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(54) **Air circulation unit**

(57) The casing forming an outside wall of an air circulation unit comprises loose parts (10,12,14,16) which, with a clamping strip (18), are hermetically pressed

against each other and a ventilator or heat exchanger (19) to effect a separation between the different chambers in the inlet and outlet to the ventilator or heat exchanger.

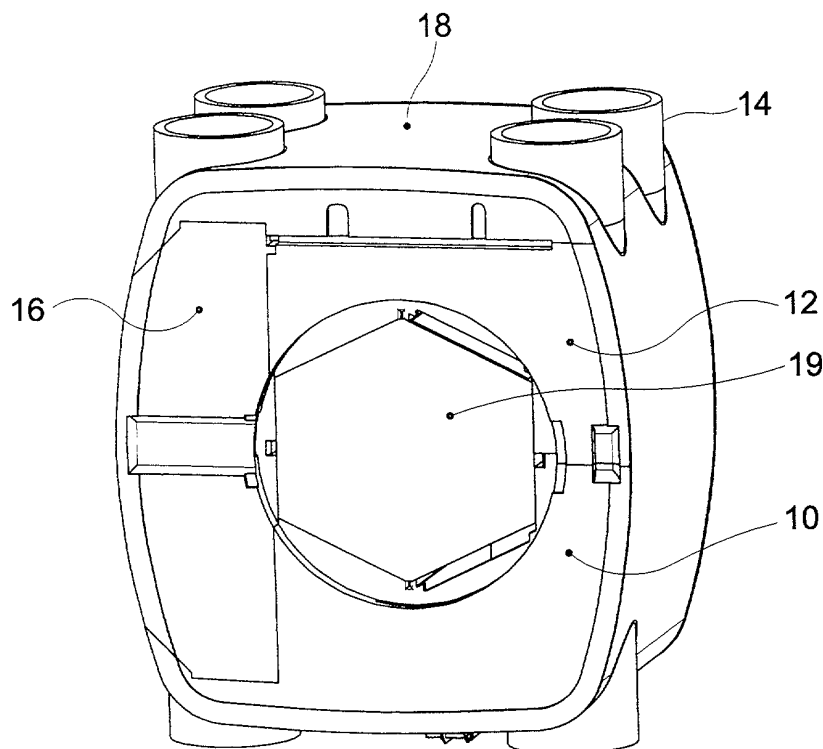


Fig. 1G

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Description

[0001] The invention relates to an air circulation unit with an air flow element, which forms an exclusive connection between at least two chambers of the air circulation unit, which communicate with openings for supplying and discharging air to and from the air circulation unit.

[0002] Such an air circulation unit may for instance be a ventilator unit, an air treatment unit or a heating unit. The air flow element is for instance a ventilator sucking air from one of the chambers to another (the chambers may be very small, sometimes not more than a few centimeters long). In one embodiment, the air circulation unit is a balance ventilation unit with a heat exchanger as air flow element, in which an incoming air flow and an outgoing air flow are brought into heat contact with each other. Such a balance ventilation unit comprises at least four chambers: inlet and outlet chambers for both air flows.

[0003] Of importance to the efficiency of such air circulation units is that there is no leakage from one chamber to the other beyond the air flow element or from the chambers to the surroundings of the air circulation unit. It is therefore important that the casing of the chambers forms a hermetic separation between the chambers and from the chambers to the surroundings.

[0004] In practice, the casing has proved to be an important cost factor, precisely because of the necessity to effect a hermetic seal.

[0005] It is inter alia an object of the invention to provide an air circulation unit in which the casing can be hermetically realized in a simple manner.

[0006] The invention provides an air circulation unit with a casing forming an outside wall of the air circulation unit with openings therein for supplying and discharging air, which casing encloses two or more chambers and which air circulation unit contains an air flow element forming an exclusive connection between at least two of the chambers, in which the air circulation unit is provided with a clamping strip and the casing comprises loose parts which, with the clamping strip, can be hermetically pressed against each other and the air flow element to effect a separation between the chambers.

[0007] The parts of the casing are preferably somewhat resilient, so that they deform under the pressure of the clamping strip and are thus pressed against each other and the air flow element.

