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(54) **Fan convector**

(57) A fan convector (1) suitable for operating in cooling and heating mode and equipped with a casing (2) with: an intake opening (11) arranged at the lower end of the casing (2), a first delivery opening (21) arranged at the upper end of the casing (2), a second delivery opening (22) arranged on a front side of the casing (2) and a heat exchanger (3) and a fan group (4) housed in said casing (2). The fan group (4) is intended to suck air from the intake opening (11) and discharge air towards the heat exchanger (3) and from this towards the delivery openings (21, 22). The casing (2) also comprises valve means (50) to intercept the flow of air flowing towards the delivery openings (21, 22) and allow the discharge

of the air alternatively from the first delivery opening (21) or from the second delivery opening (22). The valve means (50) is also mobile between a first position associated with a heating operating mode of the fan convector and a second position associated with a cooling operating mode of the fan convector. In the heating operating mode the valve means (50) is in a position such that the air sucked in by the fan group (4) and treated by the heat exchanger is discharged from the second delivery opening (22), whereas in the second cooling mode, the valve means (50) is in a position such that the air sucked in by the fan group (4) and treated by the heat exchanger (3) is discharged from the first delivery opening (21).

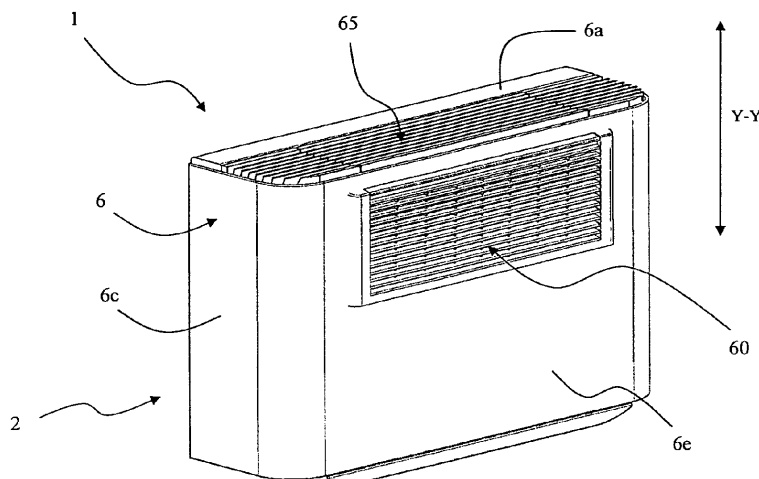


Fig. 1

Description

[0001] The present invention refers to a fan convector.

[0002] A fan convector typically comprises a casing inside which a finned heat exchanger is housed, which is equipped with a coil, for the circulation of a heat exchange fluid and a fan group that creates a forced convection of the air through the finned exchanger from a lower intake opening to an upper delivery opening.

[0003] Such a configuration is, however, inadequate if the fan convector must be used both in cooling and heating mode. In particular, the fixed position of the two openings means that the fan convector can only be used efficiently during the summertime in cooling mode. Indeed, it is known that hot air and cold air have different densities and that hot air tends to rise whereas cold air tends to fall. Therefore, in cooling mode, the cold air discharged from the upper opening is heavier than the air present in the room and therefore tends to fall towards the floor, resulting in uniform cooling. Contrarily, in heating mode, the hot air discharged from the upper opening is lighter than the air present in the room and therefore tends to rise towards the ceiling, thus making it difficult to heat the room uniformly.

[0004] It should also be noted that the heat comfort level perceived by the occupants of a building depends on various factors such as: air speed, temperature, humidity, etc. Common vertical delivery fan convectors offer excellent performance in hot weather in which cooling is needed but in cold weather, when the room needs to be heated, the vertical release of air is not the best choice since it promotes the natural thermal stratification inside the room. The hot air, which is less dense, tends to occupy the top part of the room, leaving the volume below to colder air with a consequent reduction in perceived comfort.

[0005] Thermo-fluid dynamic studies carried out by the Applicant have shown how in incorrect ventilation conditions during the winter it is possible to have vertical temperature differences within the occupied area of the order of 4-5°C. The use of fan convectors capable of directing the hot air towards the floor allows the vertical temperature gradient to be reduced with differences of the order of 1-2°C.

