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(54) **COMPACT DEVICE FOR CONTROLLING AN AIR FLOW**

(57) A device (1) for controlling air flow, comprising a chamber (2) comprising an air inlet (3) and an air outlet (4), and an inner wall structure (30), arranged in the chamber, separating an inlet compartment (13) at said air inlet from an outlet compartment (14) at said air outlet (4). The inner wall structure comprises a first wall member (31) having a planar wall portion (32) comprising a layer of porous material which is permeable to air, and a valve mechanism (40), configured to move a cover member (41) over the first wall member to control a degree of exposure of said wall portion.

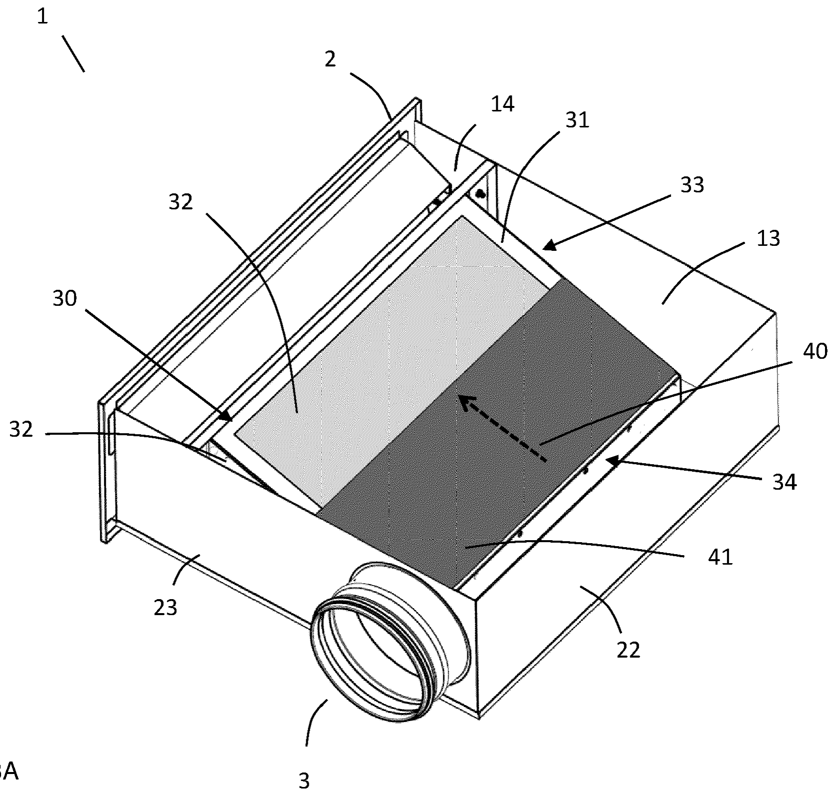

Fig. 3A

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Description

Technical field

[0001] This disclosure relates to the field of devices for regulation of air flows. More specifically, solutions are presented in the field of supply air devices for variable restriction of flows for use in different types of building spaces, or between air ducts.

Background

[0002] In ventilation systems, supply air devices or terminals are configured to supply air into building spaces. Traditionally, terminals providing a steady flow have predominantly been used. In recent years, though, energy saving has been a key focus area, for both environmental and financial reasons. This has in turn led to increased use of air terminals capable of providing variable flow. By controlling the supply air flow, air can be provided according to need, and may also replace liquid-based cooling systems, by providing a controlled amount of tempered air.

[0003] The use of variable flows may cause flow changes in supply air duct systems, and hence large pressure differences at the terminals. Also, modernization of older buildings for energy efficiency reasons will often require high pressure in the system, since there may oftentimes not be room for large dimension air ducts in lowered ceilings. This means that there is a need for a type of air supply device that can cope with both high and low air pressure, while providing a controlled regulated air flow.

[0004] A supply air terminal typically comprises a chamber, such as a metal box, with a supply air inlet, an air valve mechanism for regulation of the airflow, and a discharge opening to an air diffuser. The air valve mechanism must be capable of throttling the air at high pressure, such as 200 Pa or more. At the same time there is normally a requirement on generated sound level at the premises, such as a maximum limit of 30 dB(A). Airflow control at high pressure and restriction of sound level generation are substantially conflicting requirements, which require careful deign. Concurrently, a supply air device which can be manufactured, assembled and maintained at low cost is an overall objective.

[0005] US8038075 presents an example of a traditional solution for throttling the air flow, based on narrowing the airstream by minimizing an opening using a damper rotatably mounted within an air duct. Variants of this pivotable plate design are well known in the art. When such an opening is closed, turbulence will appear over the damper edge and a relatively high sound level will be generated, which requires some form of damping. One way of targeting sound generation is to provide brushes at the rim of the throttle so as to reduce turbulence effects.

[0006] US5207614 presents an alternative solution, where the working principle for flow control is to translate perforated plates with respect to each other, so as to selectively open or occlude the perforations. Also here there will be sound generation over the edges of the perforations.

[0007] WO2018065363A1, by the instant inventor, offers a different solution, where a first tube arranged in a chamber is connected at an open first end to a supply air inlet, wherein the first tube has a side wall which is permeable to air. A throttle member is slidably connected to the first tube to change a degree of exposure of the side wall to control air flow through said side wall to the outlet. The exposable side wall comprises a layer of porous material through which air is discharged.

Summary

[0008] An object of the inventions is to provide improvements in the field of supply air devices for controlling air flow. More specifically, it is an object to provide a device capable controlling air flow which is compact while still being able to cover a large range of air flows, and being arranged to cause minimal generation of sound.

[0009] The proposed solution is set out in the independent claims, while various embodiments are outlined in the dependent claims.

[0010] According to one aspect, a device for controlling air flow is provided, said device comprising:

a chamber comprising an air inlet and an air outlet;
an inner wall structure, arranged in the chamber, separating an inlet compartment at said air inlet from an outlet compartment at said air outlet;
wherein said inner wall structure comprises a first wall member having a planar wall portion comprising a layer of porous material which is permeable to air; and
a valve mechanism, configured to move a cover member over the first wall member to control a degree of exposure of said wall portion.

Brief description of drawings

[0011]

Fig. 1 schematically illustrates a general presentation of a device for controlling air flow, situated to provide fresh air from an air duct to a room.
Fig. 2 illustrates an elevated view of embodiment of the device.
Fig. 3A illustrates an elevated view of the embodiment of Fig. 2 without the top wall of the chamber.
Fig. 3B illustrates a schematic cross-section top view of the embodiment of Figs 2 and 3A.
Figs. 4A and 4B illustrate a schematic cross-section side view of the embodiment of Figs 2 and 3A in different throttling settings.
Figs. 5A and 5B illustrates elevated views without the top wall of the chamber, corresponding to the

embodiments of Figs 4A and 4B, respectively.

Figs. 6A shows an embodiment of an alternative valve mechanism, with associated parts disassembled.

Fig. 6B illustrates an embodiment of the device, configured for ceiling mounting, incorporating the alternative valve mechanism of Fig. 6A.

Fig. 7A illustrates shows an embodiment of another alternative valve mechanism, with associated parts disassembled.

Figs 7B and 7C illustrated the assembled embodiment of the valve mechanism of Fig. 7A, in different views.

Figs 7D-7F illustrate the embodiment of the valve mechanism of Figs 7A-7C in different throttling settings.

Figs 8 A and 8B illustrate a variant of the embodiment of the valve mechanism of Figs 7A-7F in different throttling settings.

