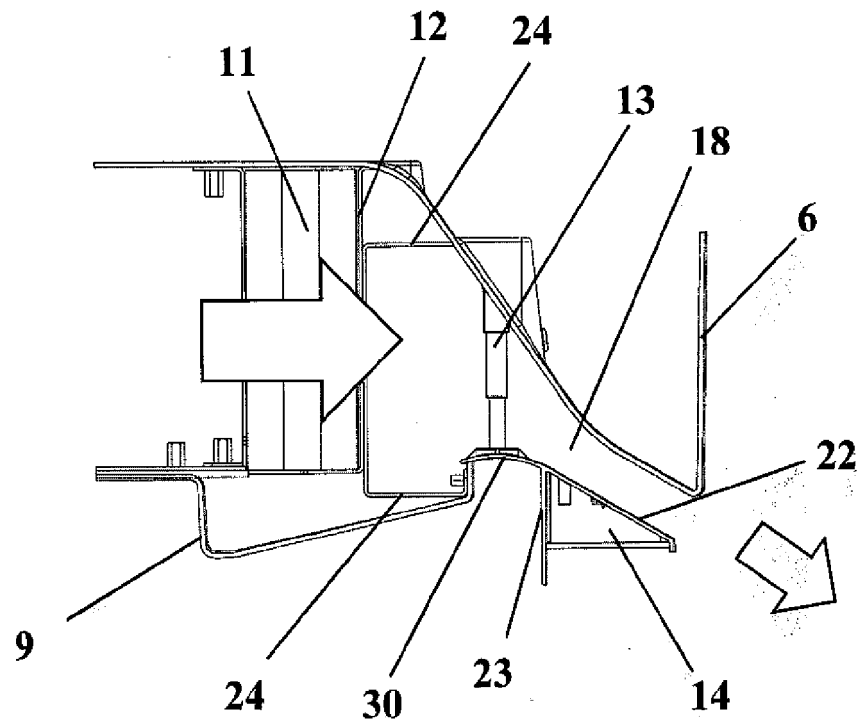


Fig. 4

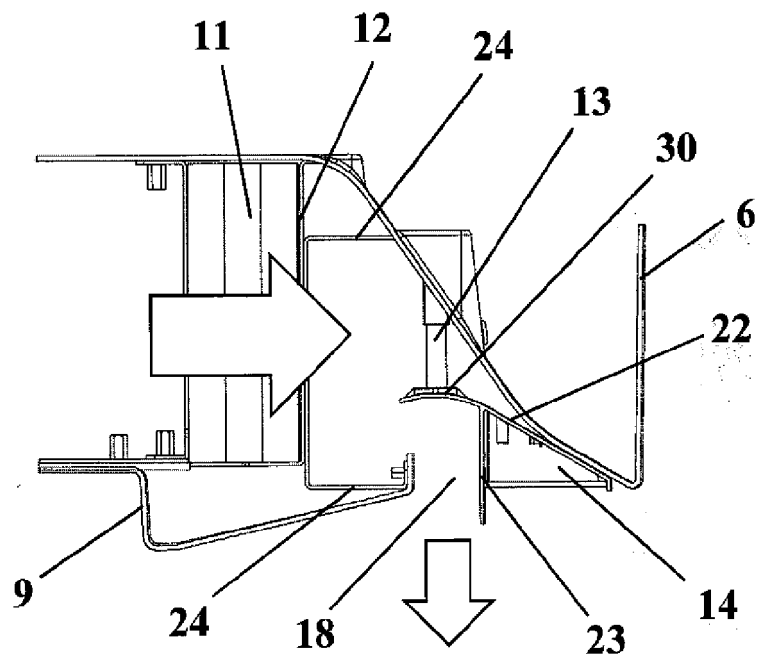


Fig. 5

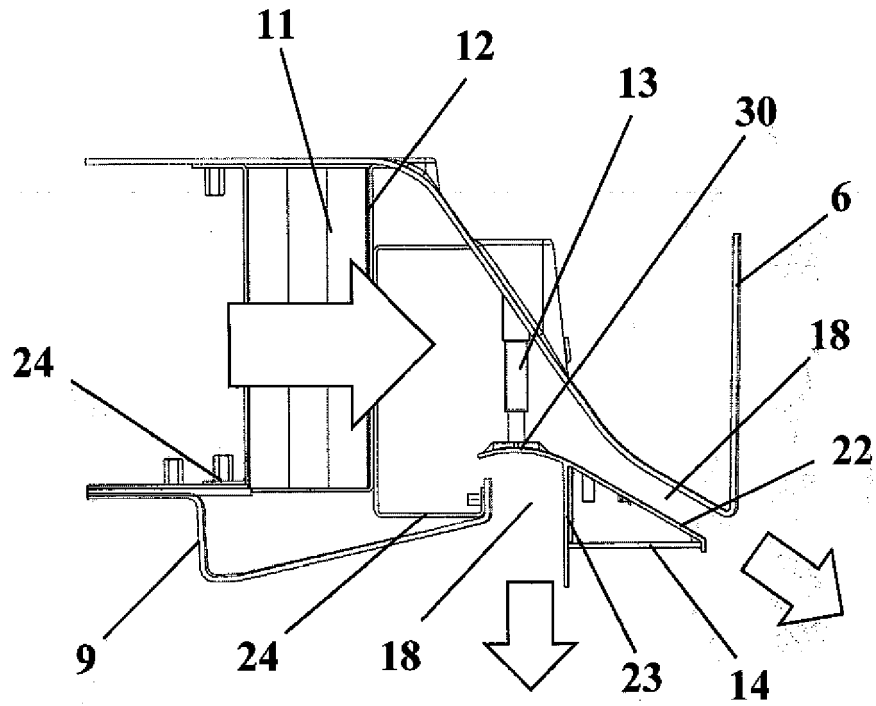


Fig. 6

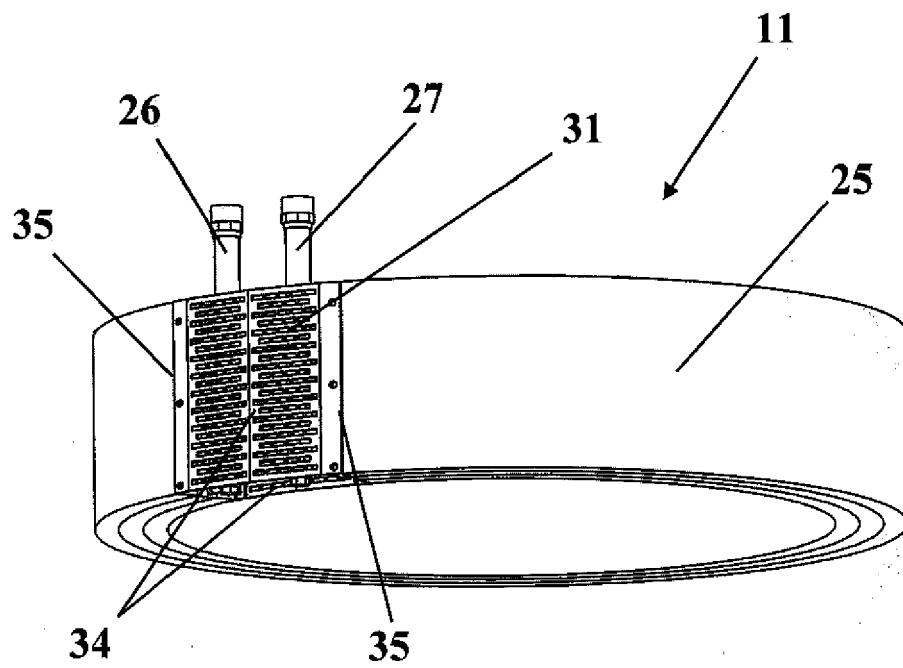
