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(54) **AIR BARRIER APPARATUS FOR AUTOMATICALLY OPENING SLIDING DOORS**

(57) The finding concerns an air barrier apparatus, adapted to be positioned above a door (P), comprising a casing (2) equipped with at least one air intake vent (3) and at least with vents (4) for the exit of ventilated air adapted to form the desired vertical air barrier (H), wherein the air is sucked inside said casing (2) by means of at least one intake fan (5) inside the casing (2), which generates a flow of air from the intake vents (3) to the exit vents (4) and wherein a slightly heated flow of air (H) is

adapted to be generated by means of at least an infrared device (10). Said infrared device (10) is positioned upstream of the intake fan (5) and heats at least a portion of the flow of air and it is also positioned in the lower part of the casing (2), near at least one intake vent (3), so that the heat waves (K), radiated downwards through said vent (3), are adapted to hit, with a localised heating, a person transiting under the apparatus (1).

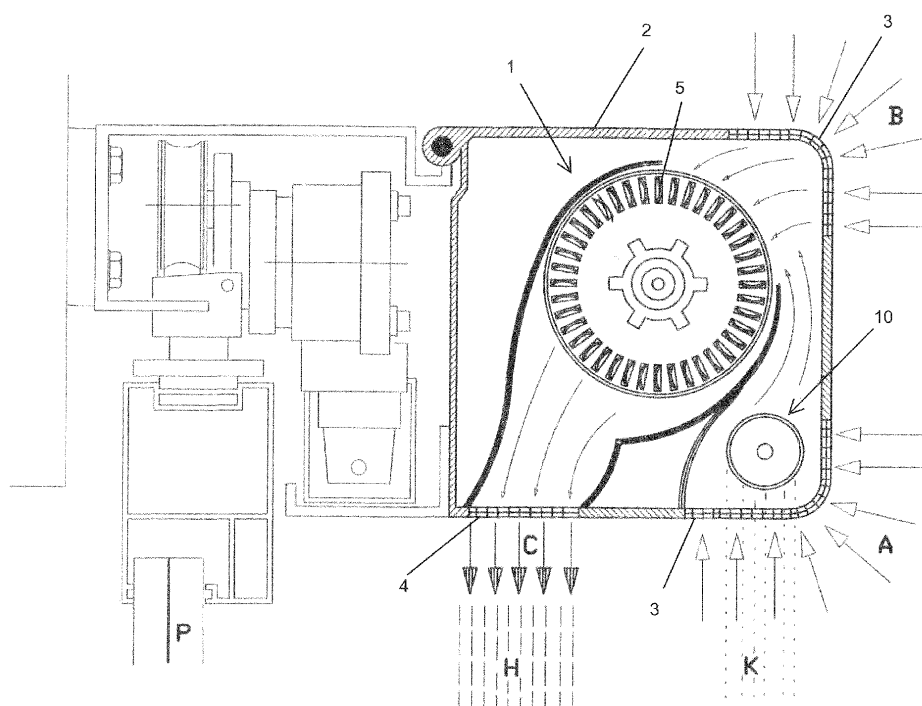


Fig. 1

Description

[0001] The present invention concerns an air barrier apparatus for automatically opening sliding doors, according to the general part of claim 1.

[0002] As is well known, in spaces frequented by a large number of people, such as shopping malls, railway stations, airports, hospitals, banks and other places with the same specificities, the continuous opening and closing of doors generates a series of problems, in particular:

- the formation of annoying air streams at the opening area of the door;
- a thermo-hygrometric decompensation of the internal environment with consequent loss of pressure of the air conditioning system inside the room;
- infiltrations of dust and other pollutants from outside.

[0003] These problems are solved with the use of so-called "air barriers", constituted by a regulated flow of air forming a vertical barrier, also called "thermal curtain", invisible and descending, which acts as a contrast to the mass of air, which, depending on the thermo-hygrometric conditions of the environment, naturally enters from the outside or evacuates from the inside towards the outside.

[0004] Constructively, the air barrier is made by means of a ventilation apparatus enclosed in a casing, equipped with air intake vents and vents placed below for the exit of the vertical flow of air that makes the aforementioned air barrier.

[0005] This involves the fact that a person, at the moment of trespassing the door, is hit by a blow of air coming from above which, even if the air is at room temperature, due to the fact of constituting a flow at high speed, makes the person perceive the annoying sensation of the presence of "cold air".