Description of embodiments

[0012] The invention will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

[0013] It will be understood that, when an element is referred to as being "connected" to another element, it can be directly connected to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" to another element, there are no intervening elements present. Like numbers refer to like elements throughout. Well-known functions or constructions may not be described in detail for brevity and/or clarity. Unless otherwise defined, all terms, including technical and scientific terms, used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

[0014] Embodiments of the invention are described herein with reference to schematic illustrations of idealized embodiments of the invention. As such, variations from the shapes and relative sizes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes and relative sizes of regions illustrated herein but are to include deviations in shapes and/or relative sizes that result, for example, from different operational constraints and/or from manufacturing constraints. Thus, the elements illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the actual shape of a region of a device and are not intended to limit the scope of the invention.

[0015] Fig. 1 presents a scene of use for embodiments presented herein. A supply air duct 100 transports air at elevated pressure to various rooms 300 of a building complex. In order to provide comfortable ventilation flow and temperature, a supply air device, such as a wall mounted device 1 and/or a ceiling-mounted device 1', is connected to the supply duct 100, for controlling at least the flow of air to the room 300 through an air outlet. A diffusor or similar device 200, 201 may be connected at the outlet, for convenient distribution of air in the room 300. Various aspects specifically related to supply air devices configured for mounting in a ceiling and in a wall will be discussed, but for the general presentation of the proposed solutions, the common reference numeral 1 will be used.

[0016] Fig. 2 illustrates an exemplary embodiment of a supply air device 1 for use as indicated in Fig. 1, for controlling supply air flow to a building space by wall mounting. The device 1 includes a chamber 2, having a supply air inlet 3 and an air outlet 4. The chamber 2 may be a metal case, e.g. of aluminum or steel sheet, and is sometimes referred to as a plenum box. The chamber 2 may take any form, but the illustrated embodiment has substantially rectangular cross-sections according to the established art. Such a format is beneficial for easy mounting and installation. The shown embodiment is designed for wall mounting, and has its supply air inlet 3 at a first side wall 23, and the air outlet 4 at a front wall 21. It may be noted, though, that the inlet opening 3 may alternatively be arranged at a back wall 22, opposite the front wall 21, in a side wall 24 opposing the side wall 23, or at a top wall 25 in various embodiment, as will be outlined. A supply air duct is connectable to the inlet 3, e.g. by tight fitting to a sleeve 5. The inlet may take any shape, such as having a rectangular or oval cross-section, while the shown embodiments are designed for a preferred embodiment having a circular cross-section.

[0017] Figs 3-5 illustrate the embodiment of Fig. 2 in different views, and will serve to describe various features and technical effects.

[0018] The proposed solution relates to a device 1 for controlling air flow. The device 1 comprises a chamber 2, which has an air inlet 3 and an air outlet 4. The chamber may have a substantially rectangular shape, with a top wall 25 and an opposing bottom wall 26, as indicated in the cross-sectional view of Fig. 4A. The chamber further comprises an inner wall structure 30, which separates an inlet compartment 13 supplied by said air inlet 3, from an outlet compartment 14 at said air outlet 4. The inner wall structure 30 comprises a first wall member 31 having a planar wall portion 32 comprising a layer of porous material which is permeable to air. This allows air to flow through the wall portion 32 from the inlet compartment 13 to the outlet compartment 14. Furthermore, a valve mechanism 40 (indicated by an arrow in Fig. 2) is configured to move a cover member 41 over the first wall member 31 to control a degree of exposure of said wall portion 32. This way, the device is configured for controlling the airflow.

[0019] By arranging the valve mechanism 40 to move the cover 41 onto the first wall member 31, by sliding the cover 42 over the planar wall portion 32, a substantially flat throttling mechanism is obtained, which occupies very little space, allowing for a compact design.

[0020] Fig. 4A shows the device in a substantially maximum open position, allowing for a high airflow, as indicated by the arrows. In Fig. 4B, the valve mechanism has instead been operated to move the cover member along the first wall member to leave only a very small, exposed part of the wall portion 32. This way, a very small airflow is obtained.

[0021] Figs 4A and 4B further show, by way of example, an actuator 42 of the valve mechanism 40, such as an electric motor, configured to displace the cover 41. The actuator 42 may be connected to the cover 41, which acts as a throttle member, by means of a threaded rod 43, passing through a nut member 44 connected to the cover 41. The actuator may be controlled by a control unit (not shown) which operates based on inter alia control signals from a flow sensor (not shown) at the inlet 3, and settings determining desired values of e.g. flow and/or temperature.

[0022] Figs 5A and 5B provide cut-out perspective views (i.e. without the top wall 25) of the device 1 in the throttling positions corresponding to Figs 4A and 4B, respectively.

[0023] In these embodiments, the cover member 41 comprises a plate of an impermeable material, such as a sheet of plastic or metal. As shown in these embodiments, the valve mechanism 40 is configured to linearly move said plate along the first wall member 31. A benefit of this design is that the surface of the exposed wall portion 32 is a linear function of the position of the cover 41. Control of the device is thus simplified.

[0024] The porous material provided at the wall portion 32 through which air is discharged provides a drastic reduction of sound generation caused by the throttling of the airflow. In one embodiment, the porous material is a nonwoven fiber felt or a fabric, including e.g. polyester fiber. In a preferred embodiment the fiber felt comprises thermo-bonded Polyethylene Terephthalate. Such materials, such as the product Airfelt™ marketed by CE Produkter AB, are normally often used as sound absorbent layers, e.g. along the inner wall of plenum boxes such as the chamber 2. Passing air at high pressure straight through such a layer of felt has a very positive silencing effect. The felt 14 will provide turbulence disruption even at a very small thickness, such as 3-8 mm, e.g. 5 mm. This mat e.g. be obtained using a nonwoven PET fiber felt having a density on the range of 10-50 kg/m^3. This has the positive effect that even if the side wall 13 of the first tube 10, through which the air flows, is relatively close to the walls (sides, up and down) of the chamber 2, the sound level generated can be kept at a low level even at high pressure in the supply air.

[0025] In one embodiment, the first wall member 31 comprises a support structure for carrying the porous material layer. The support structure may be made from a perforated metal sheet, having perforations which cover a larger portion of the wall portion than the remaining metal material of the sheet surrounding the perforations. In another embodiment, the support structure is made from a metal wire net. The use of a wire net, rather than a perforated metal sheet as is common in the art, provides both low cost, easy handling, and also a substantially full opening at the wall portion 32. The mesh size should be at lease such that the openings are wider than the distance between the wires, and preferably at lease 3-5 times the wire width. With reference to the cross-sectional views of Fig. 4A and 4B, the support structure is provided below the porous material, e.g. felt, at the first wall portion 32, such that the porous material rests on the support structure. In one variant, an addition support structure may be provided over the porous material, to obtain a sandwich structure. In another variant, the support structure may be embedded in the porous material. A benefit of these variants is that a more stable element, of the combined support structure and the porous material, is obtained, which is easier to handle in assembly. In one embodiment, guide members are provided on a frame part of the first wall member 31 outside the wall portion 32, onto which layer the cover member 41 is configured to slide. This may provide the suitable effect of allowing the cover member 41 to slide conveniently over the porous material layer with little friction or mechanical resistance.

[0026] In various embodiments, such as shown in Figs 2-5, the first wall member 31 extends at an angle to the chamber wall 21 comprising the inlet opening 3. This has the benefit of allowing for a larger maximum exposable surface of the wall portion 32, confined within the space of the chamber 2. This, in turn, allows for a great range of flow control, while at the same time a very compact chamber design can be used. If a low device 1 is desired for wall mounting, the first wall member 31 may be configured to extend parallel, or at an angle to, the tope 25 and bottom walls of the chamber 2. In one embodiment, the first wall member 31 extends at an angle to opposing outer walls of the chamber, e.g. chamber walls 25, 26 which are perpendicular to the front wall 21 comprising the inlet opening 3. In such an embodiment, the first inner wall member 31 is therefore designed to extend diagonally through the chamber 2.

