(19) DANMARK

(10) DK/EP 2971990 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *F 24 F 12/00 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2019-12-02**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2019-08-28**

(86) Europæisk ansøgning nr.: **14721959.6**

(86) Europæisk indleveringsdag: **2014-03-11**

(87) Den europæiske ansøgnings publiceringsdag: **2016-01-20**

(86) International ansøgning nr.: **IB2014000278**

(87) Internationalt publikationsnr.: **WO2014140717**

(30) Prioritet: **2013-03-12 EP 13001248**

(84) Designerede stater: **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 MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Zehnder Group International AG, Moortalstrasse 1, 5722 Gränichen, Schweiz**

(72) Opfinder: **WILLERING, Peter, Leerinkbeek 59, 8033 EH Zwolle, Holland**
BOXUM, Erik, Ereprijs 37, 7944 NR Meppel, Holland

(74) Fuldmægtig i Danmark: **Dennemeyer & Associates S.A, P.O. Box 700425, DE-81304 Munich, Tyskland**

(54) Benævnelse: **KOMPAKT VARMEGENVINDINGS-VENTILATIONSENHED**

(56) Fremdragne publikationer:
EP-A1- 0 928 932
EP-A1- 2 244 023
EP-A2- 2 498 014
WO-A1-81/03064
DE-A1- 3 208 392
JP-A- S53 100 648

DESCRIPTION

[0001] The present invention relates to a ventilation unit for providing supply air, preferably outside air or fresh air, to an apartment or parts thereof and for removing return air, preferably exhaust air or used air, from said apartment or parts thereof.

[0002] Heat recovery ventilation units have been used for many years in ventilation systems to recover heat from exhaust air exiting a house or an apartment to the surrounding atmosphere. A heat exchanger is used to transfer heat from the exhaust air exiting the house or the apartment to the outside air entering the house or the apartment. Such ventilation systems comprise an arrangement of ducts for transporting air between selected rooms of an apartment (or house) and the surrounding atmosphere. More precisely, such heat recovery ventilation systems comprise ducts collecting return air (used air) from the rooms, ducts for distributing supply air (fresh air) to the rooms on the one hand, and ducts for transporting exhaust air from the apartment to the atmosphere and ducts for transporting outside air from the atmosphere to the apartment. A heat recovery ventilation unit is located at a crossing point at which the ducts of these four air types meet. Consequently, such heat recovery ventilation units comprise a supply air outlet, a return air inlet, an exhaust air outlet, an outside air inlet and a heat exchanger inside the unit.

[0003] DE 32 08 392 discloses a ventilating appliance for ventilating and venting rooms according to the preamble of claim 1. The appliance is characterized by air guiding channels which run essentially diagonally, with the ventilating appliance consisting internally of an upper part and a lower part which are made of a partially flexible, vibration-damping and sound-damping material. Metallic or non-metallic cover plates, in particular the cover surface and the floor plate, are provided in the outer region. Moreover, the front and rear sides are covered with such plates with corresponding openings.

[0004] It is an object of the invention to provide a heat recovery ventilation unit which, on the one hand, is compact and which, on the other hand, still allows enough air throughput without requiring too much energy for driving the ventilators in the unit and thus, without creating too much air flow noise.

[0005] This object is achieved by a ventilation unit for providing supply air, preferably outside air (fresh air), to an apartment or parts thereof and for removing return air, preferably exhaust air (used air), from said apartment or parts thereof, said ventilation unit comprising:

a supply air outlet for establishing supply air flow communication with said apartment;

a return air inlet for establishing return air flow communication with said apartment;

an exhaust air outlet for establishing exhaust air flow communication with the atmosphere;

an outside air inlet for establishing outside air flow communication with an the atmosphere;

a heat exchanger having first air flow passages and second air flow passages for transferring heat energy form return air entering said first air flow passages and exhaust air leaving said first air flow passages on the one hand, to outside air entering said second air flow passages and supply air leaving said second air flow passages on the other hand;

a first ventilator at a first location within the ventilation unit, for transporting air through a first air flow path starting at said return air inlet, passing through said first air flow passages in the heat exchanger and ending at said exhaust air outlet;

a second ventilator at a second location within the ventilation unit, for transporting air through a second air flow path starting at said outside air inlet, passing through said second air flow passages and ending at said supply air outlet,

wherein said first air flow path and said second air flow path comprise internal air flow ducts having rectangular cross sections,

characterized in that

1. a) both said first ventilator and said second ventilator are located downstream of the heat exchanger in their respective air flow paths;
2. b) the air flow cross section of said return air inlet (RAI) and the air flow cross section of said outside air inlet are greater than the air flow cross section of said supply air outlet and the air flow cross section of said exhaust air outlet; and
3. c) at least a major portion of the entire length of each of the internal air flow ducts of the ventilation unit are of substantially rectangular flow cross section.