[0006] In order to eliminate this negative sensation, the "air barrier" is made with a flow of slightly heated air.

[0007] At the current state of the art, the air forming the barrier or hot "air blade" is heated by means of two systems:

- with the use of electrical resistors;
- with the use of hot water batteries.

[0008] Operationally, both systems show drawbacks.

[0009] Specifically, the air barriers equipped with electrical resistors are the most common for ease of installation, but they need models with powerful resistors to be able to heat the air sufficiently and therefore require a considerable and expensive energy consumption expressed in kWh.

[0010] On the other hand, the air barriers equipped with hot water batteries, although with considerably reduced operating costs compared to the electrical system, require considerable installation and maintenance costs.

[0011] Air barriers comprising therein infrared devices such as, for example, the one described in WO 89/01592

A1 are also known in the art, wherein, however, the infrared ray technology is used simply with secondary heat source and which does not directly heat the air exiting the barrier which is instead heated by an electric resistor.

In addition, the infrared device is placed downstream of the flow of air and is protected from it by a reflective shield whose purpose is to reflect the infrared rays outside the barrier. Also, patent document US 3211077 describes an air barrier apparatus in which infrared heating devices are present which, however, also in this case are not placed directly inside the flow of air of the barrier which they heat at a distance. It is clear that, precisely because of this distance, the heating will be very mild and the air of the barrier will be relatively warm.

[0012] Aim of the present invention is to realize an air barrier apparatus for automatically opening sliding doors that maximizes the efficacy of the use of infrared technology, avoiding the problems known in the art.

[0013] This aim is achieved by providing that, in order to heat the air and to directly heat a user who crosses the barrier, an infrared device is used, commonly known as an "infrared lamp", where the heat produced is transmitted by irradiation to the hit bodies. In practice, the use of infrared lamps, compared to other heating means, allows:

- to have a greater heating efficacy with the same power absorbed;
- a rapid reaching of the operating temperature and an equally rapid shutdown, so it is possible to operate the lamp only for the time strictly necessary to open/close the door whereas, on the other hand, the electrical resistors or hot water batteries, due to their "thermal hysteresis", must always be kept in operation, with consequent considerable energy costs.

[0014] Constructively, the infrared lamp is positioned upstream of the intake fan and engages a portion and the total flow rate of the flow of air to be heated.

[0015] Advantageously, the infrared lamp is placed in the lower part of the casing so that, thanks to the localised heating of the lamp provided with the infrared rays, it is possible to direct its heat waves downwards, which are added to the hot air barrier, thus helping to increase the well-being of the person trespassing the door.

[0016] The invention will be better defined with the description of a possible embodiment thereof, made by way of non-limiting example only, through the attached drawing tables, where:

- fig. 1 shows a sectional view of a casing containing the air barrier apparatus equipped with an infrared heating lamp;
- fig. 2 shows an air barrier apparatus in the operating step;
- fig. 3 shows a particular embodiment of an air barrier apparatus equipped with a particular housing for the infrared device;

- fig. 4 shows a further embodiment of an air barrier apparatus equipped with a deflector for directing the flow of air towards the intake fan.

[0017] As a rule, an air barrier apparatus, indicated with reference 1, adapted to be positioned above a door "P", which is usually automatic, comprises a casing 2 equipped with at least one air intake vent 3 and, at least at its own lower part, with vents 4 for the exit of ventilated air adapted to form the desired vertical air barrier "H". The air is sucked into said casing by at least one intake fan 5 inside the casing 2 which generates a flow of air from the intake vents 3 to the exit vents 4.

[0018] By at least one of the intake vents 3 at least one infrared device 10 is present, better known as an "infrared lamp", capable of eliminating the negative sensation of the presence of "cold air", which a person would perceive when trespassing the door, if he were hit by a flow of air at high speed without any preheating.

[0019] The infrared device 10 is positioned upstream of the intake fan 5 and engages at least a portion of the flow of air to be heated. The intake fan 5 can advantageously suck air also from any intake vents 3 without heating means, as visible in Fig. 1.

[0020] To make the best use of the technology and obtain the maximum efficiency, it is provided that the infrared device 10 is positioned in the lower part of the casing 2, near at least one intake vent 3, so that the heat waves K, radiated downwards through said vent 3, are adapted to hit, with a localised heating, a person transiting under the air barrier apparatus 1. The heat waves K may pass through the openings of the intake vent 3 which are necessary to allow air in.