[0006] In the state of the art fan convectors have been proposed equipped with systems for directing the cold air upwards and the hot air downwards during summer and winter operation, respectively.

[0007] Examples of fan convectors of the aforementioned type are provided by documents CN 2716696, EP 1 628 028 and JP 11-237067.

[0008] Chinese utility model CN 2716696 describes a fan convector that comprises a casing having two openings for the passage of air, a heat exchanger and a fan group to cause a circulation of air inside the unit and through the heat exchanger. The two openings for the air are arranged on the front side, respectively in the upper and lower part of the casing and they are intended

to operate without distinction as air intake and delivery openings, according to the operating mode of the fan convector, i.e. for heating in the winter and for cooling in the summer. Two flow diverters are positioned inside the casing, each of which can be commanded to pass between a heating configuration and a cooling configuration. To be specific, in cooling configuration, the two flow diverters are rotated into a position such that the fan group sucks air from the lower opening, sends such sucked air to the heat exchanger - in which a cooling fluid circulates - and discharges the treated air through the upper opening.

[0009] In heating configuration, the two flow diverters rotate into a position such that the air enters from the upper opening, is treated by the heat exchanger - in which a heating fluid circulates - and is sucked in and discharged by the fan group through the lower opening.

[0010] European patent application EP 1 628 028 describes a fan convector that comprises a casing with an intake opening and two delivery openings respectively arranged above and below the intake opening. Inside the casing a fan group and two heat exchangers are housed. The fan group is positioned centrally at the intake opening whereas the two heat exchangers are positioned at a respective delivery opening. Between the fan group and the two heat exchangers respective control guides are arranged that make it possible to block the airflow directed towards one of the two heat exchangers. Precisely, in heating mode, the flow of air is directed just towards the lower heat exchanger so as to discharge hot air from the lower delivery opening whereas, in cooling mode, the flow of air is directed just towards the upper heat exchanger so as to discharge cold air from the upper delivery opening. In this way, a uniform cooling/heating of the room in which the fan convector is installed is obtained.

[0011] Japanese patent JP 11-237067 describes a fan convector with a casing having an air intake opening arranged at the rear and two air delivery openings, one arranged on the upper surface of the casing and the other arranged at the bottom on the front surface thereof. The air entering from the intake opening is treated by a heat exchanger and sent by a fan group into the lower part of the casing where, through a deflector, the flow of air can be directed towards the lower delivery opening (heating operating mode) or towards the upper delivery opening (cooling operating mode) or towards both.

[0012] The solutions described above, although they allow the cold air to be directed upwards and the hot air downwards, respectively, during summer and winter operation, are structurally complex and not very versatile.

[0013] A further example of a fan convector is described in Japanese patent application JP 58-075641. Such a document describes a fan convector intended to be fixed to the ceiling. The fan convector has an air intake opening and two air delivery openings. The air is discharged mainly forwards by closing the damper 27 whereas it is discharged partially forwards and partially

downwards by opening the damper 27. Such a solution is also ineffective in optimising operation in summer and winter mode.

[0014] The purpose of the present invention is to provide a fan convector having structural and functional characteristics such as to satisfy the aforementioned requirements and at the same time to avoid the aforementioned drawbacks with reference to the prior art.

[0015] Such a purpose is accomplished by a fan convector according to claim 1. Such a purpose is also accomplished by a method for operating a fan convector according to claim 9.

[0016] Further characteristics and advantages of the fan convector according to the present invention will become clearer from the following description of a preferred example embodiment thereof, given for indicating and not limiting purposes, with reference to the attached figures, in which:

- figure 1 shows a front perspective view of the fan convector according to the present invention,
- figure 2 shows a rear perspective view of the fan convector of figure 1,
- figure 3 shows a side section view of the fan convector of figure 1 suitable for operating in heating mode,
- figure 4 shows a side section view of the fan convector of figure 1 suitable for operating in cooling mode,
- figure 5 shows a front perspective view of the casing of the fan convector of figure 1,
- figure 6 shows a perspective view of a detail of the fan convector of figure 1. With reference to the attached figures, reference numeral 1 globally indicates a fan convector according to the present invention.