[0008] In one embodiment of the air circulation unit according to the invention, a circumference of the outside wall around which the clamping strip is tensioned, is nearly completely of convex shape. Thus the force of the clamping strip is applied to the parts of the casing in a uniformly distributed manner. Consequently, material with limited strength will suffice for the casing. Moreover, this ensures that connections between the different parts and the air flow element are closed by pressing from all directions.

[0009] In another embodiment of the air circulation unit according to the invention, the loose parts of the casing are made of foamed plastic material. This material proves to be very suitable, because it is resilient, light and inexpensive, while it operates sufficiently hermetically.

[0010] In another embodiment of the air circulation unit according to the invention, the air flow element is an air-air heat exchanger through which two separated air flows run, which interchange heat in the heat exchanger via separation walls. In this embodiment, the above-mentioned connection in the heat exchanger connects a first and a second of the chambers, and the heat exchanger forms a further connection between a third and a fourth of the chambers. This serves to exchange heat between air flowing through the connection and air flowing through the further connection. Thus a balance ventilation unit with a complex of chambers is realized in a simple manner.

[0011] A further embodiment of the air circulation unit according to the invention is provided with a first and a second ventilator for displacing air through respectively the connection and the further connection from and to the openings, the ventilators comprising a housing against which the loose parts are hermetically pressed by the clamping strip. Thus, with the same clamping strip, the chambers are hermetically sealed from each other on the different sides of both the heat exchanger and the two ventilators.

[0012] In one embodiment, the clamping strip presses the parts of the casing under tension against the air flow element, so that the air flow element is in a position pressed between the parts of the casing. Thus no fastening measures are further required for the air flow element.

[0013] In a further embodiment of the air circulation unit according to the invention, the air circulation unit is of such design that the air flow element can be slid into and out of the air circulation unit without taking apart the parts of the casing when tension is removed from the clamping strip. Thus the cleaning of the air flow element (for instance a ventilator or heat exchanger) during the maintenance of the air circulation unit can be simply carried out.

[0014] These and other objectives and advantageous aspects of the air circulation unit according to the invention will be described with reference to the following figures.

Figures 1a-g illustrate the structure of a ventilation unit.

Figure 2 shows a finished ventilation unit.

[0015] Figures 1a-g show the structure of a ventilation unit, in this case a balance ventilation unit. In Figures 1a-d, a loose part 10, 12, 14, 16, respectively, of the casing is added to the casing of the ventilation unit. Figure 1e shows a clamping strip, and Figure 1f shows the parts

10, 12, 14, 16 of the casing with the clamping strip 18 enclosing them. In Figure 1g, a heat exchanger 19 is added.

[0016] Figure 2 shows a finished ventilation unit, in which a front plate 20 is added to the parts 10, 12, 14, 16, 18 already shown. Arranged on the rear side of the ventilation unit is a comparable rear plate (not shown). This rear plate contains, for instance, provisions for suspending the ventilation unit. As shown, the ventilation unit has six inlet and outlet openings 22a-f (also referred to as nozzles). In practice, four of them are used, the employed openings being selected depending on the need for having inlets and outlets available on one side of the ventilation unit, or on opposite sides. Arranged in the clamping strip 18 are holes through which the nozzles 22a-f project outward.

[0017] Besides the parts shown of the casing and the heat exchanger, the ventilation unit also comprises two ventilators (not shown), which are each housed in one of the loose parts of the casing, for instance in a hollow space, such as hollow space 11, which forms a connection between an opening 22a-g and the central space between the parts 10, 12, 14, 16 of the casing via a hole, such as hole 17 in the respective part of the casing. (It will be clear that each of the parts 10, 12, 16 of the casing may contain such hollow spaces 11 and holes 17.)

[0018] In operation, the ventilation unit is placed for instance in a house or an industrial building, and the openings 22a-f are connected to the ventilation system, one opening being connected to an inlet of outside air, one to a channel for distributing air through the building, one to a channel for sucking in air from the building and one to an outlet to the outside air.