[0027] As shown in Figs 2, 5A and 5B, the chamber is, in various embodiments, designed to have a height, i.e. between opposing top 25 and bottom 26 chamber walls, which corresponds to a diameter of the inlet opening 3, i.e. to a diameter of a duct 100 for engaging with the inlet opening 3. In other words, the selected dimension of the air ducts 100 (see Fig. 1) sets the limit for the configurable size of the device 1 in one dimension, such as height. Dependent on how an interface, such as the sleeve 5, arranged at the inlet 3 for connecting the device 1 to a duct 100, is formed and manufactured, the height of the chamber 2 can be limited to not exceed an outer diameter of the duct 100. In some examples, the height of the chamber 2 does not exceed the diameter associated with the inlet opening, such as the duct diameter of the ventilation system in which the device 1 is to be used, with more than 5 cm, or not more than 2 cm. This still allows for convenient ways of forming the interface, such as by welding or gluing a cylindric sleeve 5 for connection to a duct 100, as shown in Fig. 2, onto an outer side wall of the chamber 2 with a sufficiently wide engagement surface between the sleeve 5 and the chamber wall at which the inlet opening is formed, at the periphery about the inlet opening 3.

[0028] Referring specifically to Figs 3A and 3B, in some embodiments the inner wall structure 30 not only comprises the first wall member 31, but also opposing inner side wall members 32, 33, perpendicular to the first wall member 31. The opposing inner side wall members 32, 33, or at least one 32 of the opposing inner side wall members 32, 33 are thus arranged inwardly, and spaced apart from, the side walls 23, 24 of the chamber 2, such as at least the side wall 23.

[0029] Together with the first wall member 31, and potentially a further bottom inner wall member 35 as shown in Figs. 4A, the opposing inner side wall members 32, 33 thus configure the outlet compartment 14 to be partly contained within the inlet compartment 13, such that the outlet compartment 14 projects into the inlet compartment 13. This can also be seen in the cross-section view taken from above, shown in Fig. 3B. In various embodiments, the first wall member 31 extends all the way to the back wall 22 of the chamber 2. In alternative embodiments, the first wall member 31 extends to the bottom outer wall 24 of the chamber 2, inwardly of the back wall 22. In yet other embodiments, as seen in the drawings, the inner wall structure 30 comprises a back wall member 34, displaced inwardly of the chamber back wall 22.

[0030] A benefit of the design wherein the outlet compartment 14 is partly contained within the inlet compartment 13 is that it adds a degree of freedom for positioning of the inlet opening 3, as indicated by dashed lines in Fig. 3B. This facilitates easy production and increases the assembly options of various alternative configurations of the device 1.

[0031] Referring again to Figs 4A and 4B, wherein the device is designed for wall mounting, the outlet opening 4 is formed at the side wall 23 of the chamber, which forms a front wall towards a room. In this embodiment, the device may further comprise a flap 51, hinged at the outlet opening 4 such that an open slit 53 is formed between an edge 52 of the flap and an inwardly projecting air-guiding wall 54, wherein the flap 51 is configured to pivot under influence of an airflow through the device 1 such that a width of the slit 53 is self-adjusted. In other words, the slit 53 is always open, but has an adjustable width, controlled by the airflow. The size of the minimum slit opening 53 may be in the range of 1-20 mm, e.g. in the range of 1-10 mm, 5-10 mm, or 5-20 mm, such as >1 mm or > 5 mm. The self-adjusted width 53, accomplished by the flap 51, provides for higher velocity of the air even for low flows, such that improved air distribution is obtained.

[0032] The flap 51 may be suspended at a lower side of the air-guiding wall 54 and extend upwards into the inlet opening, wherein the air-guiding wall 54 forms an outlet channel which is angled upwards. The flap 51 is connected by a hinge arrangement to the chamber, such as to a lower portion 55 of the inwardly projecting wall 54. The inwardly projecting wall 54 form a channel for directing the air out of the device. In some embodiments, the channel directs the air at an upwards angle of 10-50 degrees, e.g. 20-45 degrees, so as to direct air towards a ceiling portion of a room for improved air distribution of supplied air. In some embodiments, the flap 51 has a balancing member 56 for calibrating the position of center of gravity for the flap with respect to a hinge axis, i.e. its axis of rotation. The balancing member 56 may e.g. be a movable weight, or a clip-on element of selectable weight. The balancing member allows for calibration of the device 1, such as at or before installation, or upon maintenance.

[0033] It shall be noted that various the embodiments of the device 1 as provided above may easily and just as well be configured for ceiling mounting, i.e. where outlet opening 4 of the chamber faces downwards, unless where it is clearly contradictory.

[0034] Figs 6A and 6B illustrate an alternative of the device 1, both of the chamber 2 and of the valve mechanism 40, which in these drawings are employed in a device 1 configured for ceiling mounting by way of example.

[0035] Fig. 6A shows an exploded view, depicting a chamber comprising a hood 61 forming at least top and side walls of the chamber 1, and a bottom wall 62. The chamber comprises an air inlet 3 and an air outlet 4. The outlet opening 4 is provided at the bottom wall 62, and runs in the periphery between the hood 61 and the bottom wall 62, as can be seen in Fig. 6B. An inner wall structure comprises at least a first wall member 31 having a planar wall portion 32 comprising a layer of porous material which is permeable to air, as described. The valve mechanism 40 is configured to move a cover member 41 over the first wall member 31 to control a degree of exposure of said wall portion 32. The cover member comprises a plate of an impermeable material, such as metal or plastic, and the valve mechanism is configured to rotate said plate along the first wall member 31 about an axis perpendicular to the first wall member.

[0036] This embodiment provides an alternative to the valve mechanism as shown in Figs 2-5. The valve mechanism may further comprise an actuator (not shown) configured to rotate the cover member 41, such as an electric motor. The valve mechanism of Fig. 6 may also be incorporated in a device 1 configured for wall mounting, at the first inner wall member 31.

[0037] The device 1 may be configured such that the first wall member 31 extends at an angle to opposing outer wall members 61, 62 of the chamber 2. Thereby, a larger exposable surface of the wall portion 32 can be obtained.

[0038] Figs 7A-7F illustrate another alternative embodiment of the valve mechanism 40 of the device 1, which in these drawings is shown without the chamber 2, for the sake of simplicity. Fig. 7A shows an exploded view of disassembled parts, whereas Fig. 7B shows an elevated view and Fig. 7C shows a side view, of the assembled valve mechanism. Figs 7D-7E schematically illustrate three different settings of the valve mechanism 40 for control of the airflow.

[0039] As noted, an inner wall structure 30 of the device 1, arranged in the chamber, is configured to separate an inlet compartment from an outlet compartment of the chamber. The inner wall structure comprises a first wall member 31 having a planar wall portion 32 comprising a layer of porous material which is permeable to air. The valve mechanism 40 is configured to move a cover member 70 over the first wall member to control a degree of exposure of said wall portion 32.

[0040] In this embodiment, the cover member 70 comprises a belt 70 of an impermeable material, i.e. impermeable to air, suspended between two rollers 72, 73 arranged at opposing ends of said wall portion 32. The valve mechanism is configured to rotate the belt along the first wall member 31 to position an opening 71, formed in a portion of the belt 70, with respect to said wall portion 31. The valve mechanism further comprises a suspension mechanism (not shown) for suspending the rollers72, 73, and an actuator (not shown) and for rotating at least one of the rollers 72, 73, such as an electric motor.

[0041] As can be seen in Fig. 7B, air will flow at least from the side of the valve mechanism (indicated by arrows) to the exposed part of the wall portion 31, and partly through the opening 71 in the part of the belt 70 that faces upwards in the drawing, and which is not positioned onto the wall portion 32.

[0042] Figs 7D to 7E schematically illustrate the valve mechanism 40 in different positions or settings, where Fig. 7D illustrates a fully closed position, Fig. 7E provides a half open position, and Fig. 7F illustrates a fully open position.