[0017] The fan convector 1 comprises a casing 2 inside which a heat exchanger 3 and a fan group 4 are arranged.

[0018] The casing 2 extends according to a longitudinal direction Y-Y between a lower end 2a and an upper end 2b.

[0019] In accordance with an embodiment, the casing 2 comprises a support frame 5, preferably made from metallic material, which supports the heat exchanger 3 and the fan group 4 and a covering 6, preferably made from plastic material, which covers the frame 5 and the components supported by it.

[0020] The heat exchanger 3 has connections 7, 8 for the connection to a supply circuit of a heat exchange fluid.

[0021] The fan group 4 is arranged, with respect to the heat exchanger 3, so as to direct the flow of air discharged by it towards the heat exchanger 3 itself.

[0022] The fan group 4 comprises one or more fans and is coupled with an electric motor (not shown in the figures) suitable for setting the fans of the fan group 4 in rotation around a rotation axis.

[0023] The casing 2 has an intake opening 11 and a

delivery chamber 20 with a first delivery opening 21 and a second delivery opening 22.

[0024] The intake opening 11 is arranged at the lower end 2a of the casing 2.

[0025] The first delivery opening 21 is positioned at the upper end 2b of the casing 2. The second delivery opening 22 is positioned on a front side of the casing 2.

[0026] In one version, the second delivery opening 22 is formed in the upper portion of the front panel 6e and is closed through a grate 60 equipped with air deflection fins oriented so as to direct the flow of air discharged by the fan group 4 downwards.

[0027] In accordance with an embodiment, the second delivery opening 22 is arranged at a height h comprised between half the overall height H of the fan convector and the overall height H of the fan convector 1.

[0028] In accordance with an embodiment, the casing 2 has an intake chamber 10 having the intake opening 11 and a delivery chamber 20 downstream of the heat exchanger 3.

[0029] The fan group 4 is intended to suck in air from the intake opening 11 and discharge air towards the heat exchanger 3 and from this into the delivery chamber 20.

[0030] In particular, the fan group 4 is intended to suck in air from the intake opening 11 and discharge air towards the heat exchanger 3 and from this towards the two delivery openings 21 and 22.

[0031] In the example shown in the attached figures, the covering 6 of the casing 2 is defined by an upper panel 6a, a front panel 6e and two side panels 6c, whereas the frame 5 of the casing 2 is defined by a rear panel 5b, a lower panel 5d and two side panels 5c, connected together or made in one piece.

[0032] The intake opening 11 is formed in the lower panel 5d of the frame 5, the first delivery opening 21 is formed in the upper panel 6a of the covering and the second delivery opening 22 is formed in the front panel 6e of the covering 6.

[0033] The fan convector 1 comprises valve means 50 to intercept the flow of air flowing towards the delivery openings 21, 22 and allow the discharge of the air alternatively through the first delivery opening 21 or the second delivery opening 22.

[0034] In particular, the valve means 50 are moveable between a first position associated with a heating operating mode and a second position associated with a cooling operating mode.

[0035] In the first position, i.e. in the heating operating mode (cf. Fig. 3), the valve means 50 are arranged to close the first delivery opening 21 so that the fan group 4 sucks in air from the intake opening 11 and discharges the air treated by the heat exchanger 3 from the second delivery opening 22. Therefore, in the first position, i.e. in the heating operating mode, the air sucked in from the lower end 2a is discharged from the front side of the fan convector 1. In the second position, i.e. in the cooling operating mode (cf. Fig. 4), the valve means 50 are arranged to close the second delivery opening 22 so that

the fan group 4 sucks in air from the intake opening 11 and discharges the air treated by the heat exchanger 3 from the first delivery opening 21. Therefore, in the second position, i.e. in the cooling operating mode, the air sucked in from the lower end 2a is discharged from the upper end 2b of the fan convector 1.

[0036] In this way, in both heating and cooling operating modes there is uniform heating/cooling of the room in which the fan convector is located, optimising the efficiency of the fan group and of the heat exchanger as well as minimising the overall costs of the fan convector.

[0037] In one version, the valve means 50 are arranged at the delivery openings 21, 22 of the delivery chamber 20.