[0021] Therefore, as visible in fig. 1, the innovative feature of the invention consists in the fact of equipping the air barrier apparatus 1 with an infrared device 10 capable of simultaneously heating by irradiation at least a part of the flow of air entering the intake fan 5 and a possible user who passes under said apparatus, so as to increase the overall well-being of the same, who will not perceive cold sensations.

[0022] The heated part of the flow of air, indicated with the reference "A" in Fig. 1, can advantageously mix also with another part, indicated with the reference "B", of air being sucked, thus heating it so that the exiting ventilated and heated air, indicated with the reference "C", provides a vertical air barrier "H" at the required temperature.

[0023] It is also possible to provide that the infrared device 10 heats the total flow rate of the area being sucked.

[0024] Fig. 3 shows a particular embodiment of an apparatus according to the invention in which at least one intake vent 3, near which there is an infrared device 10, has a substantially circular cross-section open on its lower and upper part, so as to allow the intake of the air by means of the intake fan 5.

[0025] Advantageously in this case, the infrared device 10 can be more exposed to the external environment of

the casing 2 than traditional grid intake vents, as it is positioned inside the perimeter of the intake vent 3 and this fact improves the efficacy of the direct irradiation operation of the user.

[0026] In addition, a reflective panel 6 positioned above the infrared device 10 may advantageously be provided to reflect downwards the rays emitted by the device 10, which would otherwise heat the internal components of the apparatus 1.

[0027] Said reflective panel 6 comprises at least one hole 7 to allow the passage of the air to be sucked in.

[0028] In the further embodiment illustrated in Fig. 4 an air barrier apparatus 1 is shown in which at least one air deflector 8 is provided, placed above at least one intake vent 3, so as to direct the flow of air coming from said intake vent 3 towards the intake fan 5.

[0029] This embodiment allows to avoid dispersion of the heated air, increasing the efficiency of the apparatus 1.

[0030] An air barrier apparatus of the type described in the invention is usually configured to be switched on only when a user is passing so as not to waste electricity unnecessarily for its operation.

[0031] A control unit (not illustrated) may be provided adapted to receive data concerning the passage of a user under the apparatus 1, in order to operate it accordingly. Advantageously, in the event that the apparatus is installed above a door "P" of the automatic opening type, said data concerning the passage of a user under the apparatus 1 would come directly from the control unit of the door "P".

[0032] Advantageously, it can be provided that if a user remained for a long time under the apparatus 1, the control unit, always depending on the data concerning the user's passage, after a predefined time, would reduce the speed of the intake fan 5, so as to reduce the speed of the jet of air "H" that hits the user. A jet of air that is too fast, however heated, could be perceived by the user as cold, reducing comfort.

[0033] The invention thus conceived is susceptible to variations and modifications, provided that the whole falls within the inventive concept defined by the following claims.

Claims

1. AIR BARRIER APPARATUS (1), adapted to be positioned above a door (P), comprising a casing (2) equipped with at least one air intake vent (3) and, at least at its own lower part, with vents (4) for the exit of ventilated air adapted to form a desired vertical air barrier (H), wherein the air is sucked inside said casing (2) by means of at least one intake fan (5) inside the casing (2), which generates a flow of air from the intake vents (3) to the exit vents (4) and wherein, in order to eliminate the negative sensation of the presence of "cold air" which a person perceives

at the moment of passing under the apparatus (1), when hit by a flow of air at high speed, a slightly heated flow of air (H) is adapted to be generated by means of at least an infrared device (10) ,

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said air barrier apparatus (1) **being characterized in that** the infrared device (10) is positioned upstream of the intake fan (5) and heats at least a portion of the flow of air

and in that

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the infrared device (10) is positioned in the lower part of the casing (2), near at least one intake vent (3), so that heat waves (K), radiated downwards through said vent (3), are adapted to hit, with a localised heating, a person transiting under the apparatus (1).