[0019] One of the ventilators (not shown) sucks in air from the channel for sucking in from the building and blows this air to the outlet to the outside air. The second ventilator (not shown) sucks air from the inlet of the outside air and blows this air to the channel for distribution through the building. The two ventilators lead these two air flows to the central space between the parts 10, 12, 14, 16 of the casing, in which the heat exchanger 19 is located. The air flows run separated from each other, but with close heat contact through the heat exchanger. In case of a heated building, heat is thus transferred from the air leaving the building to air entering the building.

[0020] In this connection, it is of course important that no leakages occur from one air flow to the other, nor between the part of the air flows leaving the heat exchanger 19 and the part of the air flow entering the heat exchanger 19. That is to say that the space between the heat exchanger 19 and the inside wall of the parts 10, 12, 14, 16 of the casing must be divided into different chambers hermetically separated from each other for respectively supplying and discharging the two air flows. This seal is partly realized through the wall of the parts 10, 12, 14, 16 of the casing and through partitions (such as partition 24) in the casing. The invention ensures that

this hermetic seal can be realized in a simple manner.

[0021] When assembling the ventilation unit, for instance first the required ventilators are placed in the parts 10, 12, 14, 16 of the casing. Subsequently, the loose parts 10, 12, 14, 16 of the casing are joined together. Then the clamping strip 18 is arranged around the loose parts of the casing. Then the heat exchanger is slid into the whole. Finally, the clamping strip 18 is tightened. This can be done in different manners, for instance with a lever or by screwing on etc.

[0022] The parts 10, 12, 14, 16 of the casing are preferably of foamed plastic, such as EPR (Expanded Poly-Propylene, that is to say foamed polypropylene). This material is resilient, very suitable for sealing air chambers and inexpensive. Of course, the invention is not limited to this material, other foamed carbon polymers having comparable properties can be very favorably used, but also non-foamed materials and even non-plastics are useful.

[0023] Through the force exerted by the clamping strip 18 on the parts 10, 12, 14, 16 of the casing, the parts are pressed against each other and against the heat exchanger 19, as a result of which a hermetic seal of the different chambers is realized. Besides, the front plate 20 and rear plate (not shown) seal, as far as necessary, the chambers sideward from each other, the resilience of the parts 10, 12, 14, 16 of the casing providing a good seal between the parts and the front and rear plates. The front and rear plates are arranged, for instance with a bayonet catch, on the parts 10, 12, 14, 16 of the casing.

[0024] As shown, the parts 10, 12, 14, 16 of the casing together form a convex circumference around which the clamping strip 18 is laid. Thus the clamping strip 18 makes contact with the casing as much uniformly as possible. Of course, this does not require that the clamping strip 18 exerts force everywhere on the circumference. Thus, for instance, no force is exerted where the nozzles 22a-f project outward. Also, a concave part may be arranged incidentally elsewhere on the circumference, as a result of which the clamping strip is remote from the circumference at that place. This may be done for instance around the seams between the different parts 10, 12, 14, 16 of the casing.

[0025] For the division shown of the casing into parts 10, 12, 14, 16, with seams being essentially perpendicular to each other between the parts 10, 12, 14, 16 and the heat exchanger, the circumference preferably contains convex parts, each with an arched shape with a range of normal vectors (perpendicular to the surface of the convex part), so that the normal to the seams is parallel to a normal vector within that range. Thus the casing is in compression on the seams in a stable manner, as a result of which these are hermetically pressed together.

[0026] In the embodiment shown, the circumference is somewhat four-sided, with sides being in the middle perpendicular to the seams and bending from the middle

convexly in the direction of the next side. This gives the desired stable compression on the seams, as a result of which these are hermetically pressed together.

[0027] Of course, the invention is not limited to the described order of assembly. Thus the heat exchanger 19 may for instance be arranged before, even before all the parts of the casing are joined together. For cleaning the heat exchanger 17 during maintenance of the ventilation unit it is advantageous, however, that the heat exchanger can be slid in and out without it being necessary to remove the parts 10, 12, 14, 16 of the casing, after removing the tension from the clamping strip 18. Thus a simple maintenance of the heat exchanger 19 is possible by removing the tension from the clamping strip 18, taking out the heat exchanger 19, cleaning or replacing the heat exchanger 19, placing back and tensioning the clamping strip 18 again. In that case, too, the central space between the parts 10, 12, 14, 16 of the casing is accessible for cleaning purposes.