[0043] Figs 8A and 8B illustrate a variant of the embodiment shown in Figs 7A-7F. Herein, the belt 70 may comprise two openings 71A and 71B, separated by impermeable portions along the direction of rotation of the belt 70. It shall be noted that Figs 8A and 8B illustrate an example where the two openings 71A and 71B are of substantially the same size. In an alternative configuration, only one opening, such as the first opening 71A, has a size which corresponds to the permeable wall portion 32, and which is controlled to move along (in contact with) the first wall member 31. The complementary second opening 71B may be smaller, and basically predominantly serve to increase the combined cross-section area for air to flow towards the permeable wall portion 32, particularly in a fully open position of the valve mechanism 40.

[0044] Fig. 8A illustrates a fully open position of the valve mechanism 40 of such an embodiment, wherein at least the first opening 71A is arranged over the permeable wall portion and the second opening 71B at least overlaps with the first opening 71A.

[0045] Fig. 8B illustrates a fully closed position of the valve mechanism 40, wherein an impermeable belt portion arranged in contact with the wall portion 32 completely covers the wall portion 32.

[0046] The embodiment of Fig. 7 and the variant provided in Fig. 8 have the benefit of a compact design of the valve mechanism, having a height, normal to the surface portion 32, predominantly determined by the diameter of the rollers apart from the thickness of the belt 70. Moreover, a larger part of the permeable wall member 32 can be exposed in a limited space, such as in the chamber 2, since the valve mechanism 40 adds very little width outside the wall portion 32. In other words, the valve mechanism 40 can be designed to have a smaller footprint relative to the footprint of the wall portion 32, compared to what can be obtained with the embodiments described with reference to Figs 2-6. In the most compact configuration, which still allows for complete closure, the valve mechanism 40 can be limited to have width, in the plane of the wall portion 32 in the direction of rotation of the belt 70 (i.e. perpendicular to the rollers 72, 73), which exceeds the wall portion 32 by only the combined radii of the rollers 72, 73 (and twice the thickness of the belt 70). The width in the direction parallel to the rollers 72, 73 is limited by the combined width of the strips 74 of the belt 70 which form the periphery of the opening 71, and the suspension mechanism (not shown) for the rollers. This will predominantly be determined by the how narrow these strips 74 can be made, while still providing a sufficiently durable construction. The belt 70 may e.g. be made of rubber, silicone, or a plastic material. The opening 71 (or at least 71A in the alternative embodiment of Figs 8A and 8B) is at least as large as the permeable wall portion 32. Preferably, the opening 71, 71A completely overlaps the permeable wall portion 32 at a maximum open position of the valve mechanism.

[0047] It shall be noted that the valve mechanism of Figs 7-8 may be employed in a device 1 for controlling an airflow configured for ceiling mounting, wall mounting, or mounting between two duct portions.

[0048] Various embodiments have been presented and discussed above. It has also been made clear that features of those embodiments may be combined, where not contradicting. In addition, other embodiment falling within the scope of the appended claims will be conceivable based on the teachings of this disclosure.

Claims

1. A device (1) for controlling air flow, said device comprising:

   a chamber (2) comprising an air inlet (3) and an air outlet (4);
   an inner wall structure (30), arranged in the chamber, separating an inlet compartment (13) at said air inlet from an outlet compartment (14) at said air outlet (4);
   wherein said inner wall structure comprises a first wall member (31) having a planar wall portion (32) comprising a layer of porous material which is permeable to air; and
   a valve mechanism (40), configured to move a cover member (41) over the first wall member to control a degree of exposure of said wall portion.

2. The device of claim 1, wherein the first wall member (31) extends at an angle to a chamber wall (21) comprising the inlet opening (3).

3. The device of claim 1 or 2, wherein the first wall member (31) extends at an angle to opposing outer wall members (25, 26) of the chamber.

4. The device of any preceding claim, wherein the cover member comprises a belt (70) suspended between rollers (72, 73), wherein the valve mechanism is configured to rotate the belt along the first wall member to position an opening (71), formed in the belt, with respect to said wall portion.

5. The device of claim 4, wherein said opening is at least as large said wall portion.

6. The device of claim 5, wherein said opening completely overlaps said wall portion at a maximum open position of the valve mechanism.

7. The device of any of claims 1-3, wherein the cover member comprises a plate of an impermeable material, and wherein the valve mechanism is configured to move said plate along the first wall member.

8. The device of any preceding claim, wherein the inner wall structure comprises opposing inner side wall members (32, 33), perpendicular to the first wall member, such that the outlet compartment is partly contained within the inlet compartment.

9. The device of any preceding claim, wherein the chamber has a height which corresponds to a duct diameter associated with the inlet opening.

10. The device of claim 9, wherein the height of the chamber is less than 5 cm more than said diameter.

11. The device of any preceding claim, wherein the outlet opening is formed at a front wall (21) of the chamber, the device further comprising:
    a flap (51), hinged at the outlet opening such that an open slit (53) is formed between an edge (52) of the flap and an inwardly projecting air-guiding wall (54), wherein the flap is configured to pivot under influence of an airflow through the device such that a width of the slit is self-adjusted.

12. The device of claim 11, wherein the flap has a balancing member (56) for calibrating the position of center of gravity for the flap with respect to a hinge axis.

13. The device of claim 11 or 12, wherein the flap is suspended at a lower side of the air-guiding wall (54) and extends upwards into the inlet opening, and wherein the air-guiding wall forms an outlet channel which is angled upwards.

14. The device of any preceding claim, wherein said porous material is a nonwoven felt.

15. The device of any preceding claim, wherein a layer of nonwoven felt is provided on a frame part of the first wall member outside said wall portion, onto which layer the cover member is configured to slide.