[0038] In particular, the valve means 50 comprise a dividing wall 51 hinged to the casing 2 and able to be actuated to move between two closed positions. In particular, the dividing wall 51 is intended to alternatively close the first delivery opening 21 or the second delivery opening 22 in the heating and cooling operating modes, respectively.

[0039] In an embodiment, the dividing wall 51 is moveable into at least one intermediate position between the two closed positions to partially close the two delivery openings 21, 22 in the heating and cooling operating modes, respectively, so as to divide the flow of air through the two delivery openings 21, 22 according to the user's requirements, proportionally to the closing thereof.

[0040] In a version, the dividing wall 51 is hinged in rotation around a hinging axis X-X and has a substantially flat rectangular shape with the long sides 51a, 51b extending parallel to the direction of the hinging axis X-X between the two side panels 5c of the frame 5. In a version, the dividing wall 51 has a wing-type profile in which, at the two short sides 51c, 51d of the dividing wall 51 itself, there are two prolongations 52, 53 projecting perpendicular to the short sides 51c, 51d along the direction X-X. The prolongations 52, 53 are intended to be inserted in respective seats formed in the side panels 2c so as to allow the rotation of the dividing wall 51 around the hinging axis X-X.

[0041] In an embodiment, the dividing wall 51, on the long side 51b opposite the long side 51a of rotation of the dividing wall 51, has a strip of flexible material 54, preferably made from rubber or nylon. Such a strip 54 ensures the airtight seal of the dividing wall 51 and, by deforming, prevents interference of the dividing wall 51 with the heat exchanger 3 during the rotation of the dividing wall 51 itself.

[0042] As illustrated in the example of figure 6, the valve means 50 comprise an actuation lever 55 connected to the dividing wall 51 to move the dividing wall 51 between the two closed positions. In particular, the actuation lever 55 is connected to one of the prolongations 52, 53.

[0043] In accordance with an embodiment, the fan convector 1 can have flow deflectors 65 foreseen at the first delivery opening 21. Such flow deflectors 65 can be con-

figured fixed or mobile in a plurality of positions between a completely closed position and a completely open position so as to adjust the flow rate of air discharged by the fan convector 1 through the first delivery opening 21.

[0044] As can be appreciated from what has been described, the fan convector according to the present invention makes it possible to satisfy the requirements and overcome the drawbacks referred to in the introductory part of the present description with reference to the prior art.

[0045] Of course, a man skilled in the art can bring numerous modifications and variants to the fan convector according to the invention described above, in order to satisfy contingent and specific requirements, all of which are in any case covered by the scope of protection of the invention as defined by the following claims.

Claims

1. Fan convector (1) suitable for operating in cooling and heating mode, said fan convector comprising:

- a casing (2) extending along a longitudinal direction (Y-Y) between a lower end (2a) and an upper end (2b), said casing (2) having:

- an intake opening (11) arranged at the lower end of the casing (2),
- a first delivery opening (21) arranged at the upper end of the casing (2),
- a second delivery opening (22) arranged on a front side of the casing (2),

- a heat exchanger (3) and a fan group (4) housed in said casing (2), said fan group (4) being intended to suck air from said intake opening (11) and discharge air towards said heat exchanger (3) and from this latter towards said delivery openings (21, 22),
- valve means (50) to intercept the flow of air flowing towards said delivery openings (21, 22) and allow the discharging of air alternatively through said first delivery opening (21) or said second delivery opening (22),

wherein:

- said valve means (50) are movable between a first position associated with a heating operating mode of the fan convector and a second position associated with a cooling operating mode of the fan convector,
- in said first position, said valve means (50) are arranged to close said first delivery opening (21) so that the air sucked in by the fan group (4) and treated by the heat exchanger (3) is discharged from the second delivery opening (22),