[0028] The ventilators (not shown) are each preferably mounted in an opening in a plate (one plate per ventilator or one plate for both ventilators). This plate is arranged between the parts 10, 12, 14, 16 of the casing such that the edge of the plate is completely between different parts. Thus the plate is clamped when tensioning the clamping strip 18, so that no air can escape along the ventilators.

[0029] It will be clear that, although the invention is excellently suitable for a ventilation unit of the type shown with the heat exchanger 19 and four chambers around it for supplying and discharging two air flows, the invention is also suitable for more complicated or simpler ventilation units or more in general for air circulation units, including heating units, such as for instance a ventilation unit with two chambers with an interposed ventilator for sucking air from one chamber to the other, or a closed boiler with an inlet for combustion air and an outlet of flue gas.

Claims

1. An air circulation unit provided with a casing forming an outside wall of the air circulation unit with openings therein for supplying and discharging air, which casing encloses two or more chambers and which air circulation unit contains an air flow element forming an exclusive connection between at least two of the chambers, in which the air circulation unit is provided with a clamping strip and the casing comprises loose parts which, with the clamping strip, can be hermetically pressed against each other and the air flow element to effect a separation between the chambers.
2. An air circulation unit according to claim 1, wherein a circumference of the outside wall around which the clamping strip is tensioned, is nearly completely

of convex shape.

3. An air circulation unit according to claim 1 or 2, wherein the loose parts of the casing are made of foamed plastic material.
4. An air circulation unit according to any one of the preceding claims, wherein the air flow element is a heat exchanger in which the connection connects a first and a second of the chambers, and wherein the heat exchanger forms a further connection between a third and a fourth of the chambers to exchange heat between air flowing through the connection and air flowing through the further connection.
5. An air circulation unit according to claim 4, provided with a first and a second ventilator for displacing air through respectively the connection and the further connection from and to the openings, the ventilators comprising a housing against which the loose parts are hermetically pressed by the clamping strip.
6. An air circulation unit according to any one of the preceding claims, wherein the clamping strip presses the parts of the casing under tension against the air flow element, so that the air flow element is in a position pressed between the parts of the casing.
7. An air circulation unit according to claim 6, of such design that the air flow element can be slid into and out of the air circulation unit without taking apart the parts of the casing when tension is removed from the clamping strip.