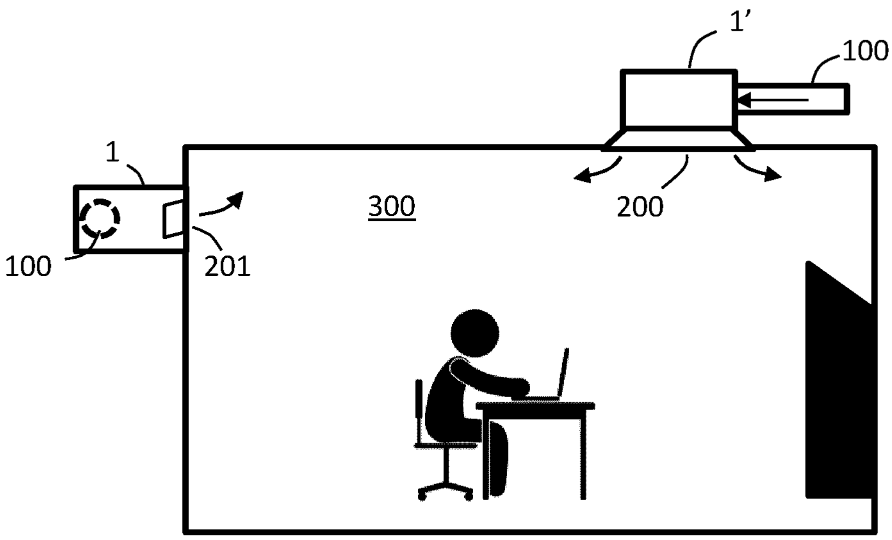

Fig. 1

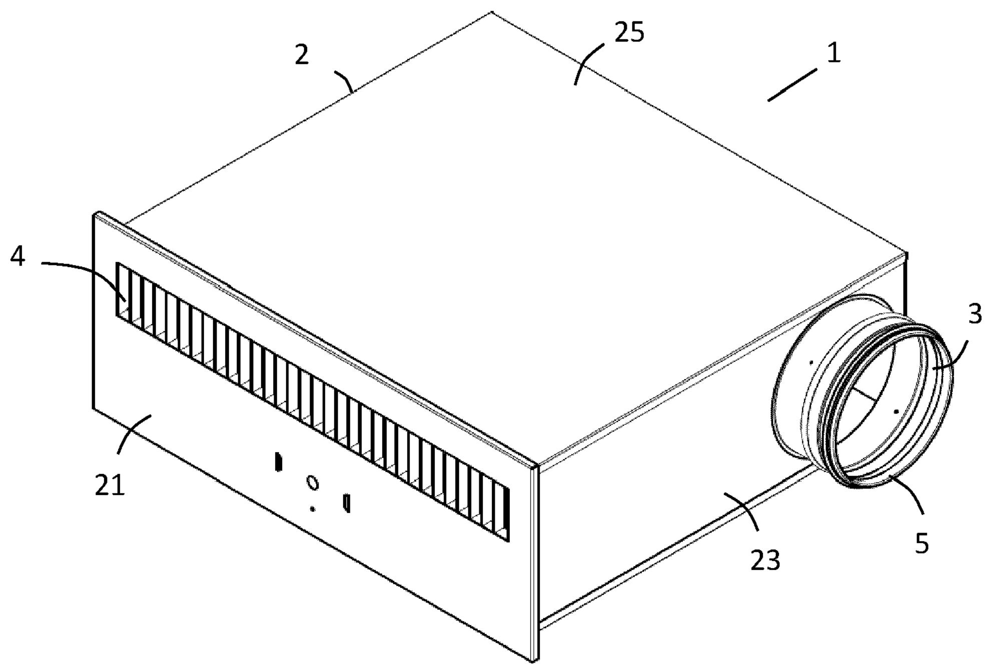

Fig. 2

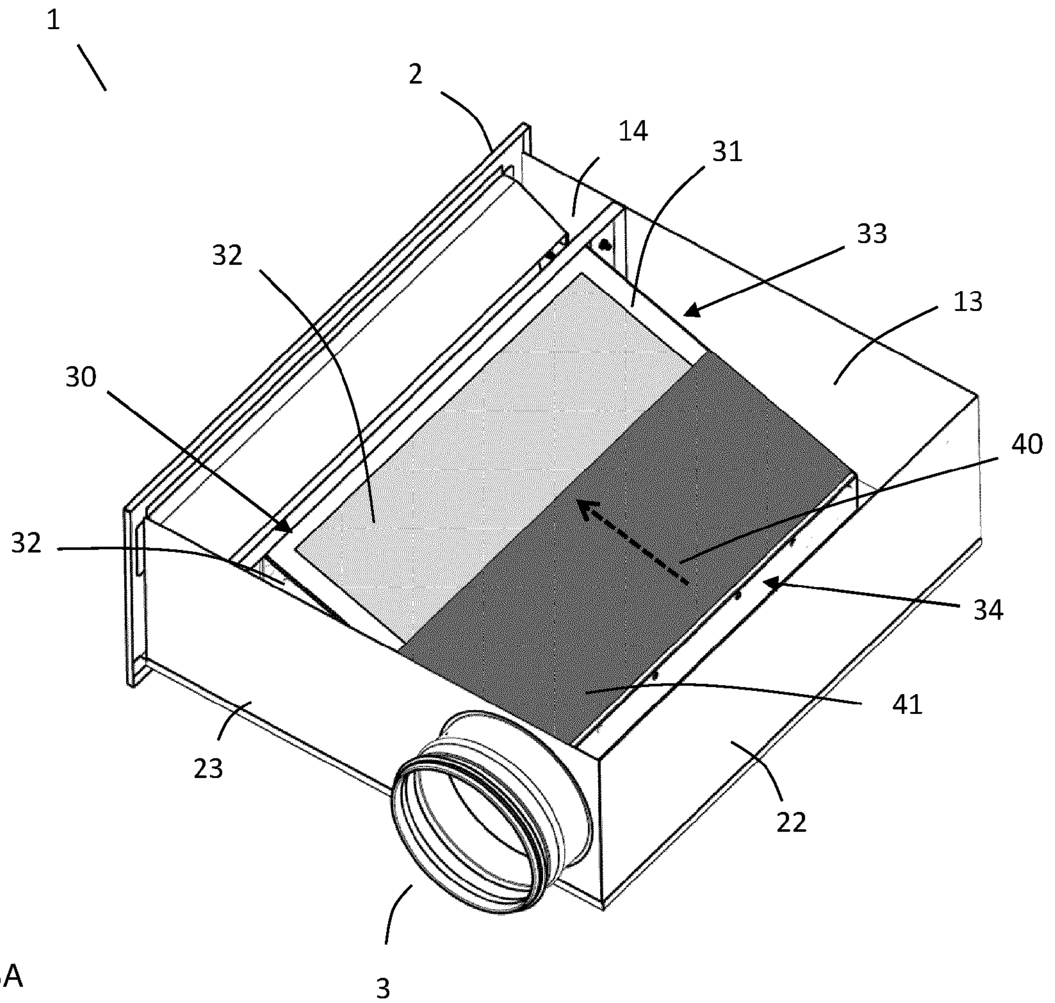

Fig. 3A

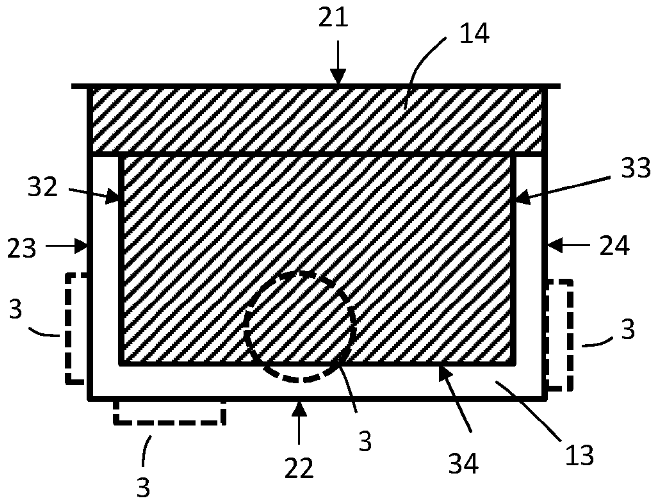

Fig. 3B

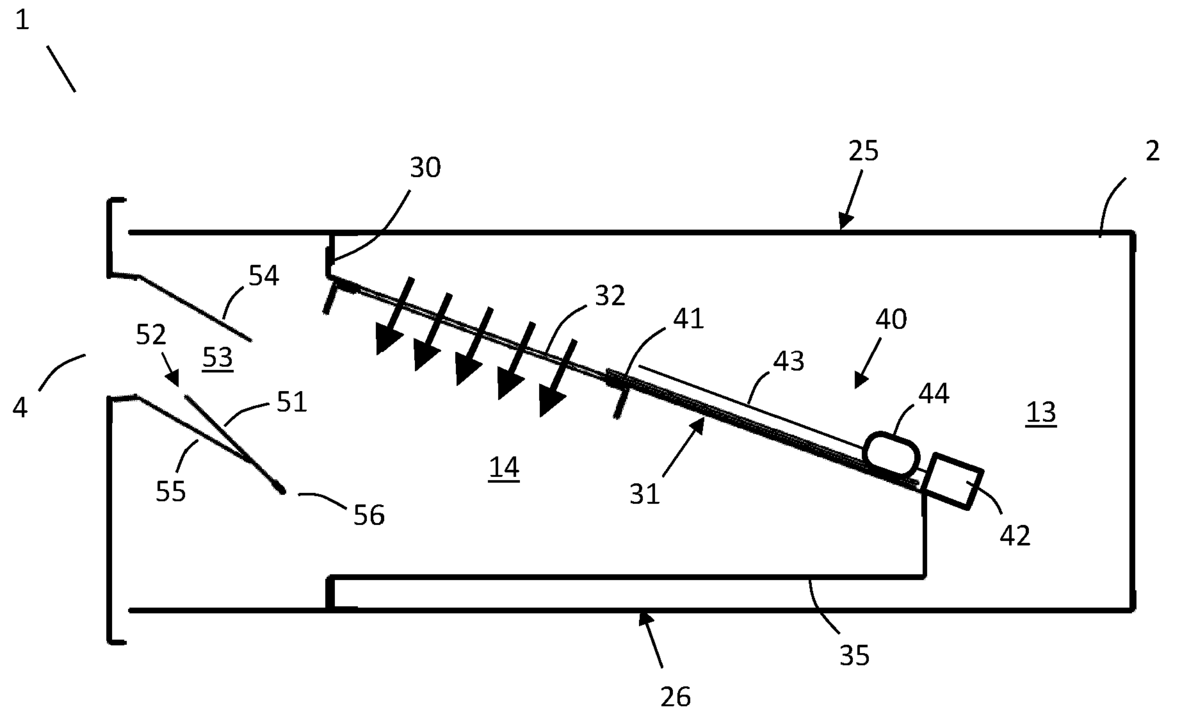

Fig. 4A

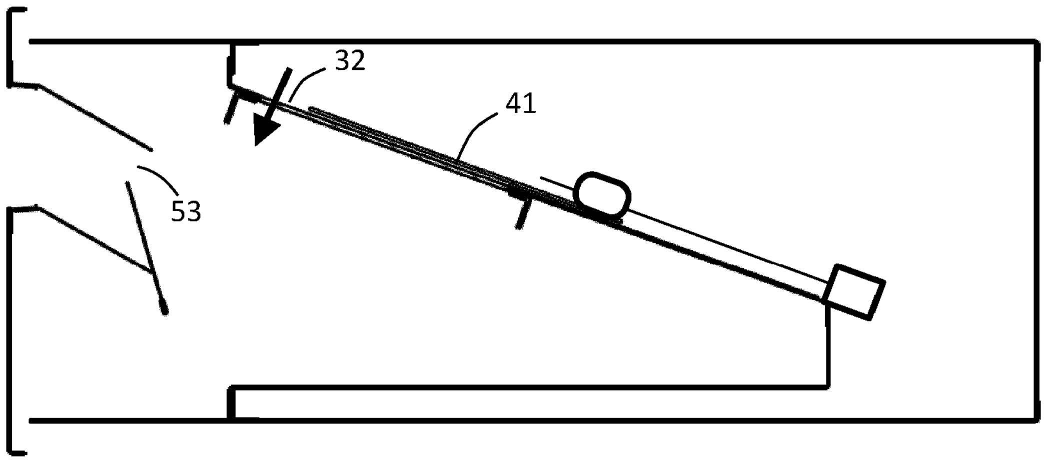

Fig. 4B

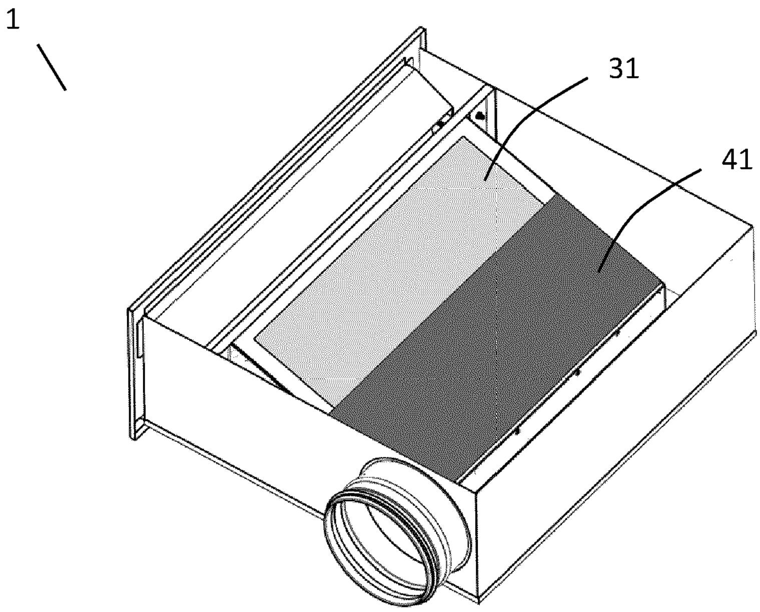

Fig. 5A

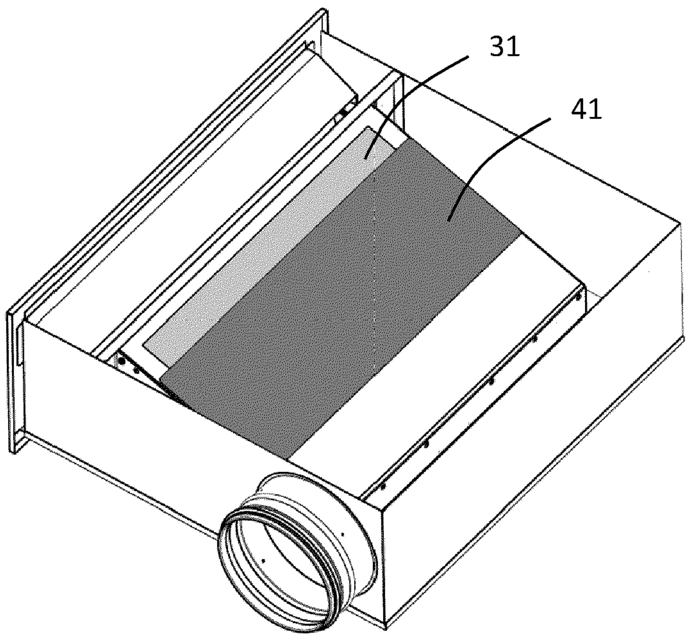

Fig. 5B

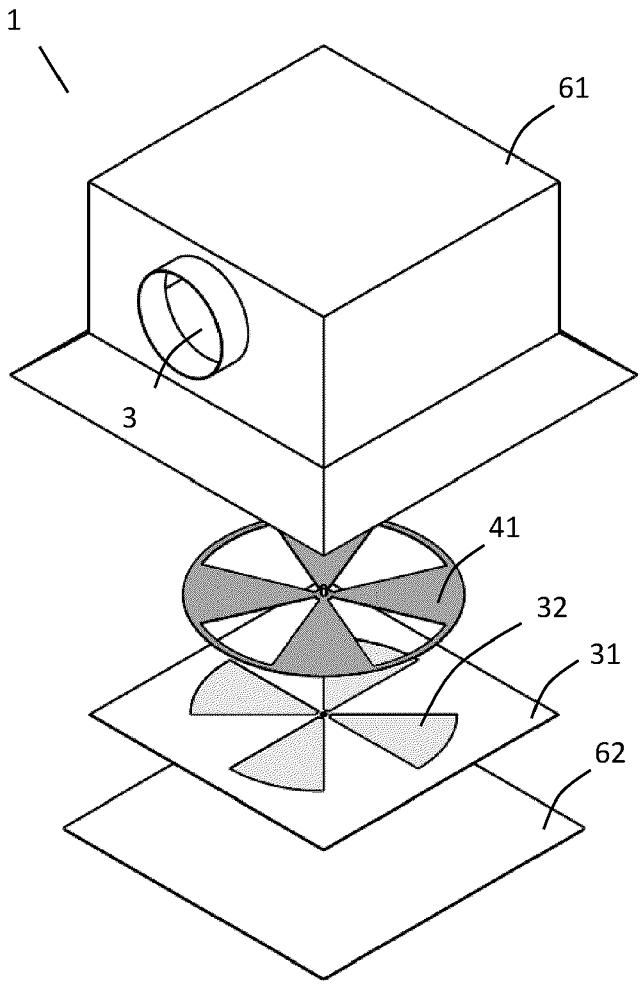

Fig. 6A

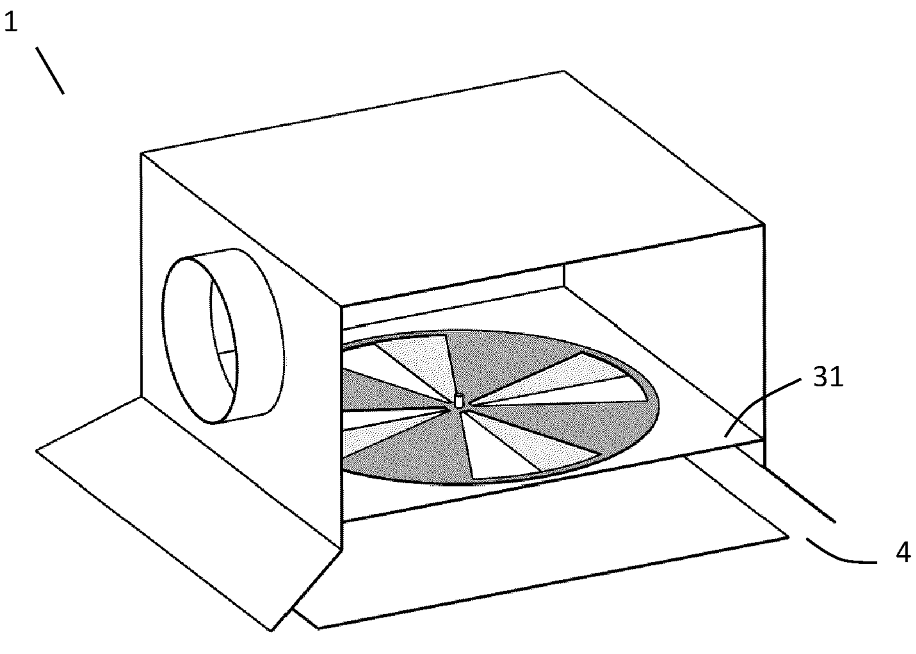

Fig. 6B

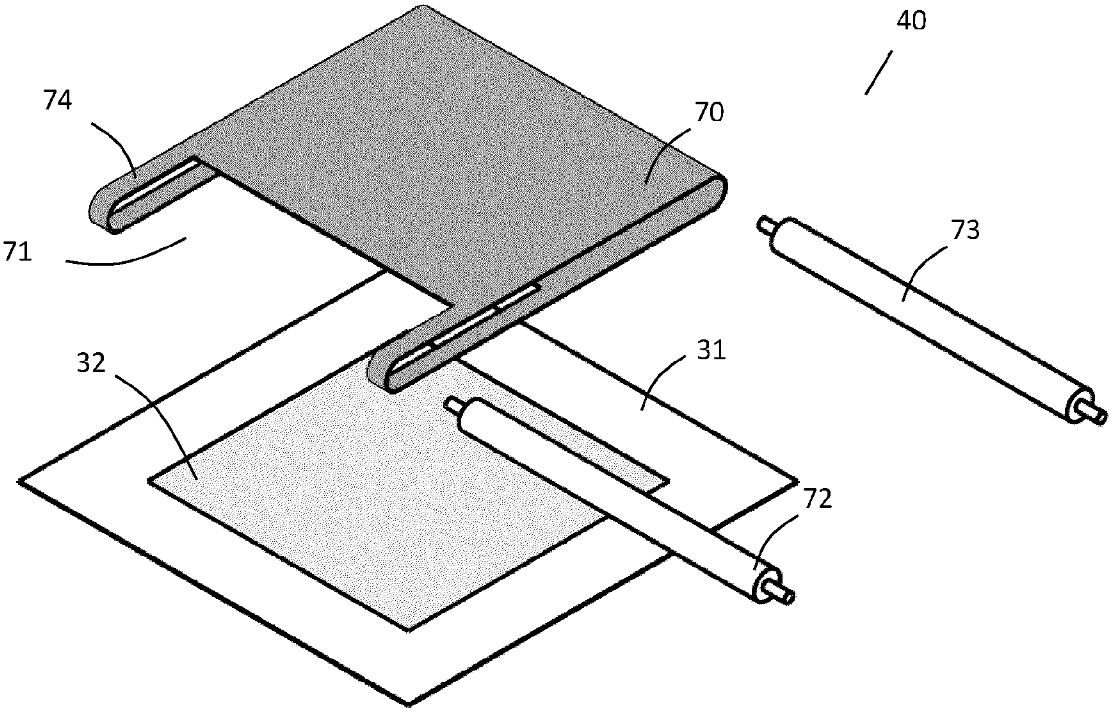

Fig. 7A

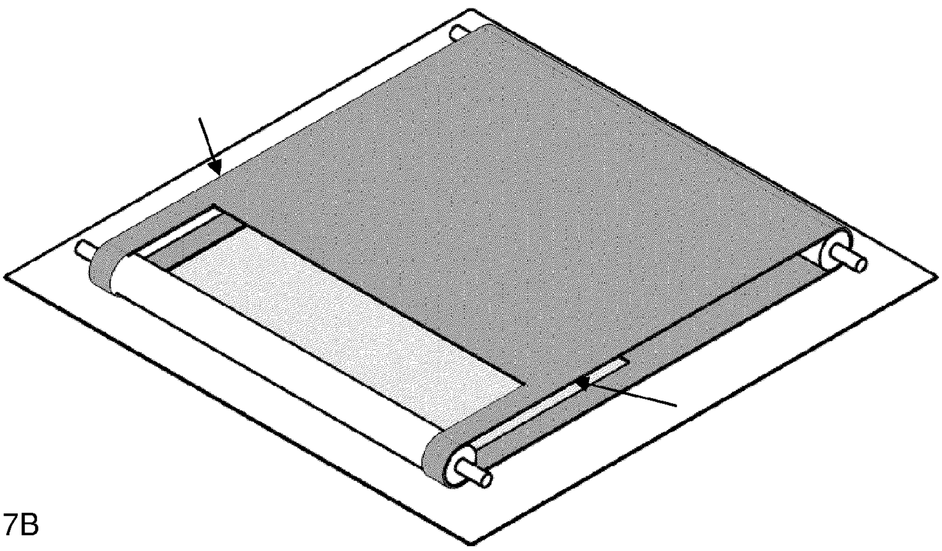

Fig. 7B

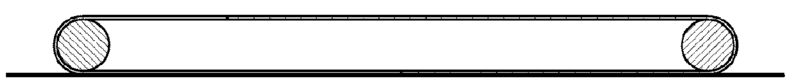

Fig. 7C

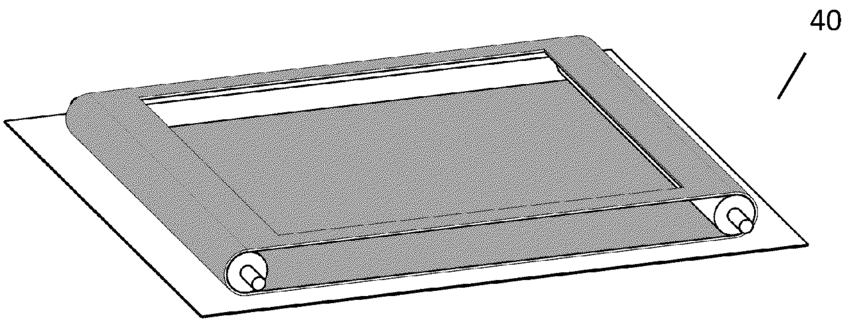

Fig. 7D

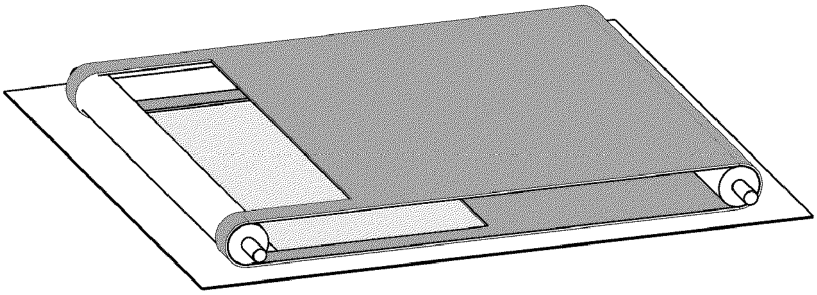

Fig. E