- in said second position, said valve means (50) is arranged to close said second delivery opening (22) so that the air sucked in by the fan group (4) and treated by the heat exchanger (3) is discharged from the first delivery opening (21). 5
2. Fan convector according to claim 1, wherein said casing (2) comprises a support frame (5) to support the heat exchanger (3) and the fan group (4) and a covering (6) that covers the frame (5), wherein 10
- the covering (6) is defined by an upper panel (6a), a front panel (6e) and two side panels (6c), and
 - the frame (5) is defined by a rear panel (5b), a lower panel (5d) and two side panels (5c), 15
- wherein
- said intake opening (11) is formed in the lower panel (5d) of said frame (5), 20
 - said first delivery opening (21) is formed in the upper panel (6a) of said covering (6) and
 - said second delivery opening (22) is formed in the front panel (6e) of said covering (6). 25
3. Fan convector according to claim 2, wherein said second delivery opening (22) is formed in the upper portion of the front panel (6e) of said covering (6) and is closed through a grating (60) equipped with air deflection fins oriented so as to direct the flow of air discharged by the fan group (4) downwards. 30
4. Fan convector according to any one of claims 1 to 3, wherein said valve means (50) comprise a dividing wall (51) hinged to the casing (2) and able to be actuated to move between said first and said second position to alternatively close the first (21) or the second delivery opening (22). 35
5. Fan convector according to claim 4, wherein said dividing wall (51) is moveable into at least one intermediate position between the first and the second position to partially close the two delivery openings (21, 22). 40
6. Fan convector according to claim 4 or 5, wherein said valve means (50) comprise an actuation lever (52) connected to the dividing wall (51) to move the dividing wall (51) between said two closed positions and said at least one intermediate position. 45
7. Fan convector according to claim 2 and 6, wherein said actuation lever (52) is arranged externally on the frame (5) of the casing (2). 50
8. Fan convector according to any one of claims 1 to 7, wherein said second delivery opening (22) is ar-

ranged at a height h comprised between half the overall height H of the fan convector 1 and the overall height H of the fan convector 1, measured between the lower end (2a) and the upper end (2b).

9. Method for operating a fan convector (1) according to any one of claims 1 to 8, wherein

- in heating mode, said valve means (50) are arranged to close said first delivery opening (21) so that the air sucked in by the fan group (4) and treated by the heat exchanger (3) is discharged by the second delivery opening (22),
- in cooling mode, said valve means (50) are arranged to close said second delivery opening (22) so that the air sucked in by the fan group (4) and treated by the heat exchanger (3) is discharged by the first delivery opening (21).