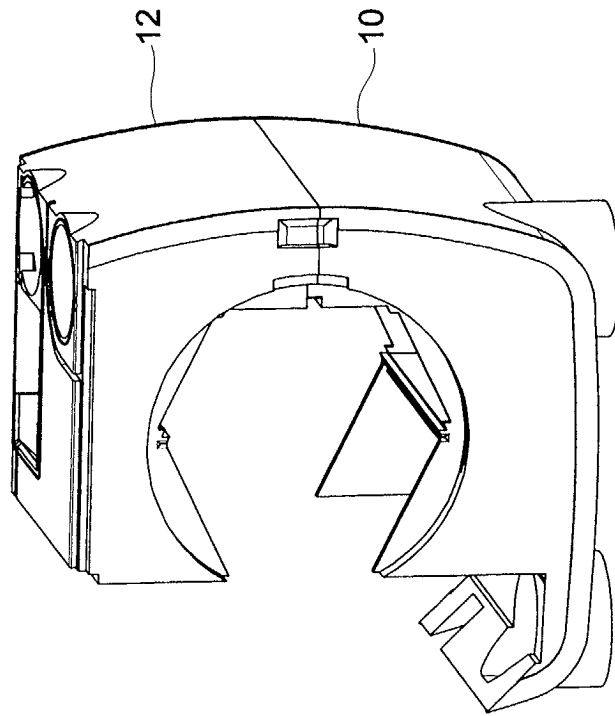


Fig. 1B

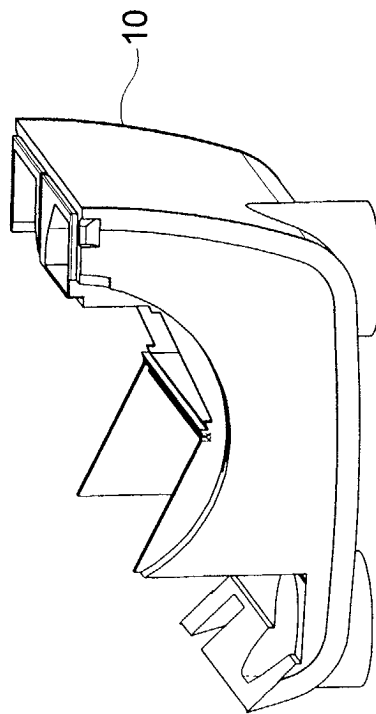


Fig. 1A

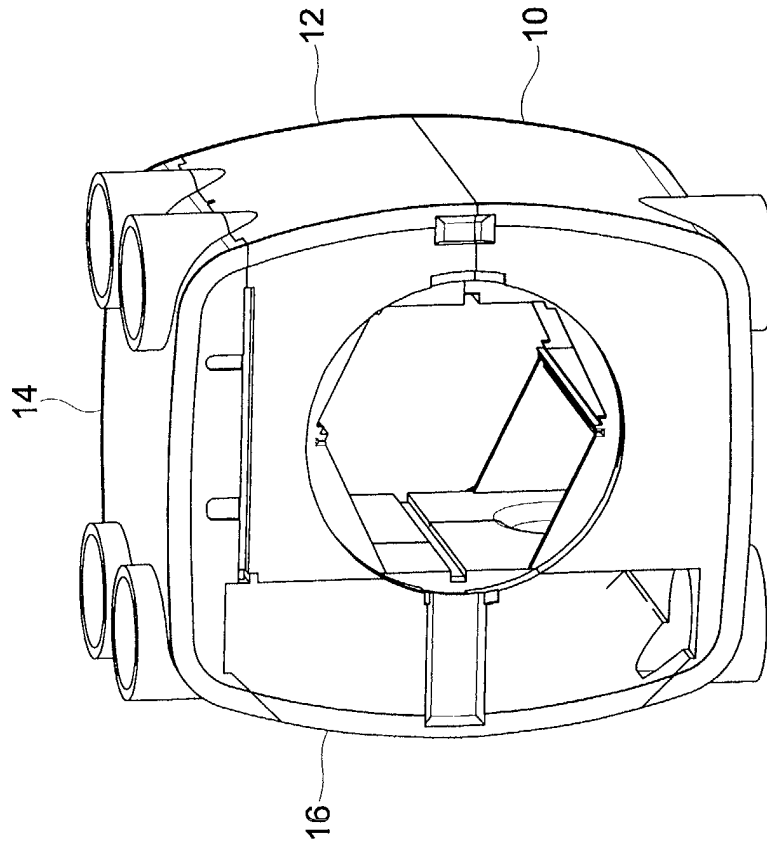


Fig. 1D