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2. AIR BARRIER APPARATUS (1), according to claim 1, **characterized in that** at least one intake vent (3), near which there is an infrared device (10), has a substantially circular cross-section open on its lower and upper part, so as to allow the intake of air by means of the intake fan (5); the infrared device (10) being positioned within the perimeter of the intake vent (3). 20 25
3. AIR BARRIER APPARATUS (1), according to claim 2, **characterized in that** above the infrared device (10) there is provided a reflective panel (6) comprising a hole (7) to allow the passage of the air to be sucked in. 30
4. AIR BARRIER APPARATUS (1), according to any one of the preceding claims, **characterized by** comprising at least one air deflector (8), placed above at least one intake vent (3) and oriented to direct the flow of air coming from the intake vent (3) towards the intake fan (5). 35
5. AIR BARRIER APPARATUS (1), according to any one of the preceding claims, **characterized by** comprising at least one intake vent (3) near which there is no infrared device (10). 40
6. AIR BARRIER APPARATUS (1), according to any one of the preceding claims, **characterized by** comprising a control unit adapted to receive data concerning the passage of a user under the apparatus (1) to operate according to said data the at least one intake fan (5) and the at least one infrared device (10). 45 50
7. PROCESS FOR CONTROLLING AN AIR BARRIER APPARATUS (1), according to claim 6, **characterized in that**, after a predetermined period of a user staying under the apparatus (1), the control unit reduces the speed of the at least one intake fan (5). 55