[0006] Due to the rectangular cross sections of the internal air flow ducts, the ducts can be arranged in a very compact manner within the housing of the heat recovery ventilation unit of the invention, thus allowing relatively large duct cross sections within a minimum of equipment space. As a result, a very compact heat recovery ventilation unit is achieved without reducing the performance with respect to air throughput and noise generation. Given the fact that the return air duct portions and the outside air duct portions are driven in suction mode with respect to atmospheric pressure, the greater cross sections in these duct portions minimize overall pressure drop in the first air flow path driven by the first ventilator, on the one hand, and overall pressure drop in the second air flow path driven by the second ventilator, on the other hand. Again, this improves the performance of the unit with respect to air throughput and noise generation. The features under bullet point c) contribute to the compactness of the heat recovery ventilation unit without reducing the performance in respect of air throughput and noise generation.

[0007] Preferably, in the ventilation unit according to the invention, said supply air outlet, said return air inlet, said exhaust air outlet and said outside air inlet all have substantially rectangular air flow cross sections.

[0008] Preferably, the ventilation unit comprises an optional bypass air flow path bypassing said heat exchanger. More preferably, said bypass flow path comprises two separate flow paths symmetrically bypassing said heat exchanger. Again, this improves the performance of the unit with respect to air throughput and noise generation.

[0009] Preferably, a bypass valve is provided which can be moved from a first valve position allowing return air to pass through the heat exchanger along said first air flow path and allowing outside air to pass through the heat exchanger along said second air flow path, to a second valve position allowing return air to bypass the heat exchanger along said first air flow path and allowing outside air to bypass the heat exchanger along said second air flow path. More preferably, said bypass valve is associated to a valve drive unit acting on said bypass valve, and wherein said valve drive unit is located inside the ventilation unit at a central location halfway in between said first air flow path and said second air flow path. This contributes to the compactness of the unit. Preferably, in the ventilation unit according to the invention, at least 80% of the entire length of each of the internal air flow ducts of the ventilation unit are of substantially rectangular flow cross section. Again, this contributes to the compactness of the heat recovery ventilation unit without reducing the performance with respect to air throughput and noise generation.

[0010] Preferably, in the ventilation unit according to the invention, said first air flow path and said second air flow path are arranged in a rotationally symmetrical manner with respect to each other with respect to an axis of rotation extending through the ventilation unit and with respect to a 180° rotation of the ventilation unit around said axis of rotation. This improves the versatility of the heat recovery unit with respect to its installation in an apartment.

[0011] Preferably, in the ventilation unit according to the invention, a control unit, preferably having a control panel and/or a display panel, for controlling active elements of the ventilation unit such as said first ventilator, said second ventilator and said bypass valve, can be installed at a first location of the ventilation unit or at a second location of the ventilation unit, said first location and said second location being arranged in a rotationally symmetrical manner with respect to each other with respect to said axis of rotation extending through the ventilation unit and with respect to said 180° rotation of the ventilation unit around said axis of rotation. Again, this contributes to the versatility of the heat recovery unit with respect to its installation in an apartment.

[0012] Preferably, in the ventilation unit according to the invention, said first ventilator and said second ventilator are arranged in a rotationally symmetrical manner with respect to each other with respect to said axis of rotation extending through the ventilation unit and with respect to a 180° rotation of the ventilation unit around said axis of rotation. Again, this contributes to the versatility of the heat recovery unit with respect to its installation in an apartment.

[0013] Preferably, in the ventilation unit according to the invention, said second ventilator can be installed in a first orientation or in a second orientation at its location within the ventilation unit, and wherein a first supply air outlet and a second supply air outlet are provided at

different locations within the ventilation unit, said first orientation and said second orientation preferably being opposite to each other. Again, this contributes to the versatility of the heat recovery unit with respect to its installation in an apartment.

Brief description of the drawings:

[0014]

Fig. 1 is a perspective view of an embodiment of the heat recovery ventilation unit according to the invention.

Fig. 2 is a top view of the embodiment of the heat recovery ventilation unit according to the invention.

Fig. 3 is a front view of the embodiment of the heat recovery ventilation unit according to the invention.

Fig. 4 is a rear view of the embodiment of the heat recovery ventilation unit according to the invention.

Fig. 5 is a bottom view of the embodiment of the heat recovery ventilation unit according to the invention.

Fig. 6 is a front view, with the front cover removed, of the embodiment of the heat recovery ventilation unit according to the invention.

[0015] The heat recovery ventilation unit 1 provides supply air SA, preferably outside air or fresh air, to an apartment or parts thereof, and removes return air RA, preferably exhaust air or used air, from said apartment or parts thereof.

[0016] The ventilation unit 1 comprises a supply air outlet SAO for establishing supply air flow communication with said apartment, a return air inlet RAI for establishing return air flow communication with said apartment, an exhaust air outlet EAO for establishing exhaust air flow communication with the atmosphere, and an outside air inlet OAI for establishing outside air flow communication with the atmosphere.

