

(19)



(11)

EP 2 390 591 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

30.11.2011 Bulletin 2011/48

(51) Int Cl.:

F24F 9/00 (2006.01)

(21) Application number: **11168184.7**

(22) Date of filing: **31.05.2011**

(84) Designated Contracting States:

**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**

Designated Extension States:

BA ME

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(30) Priority: **31.05.2010 FI 20105614**

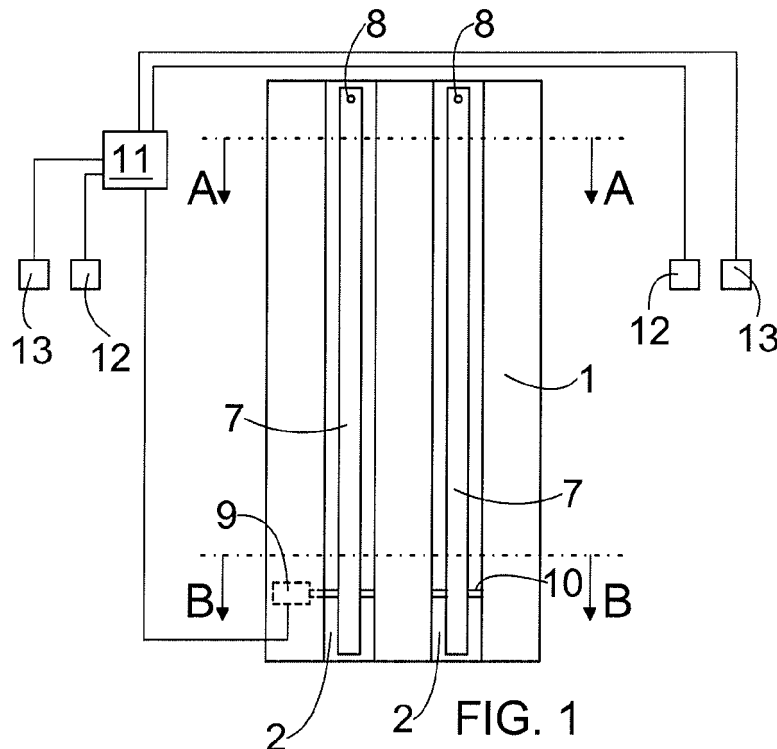
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(54) **Air conditioning device**

(57) The invention relates to an air conditioning device. The air conditioning device includes a casing (1) with at least one vertical gap (2). An air curtain is produced with the air conditioning device in connection with the opening of an entrance door by blowing air from the

gap (2). The direction of air flow coming from the gap (2) is controlled by an actuator (9). The actuator (9) is arranged to control the direction of the air flow coming from the gap (2) differently at the lower part than at the upper part.



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Description

Background of the invention

[0001] The invention relates to an air conditioning device comprising a casing with at least one vertical gap, allowing an air curtain to be produced with the air conditioning device by blowing air from the gap and the air conditioning device comprising an actuator for controlling the direction of air flow.

[0002] For instance in connection with entrance doors of large supermarkets, shopping centres, industrial halls and other similar buildings, an air conditioning arrangement is used, in which an air curtain is produced at the opening of the entrance door. Such an arrangement comprises, next to the entrance door, for instance in an entry space, a vertical casing from which air is blown substantially in the horizontal direction. The purpose of the air curtain produced is to prevent the mixing of warmer and colder air and/or air flow in the doorway. Thus, in winter warm air is prevented from flowing out of the building and cold air is prevented from flowing into the building. During hot weather in summer, the air curtain may be used, for example, for preventing cooled indoor air of a building provided with cooling equipment from flowing out and/or for preventing hot air from flowing into the building.

[0003] The flow rate of air coming from the casing may be controlled on the basis of temperature measurements, for instance. Furthermore, the flow direction of air coming from the casing may be selected manually by, for example, turning the nozzle of the casing. However, in most cases such adjustments are insufficient to provide a sufficiently versatile and rapid control.

[0004] Publication DE 4415079 discloses equipment for producing an air flow, in which equipment the air flow is blown out of the casing through a turnable nozzle. By turning the nozzle, it is thus possible to select the direction of air flow coming out of the casing. The publication further discloses that the nozzle can be turned by means of an actuator. The air conditioning equipment has a fairly complicated structure, and its functions cannot be adjusted in sufficiently many ways to meet all needs.

Brief description of the invention

[0005] It is an object of the present invention to provide a simple air conditioning solution for providing versatile functions, if necessary.