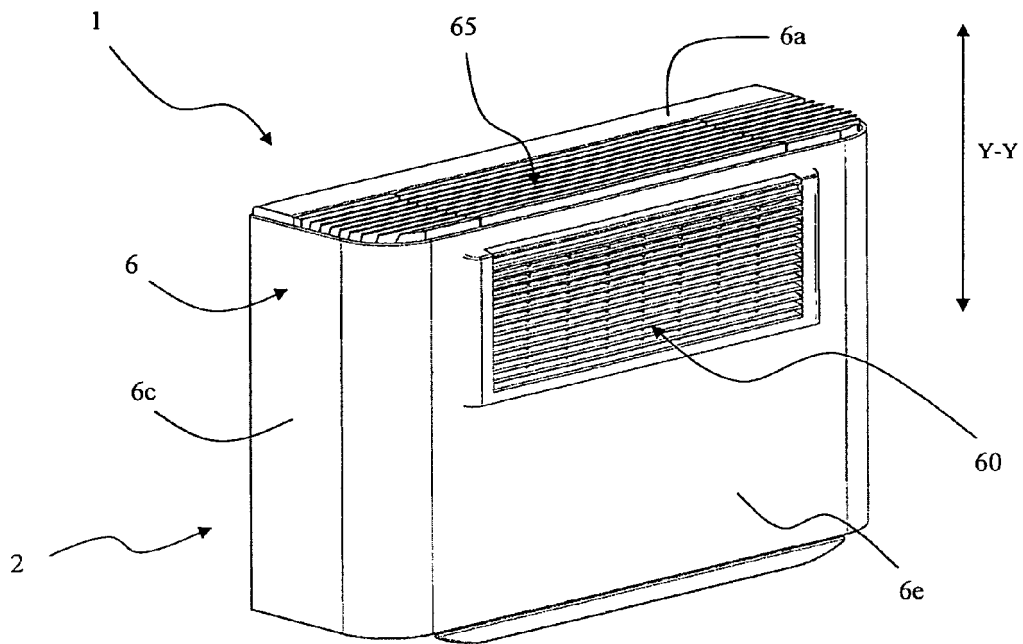


Fig. 1

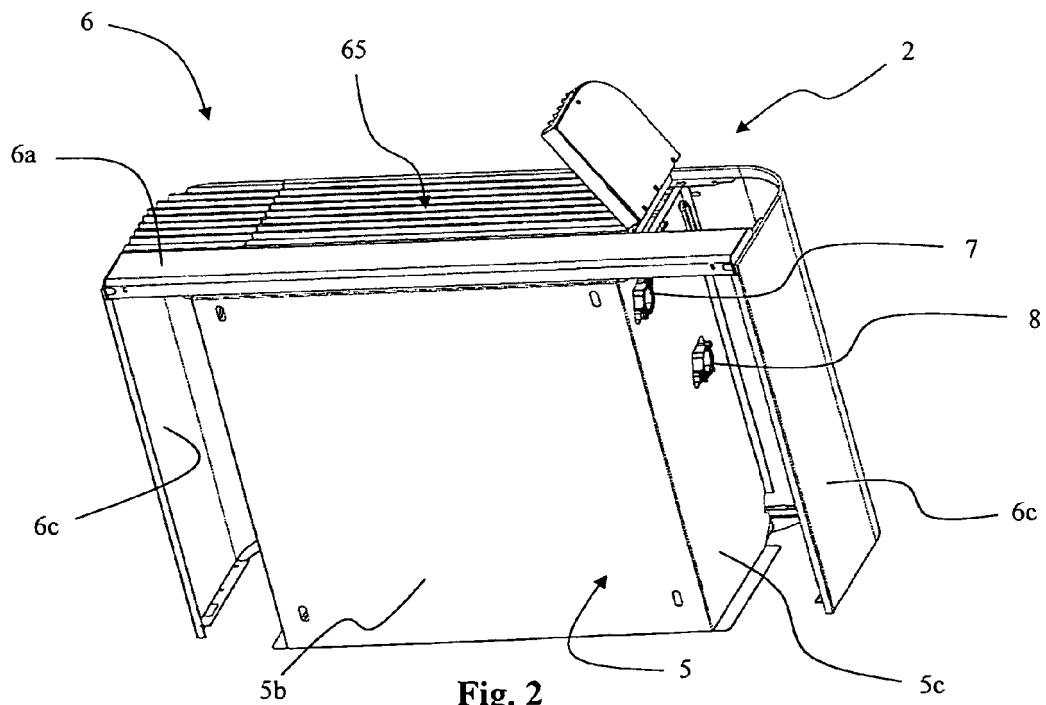