[0017] In addition, the unit 1 comprises heat exchanger HEX having first air flow passages (not shown) and second air flow passages (not shown) for transferring heat energy from return air entering said first air flow passages and exhaust air leaving said first air flow passages on the one hand, to outside air entering said second air flow passages and supply air leaving said second air flow passages on the other hand, is provided in the heat recovery ventilation unit. In addition, the unit 1 comprises a first ventilator V1 at a first location within the ventilation unit 1, for transporting air through a first air flow path AFP1 starting at said return air inlet RAI,

passing through said first air flow passages in the heat exchanger HEX and ending at said exhaust air outlet EAO, and a second ventilator V2 at a second location within the ventilation unit 1, for transporting air through a second air flow path AFP2 starting at said outside air inlet OAI, passing through said second air flow passages in the heat exchanger HEX and ending at said supply air outlet SAO.

[0018] The first air flow path AFP1 and the second air flow path AFP2 comprise internal air flow ducts having rectangular cross sections.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE3208392 [0003]

KOMPAKT VARMEGENVINDINGS-VENTILATIONSENHED

Patentkrav

1. Ventilationsenhed (1) til tilførsel af indblæsningsluft, fortrinsvis udeluft (frisk luft), til en lejlighed eller dele deraf og til fjernelse af returluft, fortrinsvis udblæsningsluft (brugt luft), fra lejligheden eller dele deraf, hvilken ventilationsenhed omfatter:

et udløb til indblæsningsluft (SAO) til etablering af en forbindelse mellem indblæsningsluftstrømmen og lejligheden;

et returluftindtag (RAI) til etablering af en forbindelse mellem returluftstrømmen og lejligheden;

et udløb til udblæsningsluft (EAO) til etablering af en forbindelse mellem udblæsningsluftstrømmen og atmosfæren;

et udeluftindtag (OAI) til etablering af en forbindelse mellem udeluftstrømmen og atmosfæren;

en varmeveksler (HEX) med første luftstrømskanaler og yderligere luftstrømskanaler til overførsel af varmeenergi fra returluft (RA), der strømmer ind i de første luftstrømskanaler, og udblæsningsluft (EA), der forlader de første luftstrømskanaler, på den ene side til udeluft (OA), der strømmer ind i de yderligere luftstrømskanaler og indblæsningsluft (SA), der forlader de yderligere luftstrømskanaler, på den anden side;

en første ventilator (V1) på et første sted i ventilationsenheden (1) til at transportere luft gennem en første luftstrømsbane (AFP1), der begynder ved returluftindtaget (RAI), passerer gennem de første luftstrømskanaler i varmeveksleren (HEX) og ender ved udløbet til udblæsningsluft (EAO);

en anden ventilator (V2) på et andet sted i ventilationsenheden (1) til at transportere luft gennem en anden luftstrømsbane, der begynder ved udeluftindtaget (OAI), passerer gennem de yderligere luftstrømskanaler i varmeveksleren (HEX) og ender ved udløbet til indblæsningsluft (SAO),

hvor den første luftstrømsbane (AFP1) og den anden luftstrømsbane (AFP2) omfatter indvendige luftstrømskanaler med rektangulære tværsnit,

kendetegnet ved, at

a) både den første ventilator (V1) og den anden ventilator (V2) er placeret nedstrøms i forhold til varmeveksleren (HEX) i deres respektive luftstrømsbaner (AFP1, AFP2);

b) luftstrømstværsnittet af returluftindtaget (RAI) og luftstrømstværsnittet af udeluftindtaget (OAI) er større end luftstrømstværsnittet af udløbet til indblæsningsluft (SAO) og luftstrømstværsnittet af udløbet til udblæsningsluft (EAO); og

c) i det mindste en større del af hele længden af hver af de indvendige luftstrømskanaler i ventilationsenheden (1) har et i det væsentlige rektangulært strømningstværsnit.

2. Ventilationsenhed som defineret i krav 1, hvor udløbet til indblæsningsluft (SAO), returluftindtaget (RAI), udløbet til udblæsningsluft (EAO) og udeluftindtaget (OAI) alle har i det væsentlige rektangulære luftstrømstværsnit.

3. Ventilationsenhed som defineret i krav 1 eller 2, hvor ventilationsenheden omfatter en omløbsluftstrømsbane, der fører forbi varmeveksleren.

4. Ventilationsenhed som defineret i krav 3, hvor omløbsluftstrømsbanen omfatter to separate strømningsbaner, der symmetrisk fører forbi varmeveksleren.

5. Ventilationsenhed som defineret i krav 3 eller 4, hvor der er tilvejebragt en omløbsventil, som kan flyttes fra en første ventilposition, der gør det muligt for returluft (RA) at passere varmeveksleren (HEX) langs den første luftstrømsbane (AFP1) og gør det muligt for udeluft (OA) at passere varmeveksleren (HEX) langs den anden luftstrømsbane (AFP2), til en anden ventilposition, der gør det muligt at lede returluft (RA) uden om varmeveksleren (HEX) langs den første luftstrømsbane (AFP1) og gør det muligt at lede udeluft (OA) uden om varmeveksleren (HEX) langs den anden luftstrømsbane (AFP2).