[0006] The air conditioning device of the invention is characterized in that the actuator is arranged to control the direction of the air flow coming from the gap differently at the lower part of the air conditioning device than at the upper part.

[0007] The idea of the invention is that an air curtain is produced with the air conditioning device in connection with the opening of the entrance door. The air curtain is produced by a casing with a vertical gap. The direction of air flow from the gap is controlled by an actuator. The

actuator is arranged to control the direction of the air flow coming from the gap differently at the lower part than at the upper part. Consequently, the direction of the air flow produced by the air curtain can be controlled in various ways and suitably for different purposes. The idea of an embodiment is that the air conditioning device comprises, in connection with the vertical gap thereof, a vertical bar arranged inside the casing of the air conditioning device and in the vicinity of the vertical gap. The actuator is used for deflecting the position of the vertical bar with respect to the vertical gap and thus controlling the direction of the air flow. The vertical bar may be fixed in its place at its upper end and the actuator may deflect the lower end of the vertical bar with respect to the vertical gap. Such an air conditioning device has a simple structure and simple functions but may be controlled in various ways.

Brief description of the figures

[0008] The invention will be described in greater detail in the attached drawings, in which

Figure 1 is a schematic side view of an air conditioning arrangement,

Figure 2 shows the air conditioning device of Figure 1 in cross section along line A—A of Figure 1,

Figure 3 shows the air conditioning device of Figure 1 in cross section along line B—B of Figure 1,

Figure 4 schematically shows the air conditioning device of Figure 1 in a different operating situation than in Figure 1, and

Figure 5 schematically shows the air conditioning device of Figure 4 in cross section along line C—C of Figure 4.

[0009] In the figures, some embodiments of the invention are shown simplified for the sake of clarity. Similar parts are marked with the same reference numerals in the figures.

Detailed description of the invention

[0010] Figure 1 shows an air conditioning arrangement, wherein an air curtain is produced with an air conditioning device. The air conditioning device includes a casing 1 with at least one vertical gap 2. In the embodiment of Figure 1 there are two vertical gaps. Thus, there may also be, for instance, only one vertical gap 2 or more than two gaps 2.

[0011] As Figure 2 shows, the casing 1 may comprise blowers 3, a heater 4 and filters 5. With the blowers 3, an air flow may be produced, whereby air flows from the gaps 2 as shown by arrows D. The heater 4 is used for heating air that flows out. The heater 4 may be a heater provided by electric resistors, for instance, or the heater 4 may be connected to a liquid circulation heating system of the building. The filter 5 filters the air taken from air inlets 6.

[0012] The casing 1 may also comprise silencers, which are not shown in the attached figures for the sake of clarity. The air curtain may also be produced with the air conditioning device that only comprises the casing 1 and the gaps 2, in which case air to be blown from the gaps 2 is led into the casing 1 along a ventilation duct, which means that air flow is not produced by the blowers inside the casing.

[0013] Vertical bars 7 are arranged in connection with the vertical gaps 2 in the vicinity thereof. By using the vertical bars 7, the direction of air flow coming from the gaps 2 is determined. When the vertical bars 7 are arranged centrally with respect to the gap 2, air flows from the gaps 2 directly away from the casing 1, as shown by arrows D in Figure 2.

[0014] The bars 7 may be solid, but preferably they are hollow, and thus the bars 7 are preferably tubes, which have a reasonable weight and are relatively easy to move.

[0015] The upper ends of the bars 7 are provided with pins 8. The bars 7 hang on the pins 8 and can turn around the pins 8, if necessary. The pins 8, in turn, may be arranged to rest on a support structure. The upper surface of the support structure may comprise, for example, a groove in which the pin 8 is arranged. A plurality of grooves may be arranged next to one another in the support structure, and by selecting a suitable groove from the adjacent grooves, it is easy to arrange the bar 7 in a desired position with respect to the upper part of the vertical gap 2. In the attached figures, the pins 8 are arranged such that the upper ends of the bars 7 are in the middle of the vertical gap 2 but, if desired, the upper ends of the bars 7 may also be arranged such that the bars 7 are not placed centrally with respect to the gaps 2. In this case, the bars 7 divert the air flow in a manner explained below.