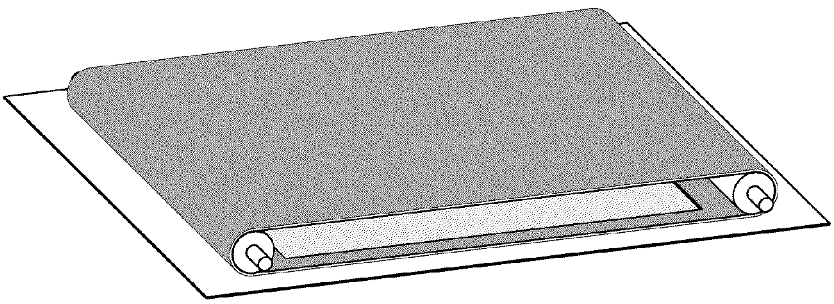

Fig. 7F

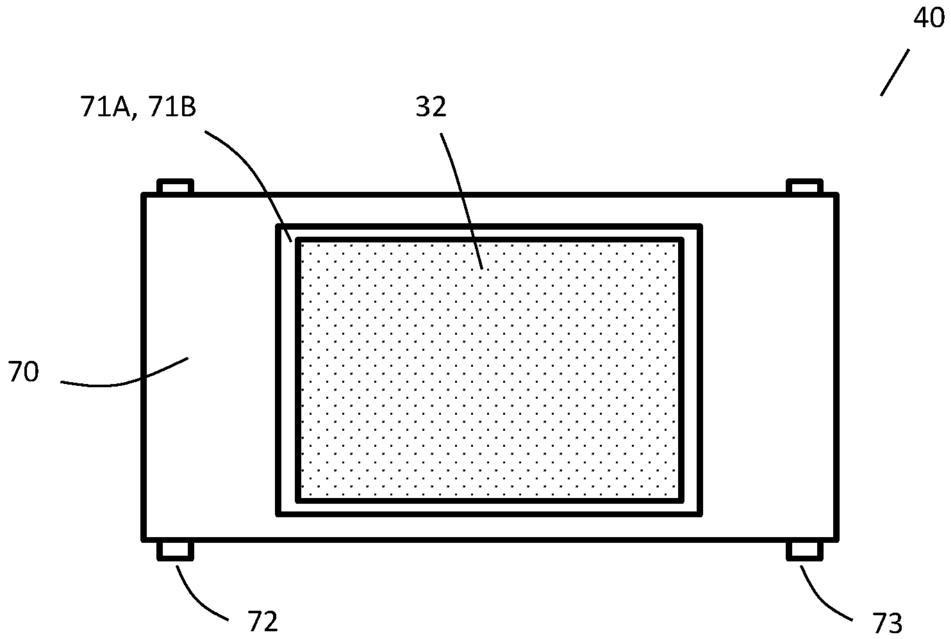

Fig. 8A

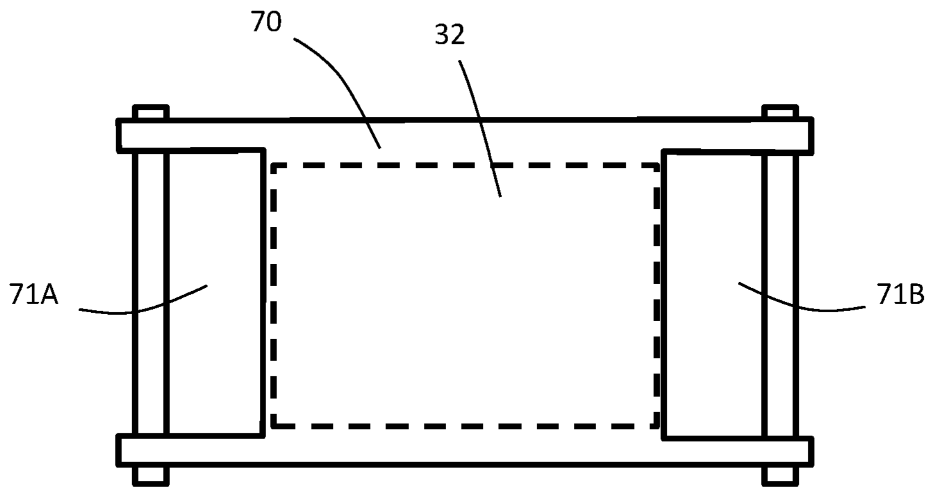

Fig. 8B

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 3760

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	EP 3 306 217 A1 (LINDINVENT AB [SE]) 11 April 2018 (2018-04-11) * the whole document * -----	1-15	INV. F24F11/74 F24F11/75 F24F13/24 F24F13/12 F24F13/06 F24F13/20
X	EP 1 628 084 A1 (TOSHO ENGINEERING CO LTD [JP]) 22 February 2006 (2006-02-22) * paragraphs [0027] - [0054]; figures 1,2 * -----	1	
A	US 2013/247995 A1 (EHRLICH DANIEL A [US]) 26 September 2013 (2013-09-26) * paragraphs [0038] - [0043]; figure 3 * -----	1,7	
A	EP 1 378 714 A1 (SANHEM KONSULTIT OY [FI]) 7 January 2004 (2004-01-07) * paragraphs [0013] - [0015]; claim 1; figure 1 * -----	1,4-6	