6. Ventilationsenhed som defineret i krav 5, hvor omløbsventilen er forbundet med en ventildrevsenhed, der indvirker på omløbsventilen, og hvor denne ventildrevsenhed er placeret inden i ventilationsenheden i en central placering halvvejs mellem den første luftstrømsbane (AFP1) og den anden luftstrømsbane (AFP2).

7. Ventilationsenhed som defineret i et hvilket som helst af kravene 1 til 6, hvor den i det mindste større del udgør mindst 80 % af hele længden af hver af de indvendige luftstrømskanaler i ventilationsenheden.

8. Ventilationsenhed som defineret i et hvilket som helst af kravene 1 til 7, hvor den første luftstrømsbane (AFP1) og den anden luftstrømsbane (AFP2) er arrangeret rotationssymmetrisk i forhold til hinanden i forhold til en rotationsakse, der strækker sig gennem ventilationsenheden, og i forhold til en 180 graders rotation af ventilationsenheden omkring rotationsaksen.

9. Ventilationsenhed som defineret i krav 8, hvor en kontrolenhed, fortrinsvis med et kontrolpanel og/eller et displaypanel, til styring af aktive elementer i ventilationsenheden såsom den første ventilator, den anden ventilator og omløbsventilen kan installeres i en første position i ventilationsenheden eller i en anden position i ventilationsenheden, hvor den første position og den anden position er arrangeret rotationssymmetrisk i forhold til hinanden i forhold til rotationsaksen, der strækker sig gennem ventilationsenheden, og i forhold til 180 graders rotationen af ventilationsenheden omkring rotationsaksen.

10. Ventilationsenhed som defineret i et hvilket som helst af kravene 1 til 9, hvor den første ventilator og den anden ventilator er arrangeret rotationssymmetrisk i forhold til hinanden i forhold til en rotationsakse, der strækker sig gennem ventilationsenheden, og i forhold til en 180 graders rotation af ventilationsenheden omkring rotationsaksen.

11. Ventilationsenhed som defineret i et hvilket som helst af kravene 1 til 10, hvor den anden ventilator kan installeres i en første orientering eller i en anden orientering i sin position i ventilationsenheden, og hvor der er tilvejebragt et første udløb til indblæsningsluft og et andet udløb til indblæsningsluft forskellige steder i ventilationsenheden, idet den første orientering og den anden orientering fortrinsvis er modsatte af hinanden.