[0016] The lower part of the casing 1 is provided with an actuator 9 moving a plate 10 which, for its part, is connected to the bars 7 in a manner illustrated in Figures 3 and 5. Thus, the bars 7 are in connection with the plate 10 and the actuator 9 may be used for moving the plate 10. The actuator 9 may thus be used for deflecting the position of the lower ends of the vertical bars 7. Figures 4 and 5 illustrate how the actuator 9 is used for moving the bars 7 away from the actuator 9. In this case the bars 7 are not placed centrally with respect to the gap 2. Thus, the bars 7 divert the air flow as illustrated by arrows E in Figure 5. The upper ends of the vertical bars 7 are thus positioned in their places by the pins 8, and the actuator 9 is used for deflecting the position of the lower ends of the bars 7. Thus, the actuator 9 controls the direction of air flow from the gap 2 differently at the lower part than at the upper part. In the case of Figures 4 and 5, the bars 7 are close to the centre of the gaps 2 at the upper part of the gaps, which means that at the upper part of the gaps air flows substantially perpendicularly, i.e. as illustrated by arrows D in Figure 2, although the position of the lower ends of the bars is deflected. If the purpose was to divert the air flow to the opposite direction than in

Figure 5, the lower ends of the bars 7 would be moved by the actuator 9 towards the actuator 9.

[0017] The air conditioning device is arranged in connection with the opening of an entrance door to produce an air curtain. The purpose of the air curtain is to prevent the mixing of warmer and colder air and/or air flow in the doorway. In winter, the air curtain prevents, on the one hand, warm air from flowing out of the building and, on the other hand, cold air from flowing into the building. In summer, the air curtain may be used, for example, for preventing cooled indoor air provided with cooling equipment from flowing out and/or for preventing hot air from flowing into the building.

[0018] The air flow at the door opening is influenced by the pressure ratio, i.e. the air pressure outside the opening compared to the air pressure inside the opening. The pressure ratio, on the other hand, is affected by ventilation of the building, air temperature differences causing a 'chimney effect', and wind. Pressure caused by the wind to the building depends on the wind speed and direction as well as the geometry of the building. Wind causes an overpressure on the surface it meets and, on the other hand, an underpressure on the wall that is protected from wind. The pressure difference caused by the temperature difference between the outdoor and indoor air is called a chimney effect. The chimney effect typically causes that inside a building that is warmer than the outdoor air, underpressure is directed to the lower parts of the building and overpressure is directed to the upper parts, when compared with the outdoor air. Consequently, wind may cause either an overpressure or an underpressure and the chimney effect, for its part, may typically cause a different kind of effect at the lower part than at the upper part, and at the upper part the effect may even sometimes be opposite to that at the lower part. In some cases it is thus advantageous that the air curtain is directed outwards from the building and in some cases it is advantageous that the air curtain is directed inwards into the building. On the other hand, in some cases it is advantageous to direct the air curtain more intensely from the lower part of the opening than from its upper part.

[0019] To control the direction of the air curtain, the air conditioning arrangement comprises a control unit 11 controlling the actuator 9 to divert the direction of the air curtain as desired. The control unit is connected with, for instance, temperature sensors 12, one of which is arranged outside the building and the other inside the building. In addition, the air conditioning arrangement may include pressure sensors 13, one of which is also arranged inside the building and the other outside the building. Thus, temperature and/or pressure differences are used for determining in which direction the air curtain is to be blown, and the actuator 9 controls the air conditioning device to blow the air curtain as desired.

[0020] The plate 10 may be connected to be moved by the actuator 9 via a spring or springs, for example, in which case the springs are arranged to be so slack that if motion of the bars is prevented, the plate 10 does not

move either, but the springs will spring as desired. Thus, if for instance a finger is inserted into the gap 2, the bar 7 is not pressed against the finger and does not cause damage to it.

[0021] In addition to or instead of the above-mentioned spring or springs, the gap 2 may be covered by, for instance, a metal grating or net to prevent damage to the fingers. The openings of the grating or net are so small that a finger cannot be inserted through them and, accordingly, as large as possible to disturb the air flow as little as possible. Furthermore, the threads of the grating or net are sufficiently thick to have a sufficiently rigid structure but, on the other hand, they have to be as thin as possible so as to disturb the air flow as little as possible.

[0022] In some cases, features disclosed in this application may be used as such, irrespective of other features. On the other hand, when necessary, the features disclosed in this application may be combined in order to provide various combinations.