A	EP 0 362 913 A1 (TNO [NL]) 11 April 1990 (1990-04-11) * abstract * -----	1,11-13	TECHNICAL FIELDS SEARCHED (IPC)
A	CN 107 796 058 A (GUANGDONG MIDEA REFRIGERATION EQUIPMENT CO LTD; MIDEA GROUP CO LTD) 13 March 2018 (2018-03-13) * paragraph [0059]; figure 11 * -----	1	F24F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	14 March 2022	Lienhard, Dominique

CATEGORY OF CITED DOCUMENTS

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14-03-2022

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
EP 3306217	A1	11-04-2018	CA	3039032	A1	12-04-2018
			DK	3306217	T3	27-04-2020
			DK	3513130	T3	03-01-2022
			EP	3306217	A1	11-04-2018
			EP	3513130	A1	24-07-2019
			LT	3306217	T	10-03-2020
			LT	3513130	T	10-01-2022
			PL	3306217	T3	19-10-2020
			US	2019226717	A1	25-07-2019
			WO	2018065363	A1	12-04-2018
EP 1628084	A1	22-02-2006	EP	1628084	A1	22-02-2006
			HK	1092205	A1	02-02-2007
			JP	4484820	B2	16-06-2010
			JP	WO2004094920	A1	13-07-2006
			KR	20060008277	A	26-01-2006
			US	2006240763	A1	26-10-2006
			WO	2004094920	A1	04-11-2004
US 2013247995	A1	26-09-2013	NONE			
EP 1378714	A1	07-01-2004	EP	1378714	A1	07-01-2004
			FI	20021324	A	06-01-2004
EP 0362913	A1	11-04-1990	EP	0362913	A1	11-04-1990
			NL	8802196	A	02-04-1990
CN 107796058	A	13-03-2018	NONE			

EPO FORM P0459

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Patent documents cited in the description

- US 8038075 B **[0005]**
- US 5207614 A **[0006]**
- WO 2018065363 A1 **[0007]**