DRAWINGS

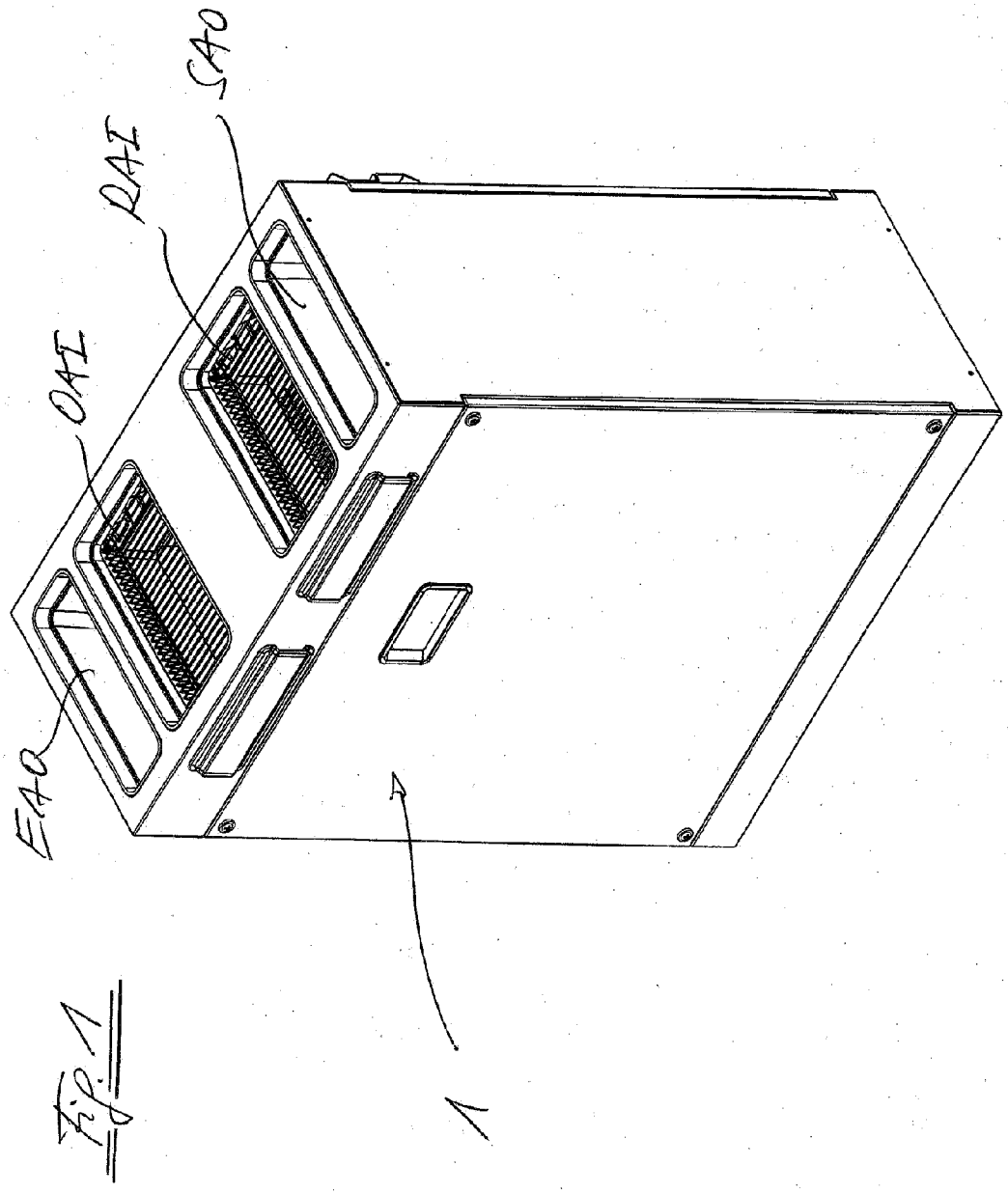

Fig. 1