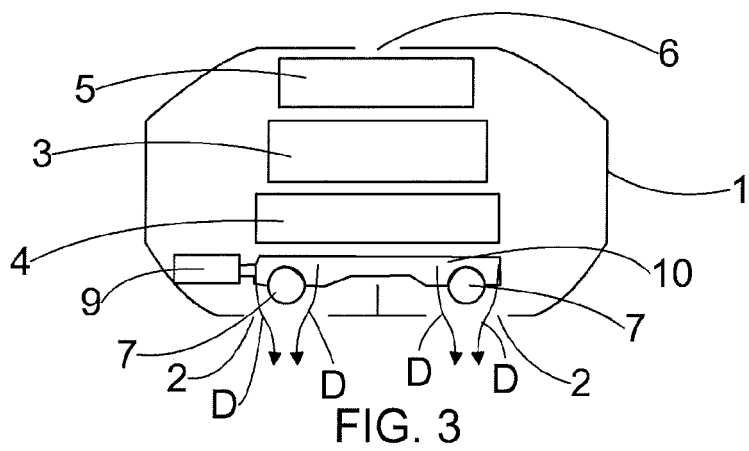
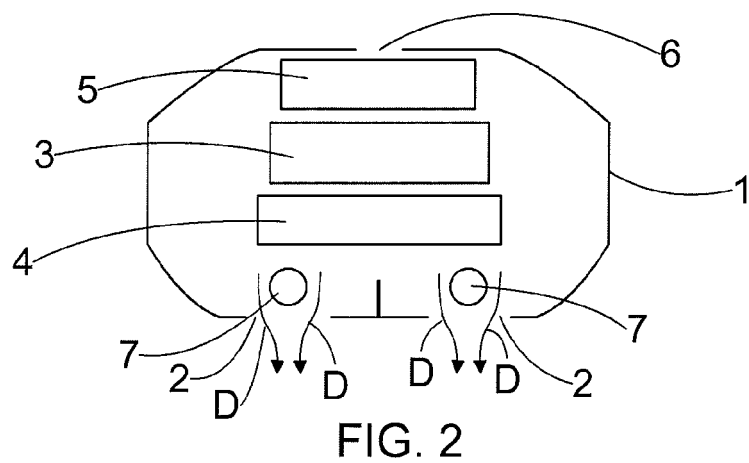
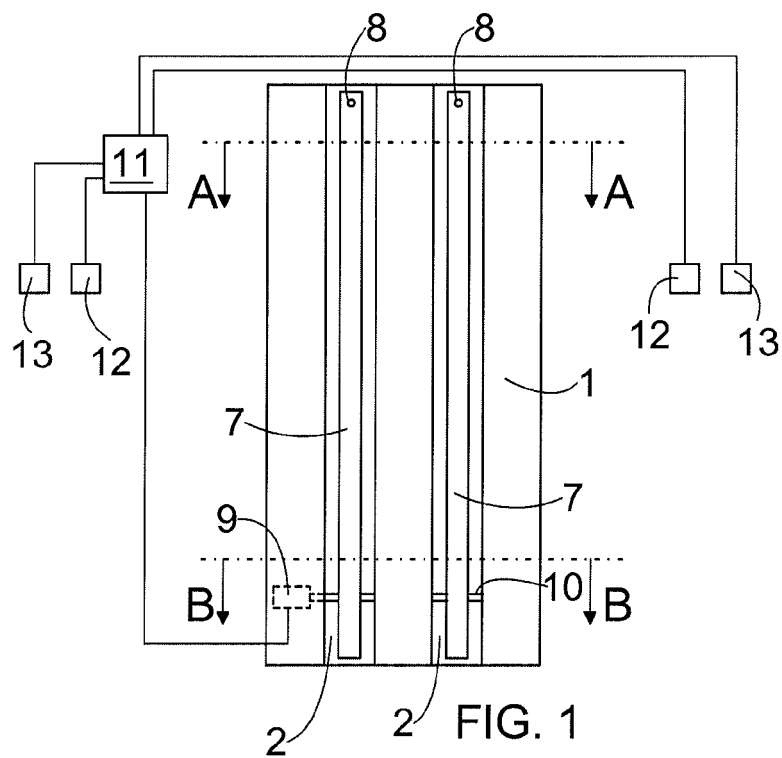
[0023] The drawings and the related description are only intended to illustrate the idea of the invention. The details of the invention may vary within the scope of the claims. Thus, if desired, the air conditioning device may be provided with an actuator 9 both at the lower end and at the upper end of the bars, whereby it is possible to automatically control the position of both the upper and lower ends of the bars.