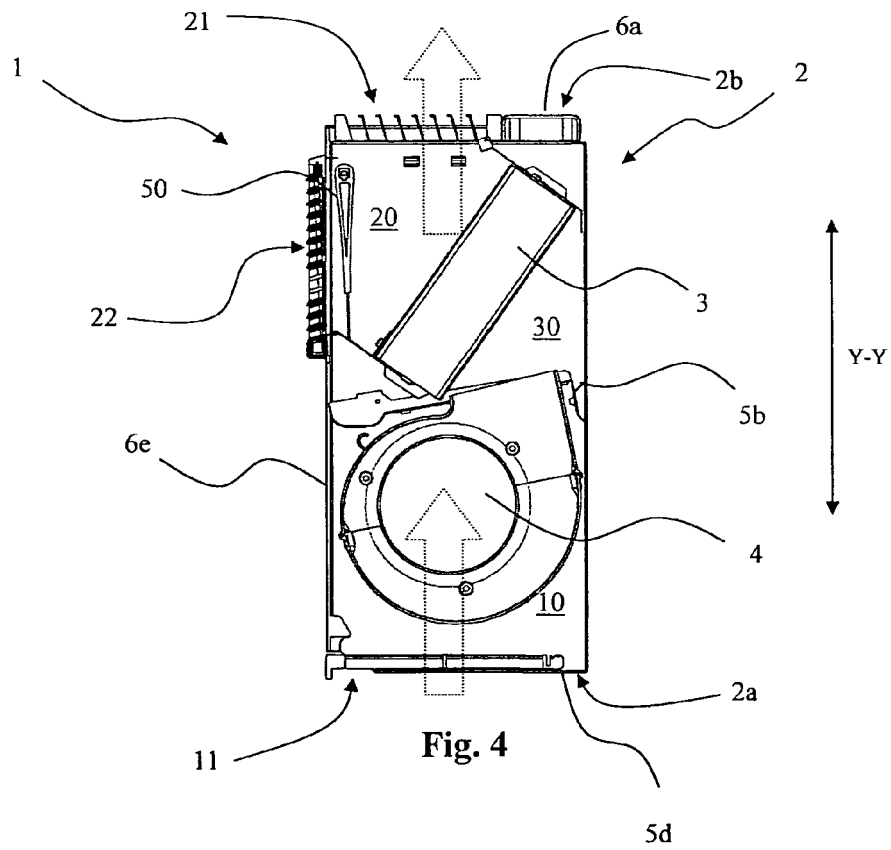
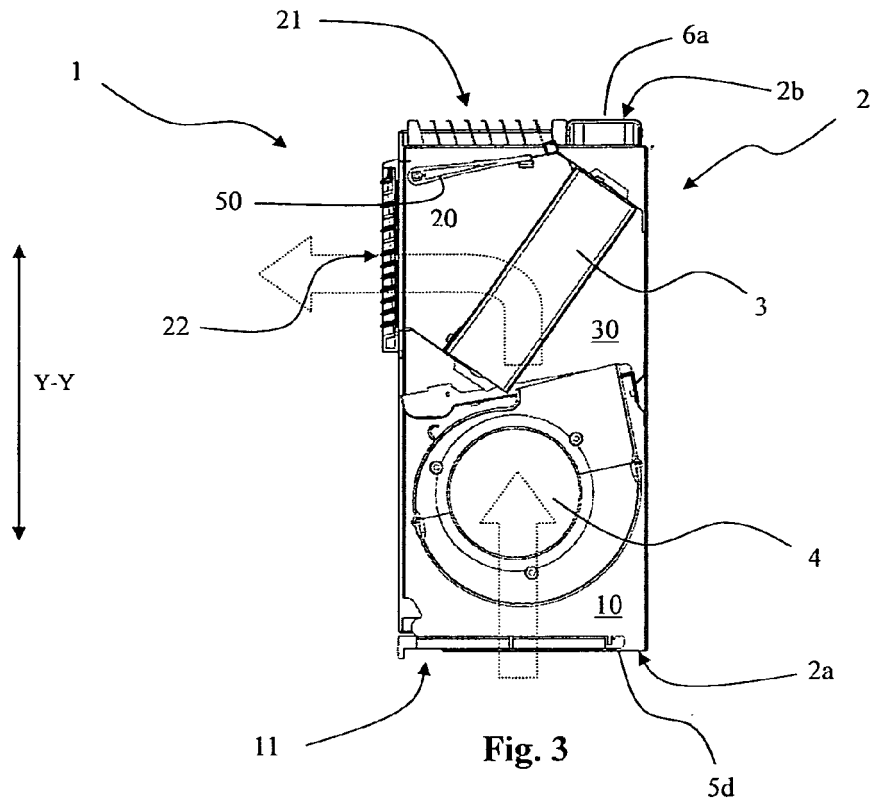