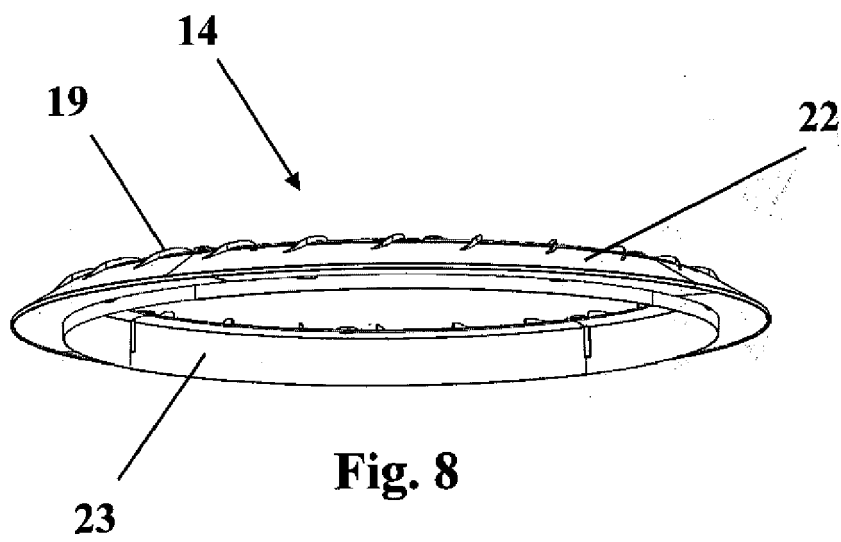


Fig. 7





EUROPEAN SEARCH REPORT

Application Number

EP 23 16 5093

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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