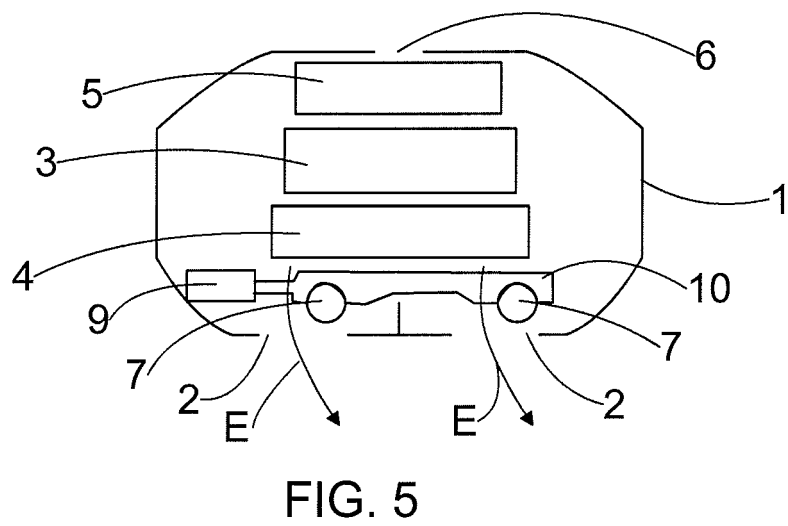
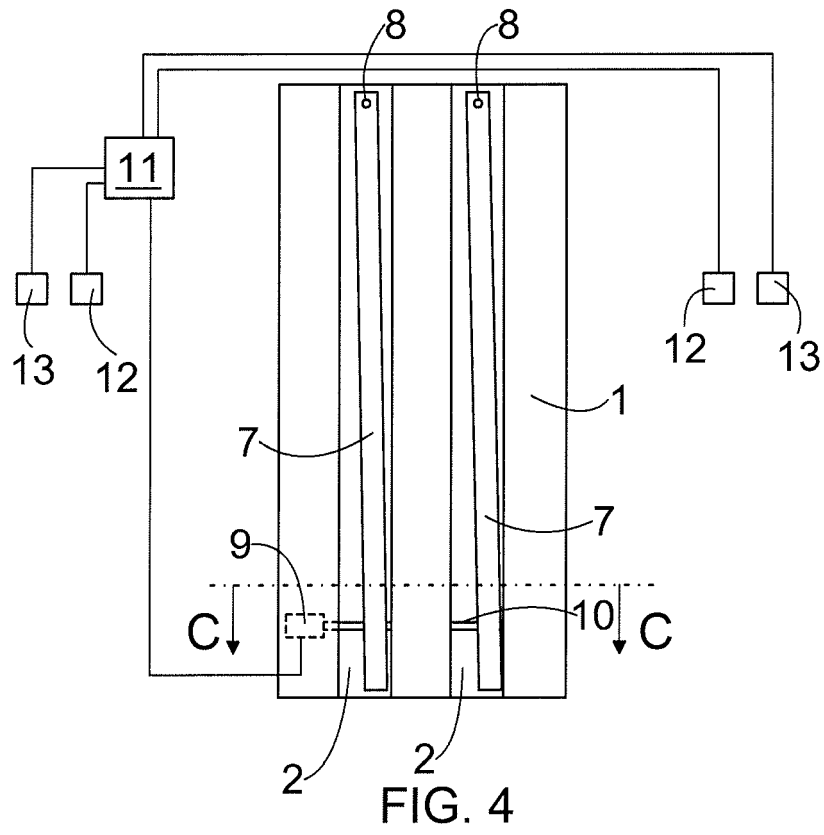
[0024] Furthermore, if there are several gaps, each bar 7 need not be movable by the actuator 9 but the bars 7 in connection with only one gap or some gaps 2 may be arranged to be immovable or movable only manually.

characterized in that the vertical bar (7) is fixed in its place at its upper end and the actuator (9) is arranged to deflect the lower end of the vertical bar (7) with respect to the vertical gap (2).

Claims

1. An air conditioning device comprising a casing (1) with at least one vertical gap (2), allowing an air curtain to be produced with the air conditioning device by blowing air from the gap (2) and the air conditioning device comprising an actuator (9) for controlling the direction of air flow, **characterized in that** the actuator (9) is arranged to control the direction of the air flow coming from the gap (2) differently at the lower part of the air conditioning device than at the upper part.
2. An air conditioning device as claimed in claim 1, **characterized in that** the air conditioning device comprises, in connection with the vertical gap (2) thereof, a vertical bar (7) arranged inside the casing (1) of the air conditioning device and in the vicinity of the gap (2), whereby the actuator (9) is arranged to deflect the position of the vertical bar (7) with respect to the vertical gap (2) to control the direction of the air flow.
3. An air conditioning device as claimed in claim 2,





REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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