Fig. 2



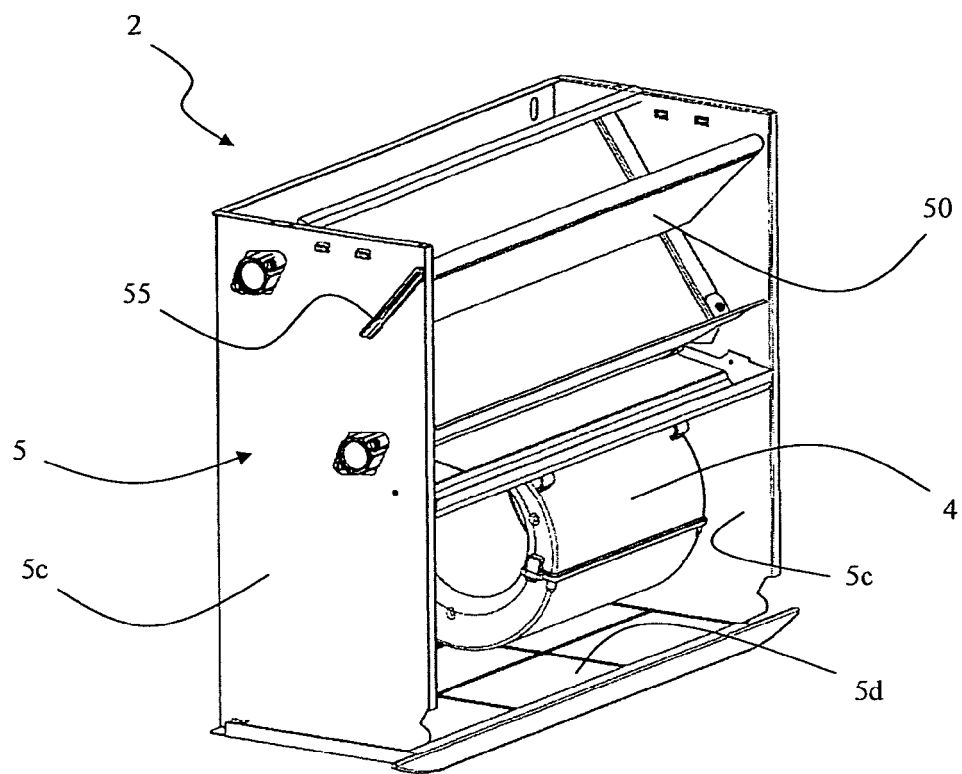


Fig. 5

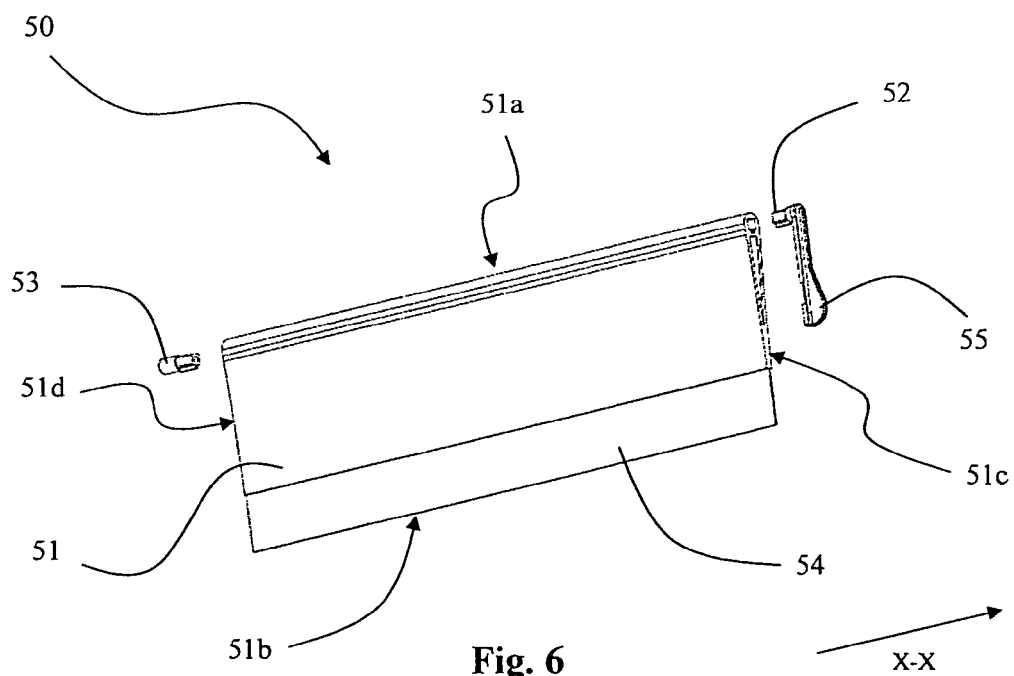


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 5745

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 16 5745

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