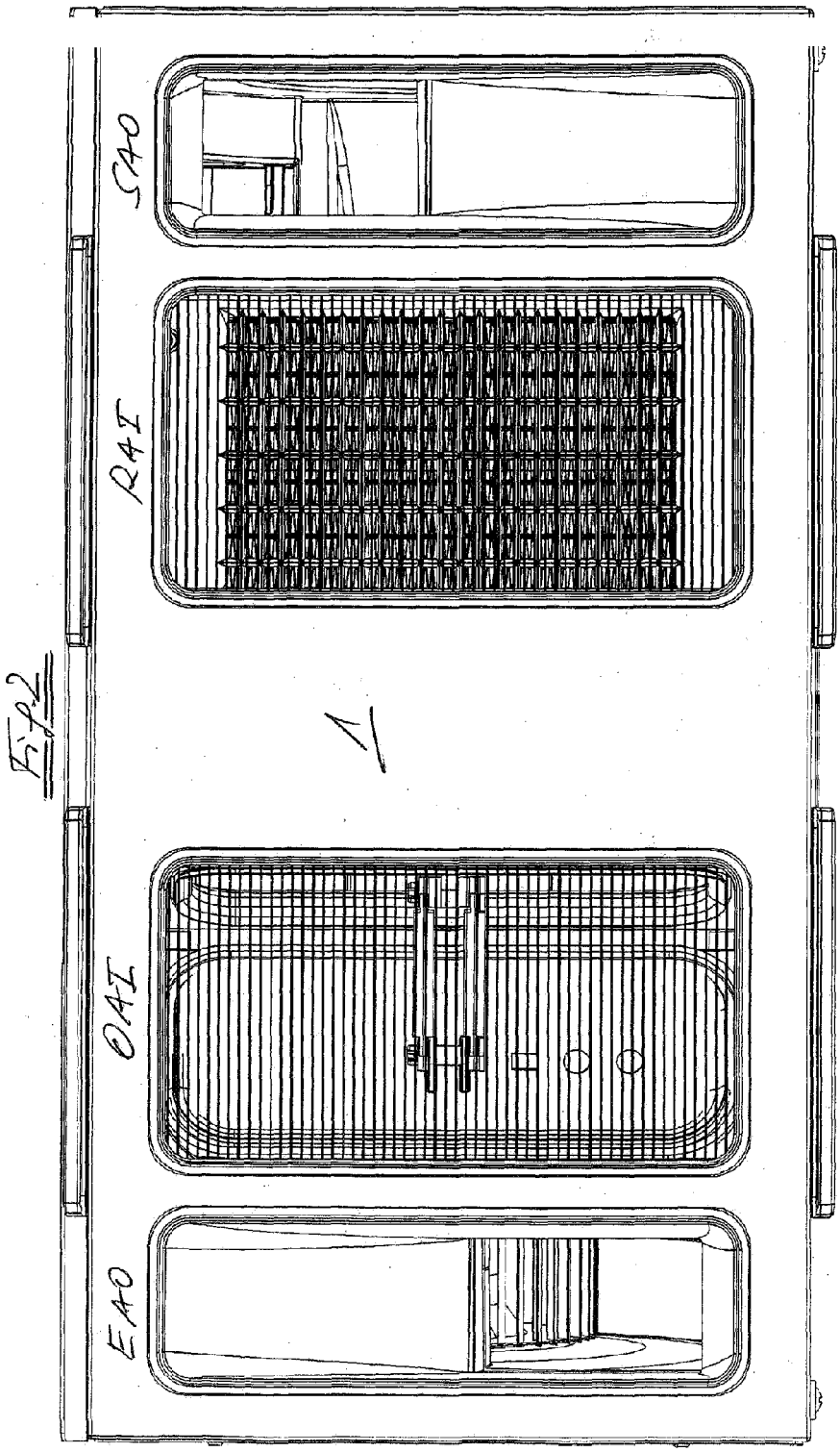

Fig 2

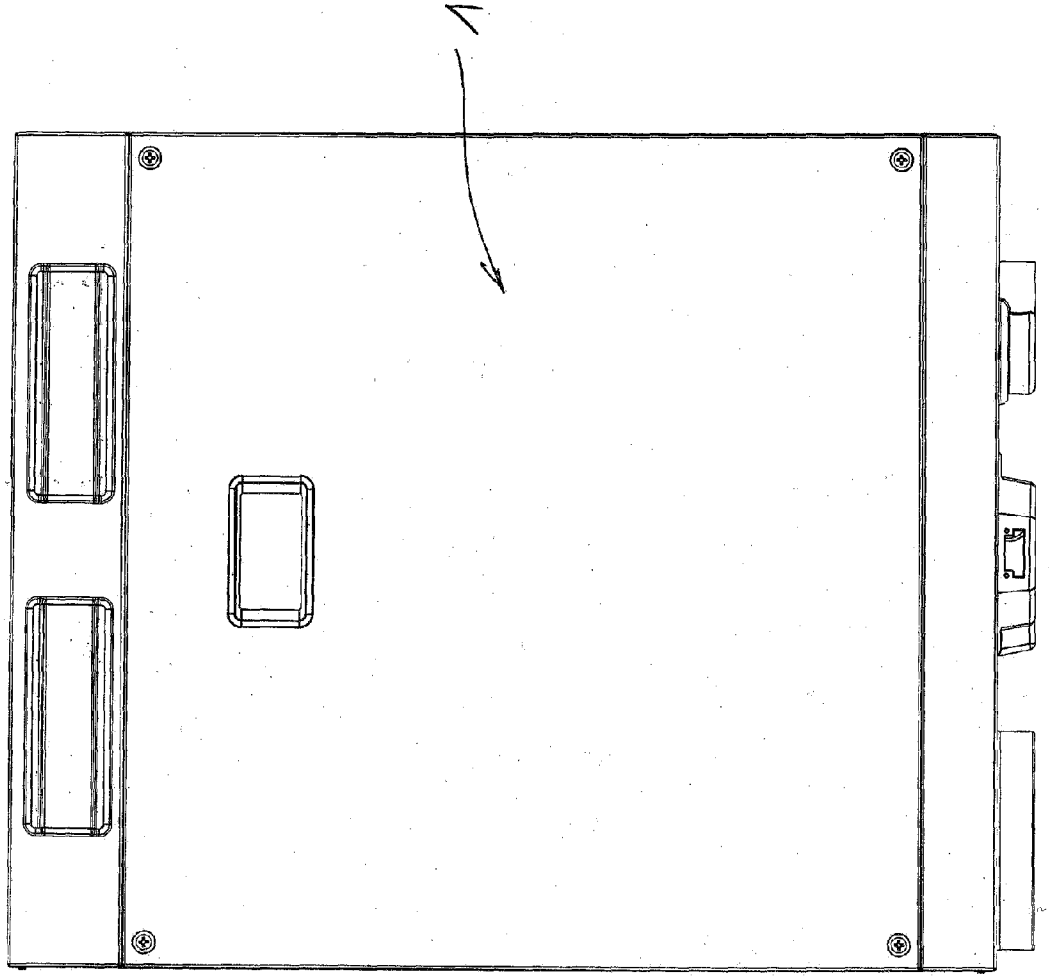