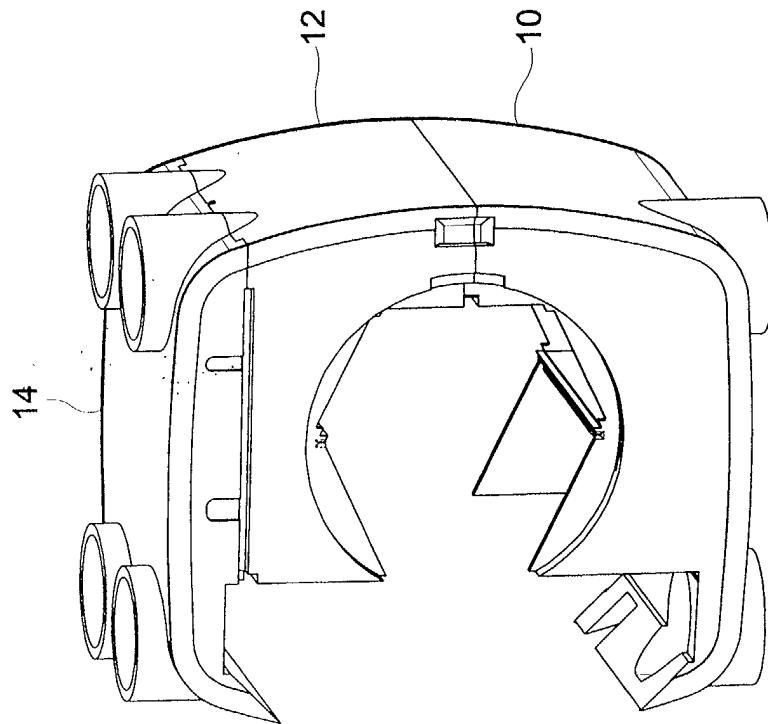


Fig. 1C

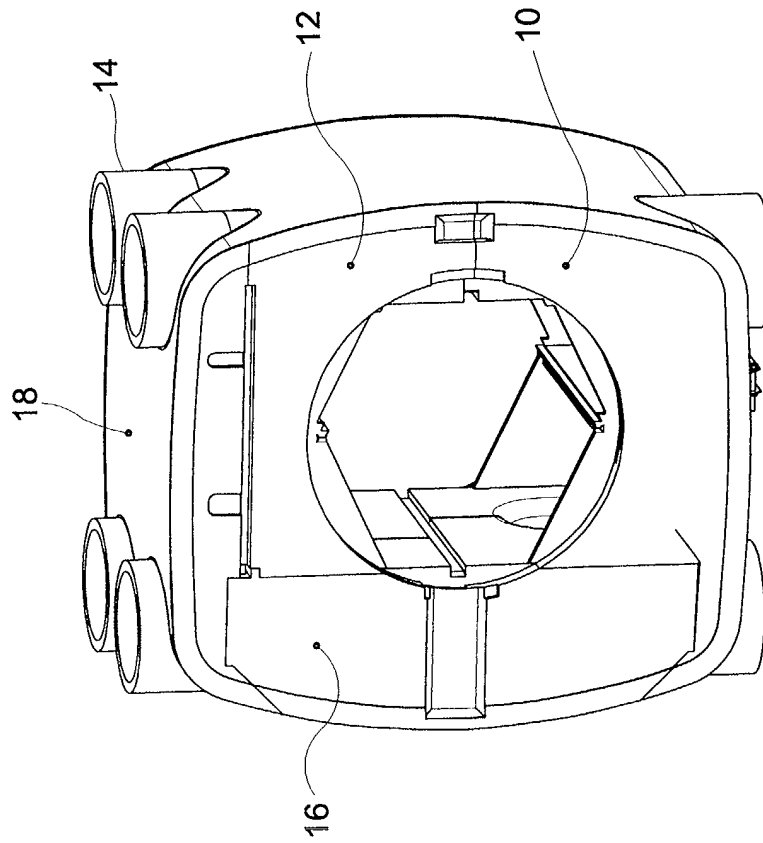


Fig. 1F

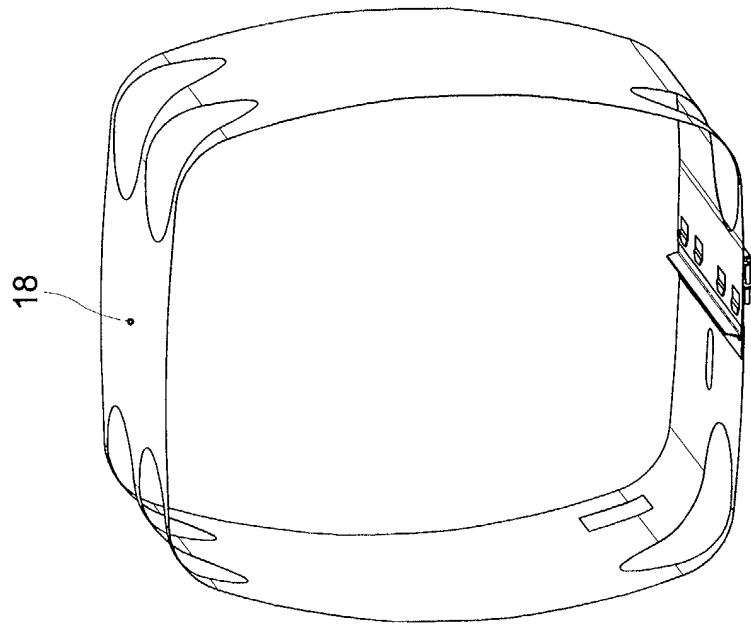


Fig. 1E