Fig. 3

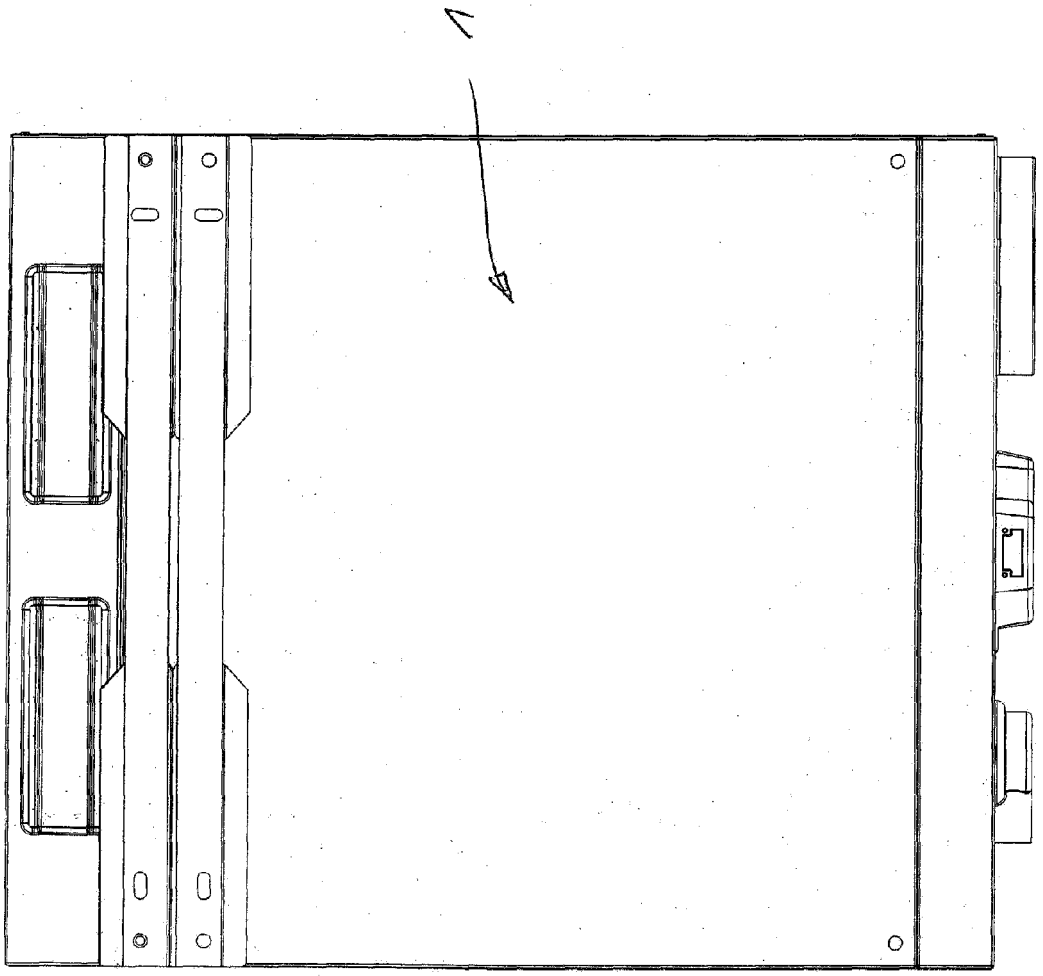

Fig. 4