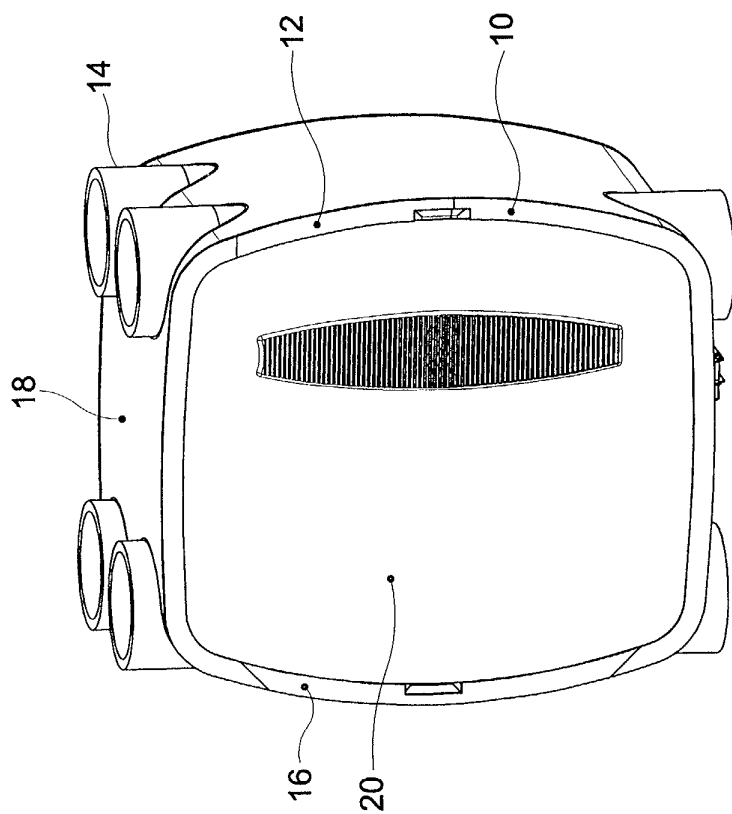


Fig. 2

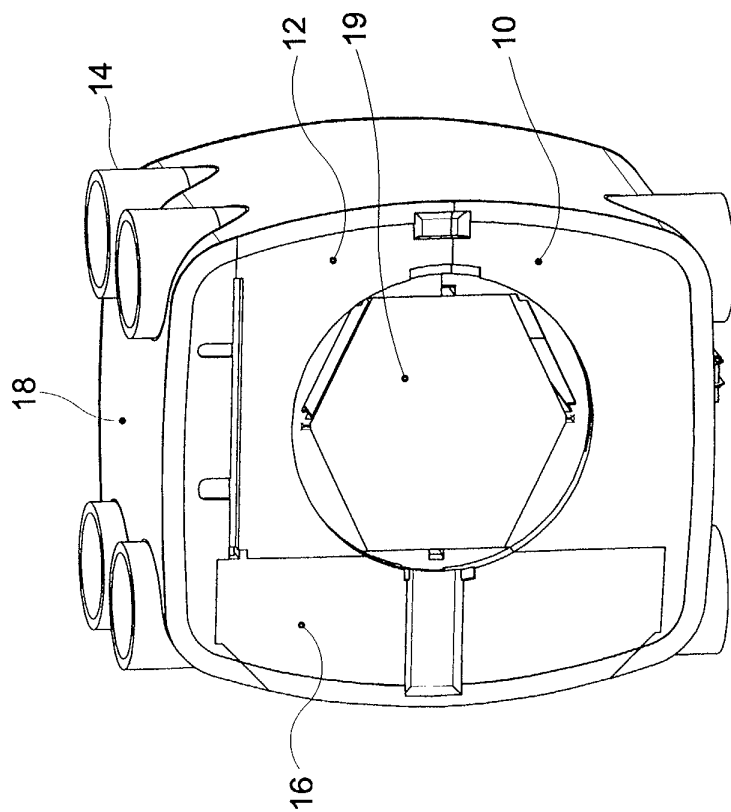


Fig. 1G



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