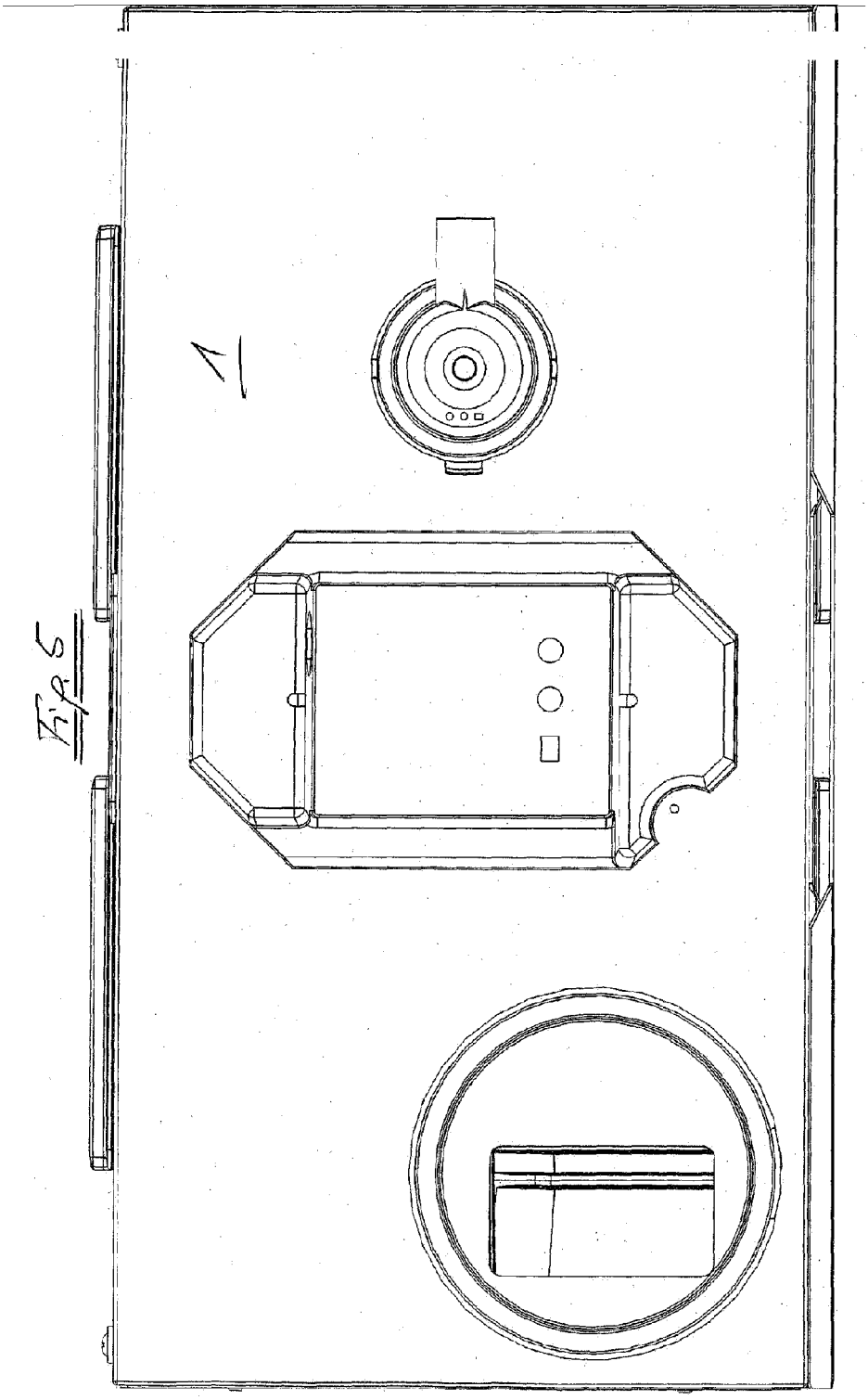

Fig 5

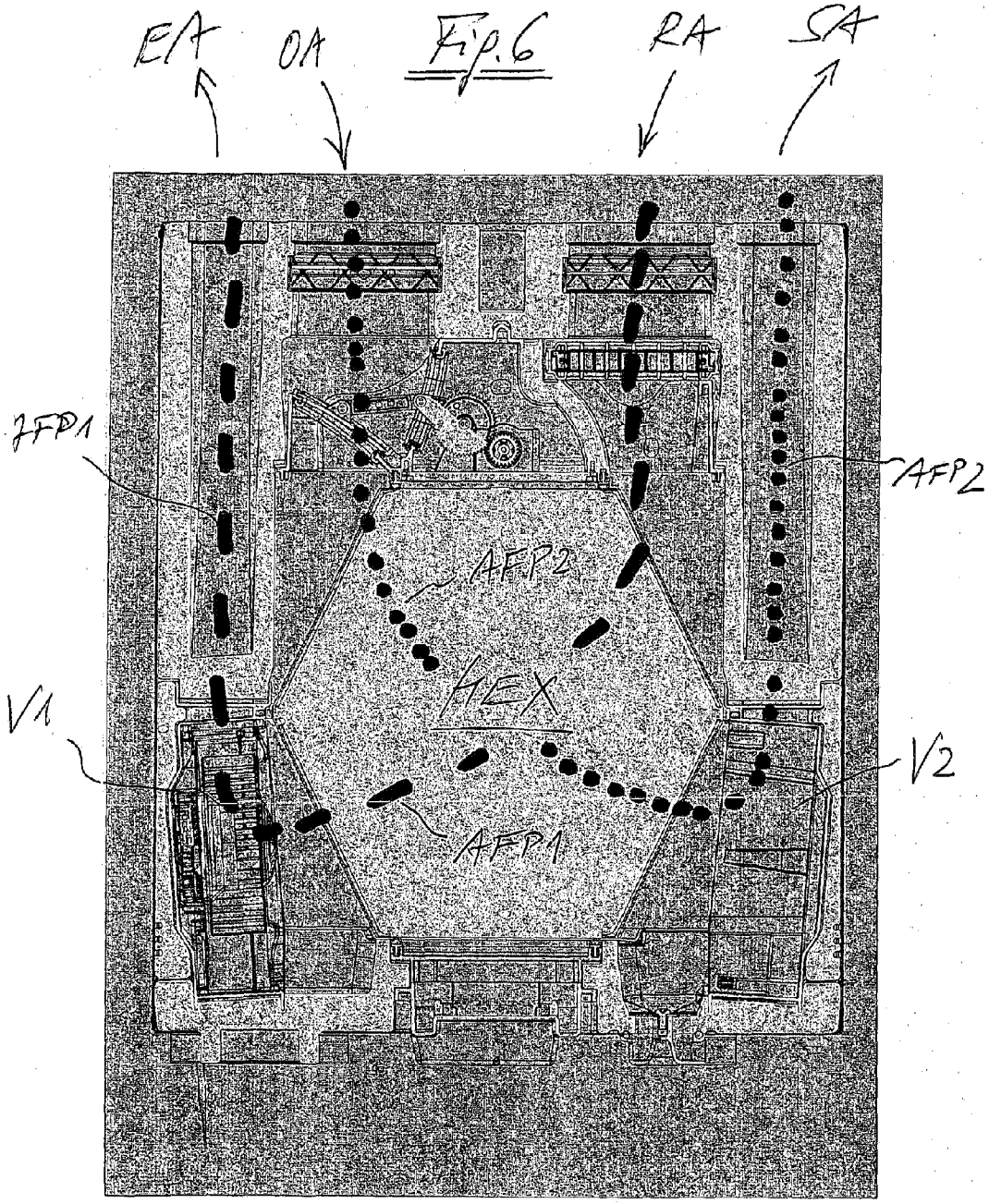

Fig.6