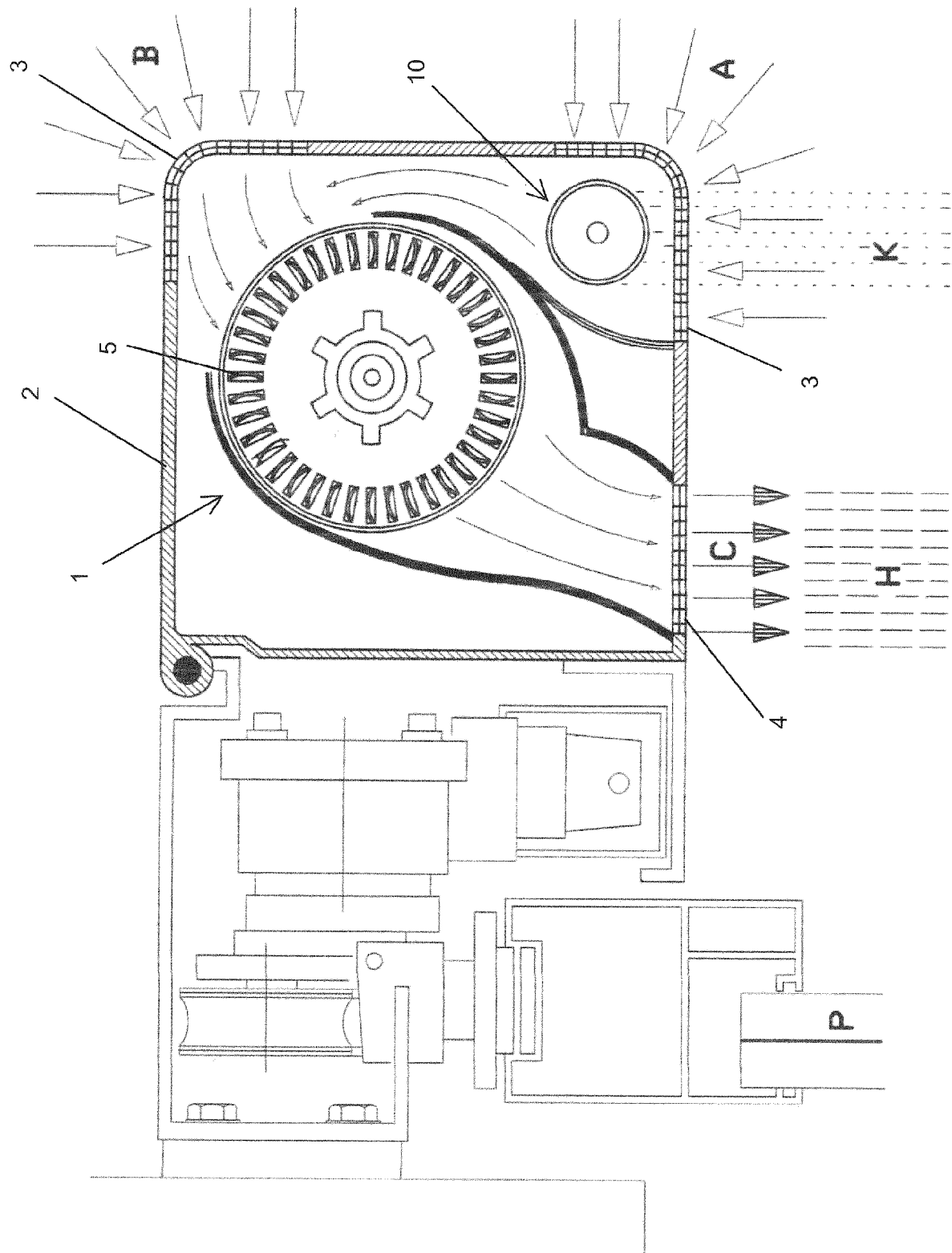


Fig. 1

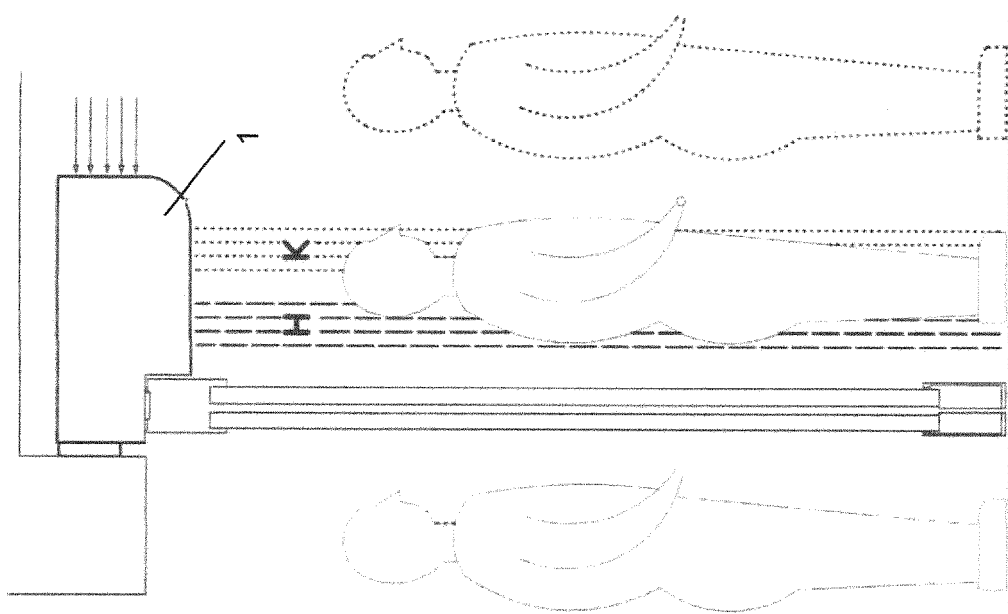
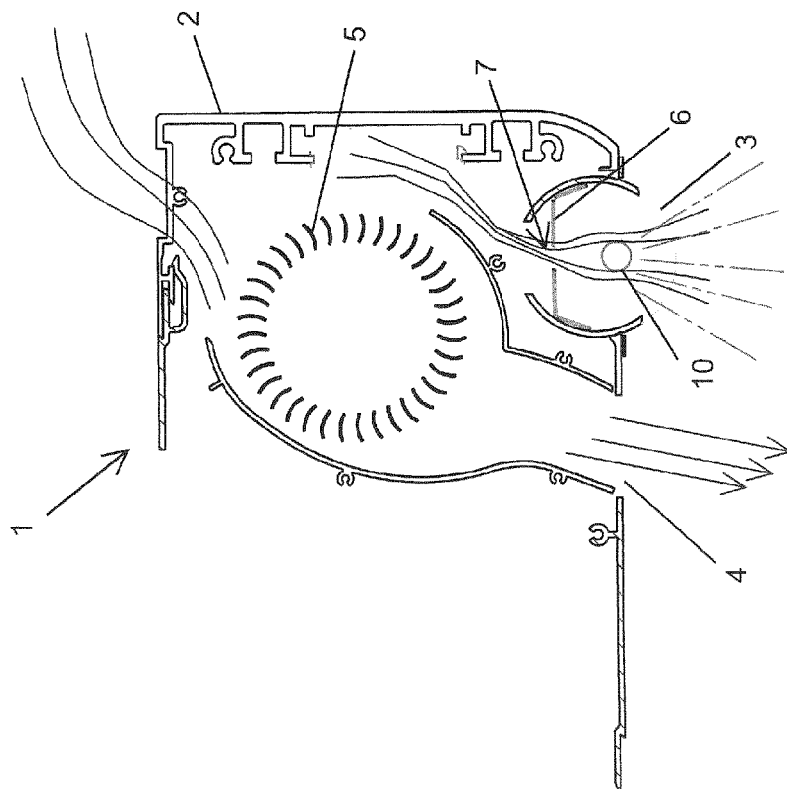
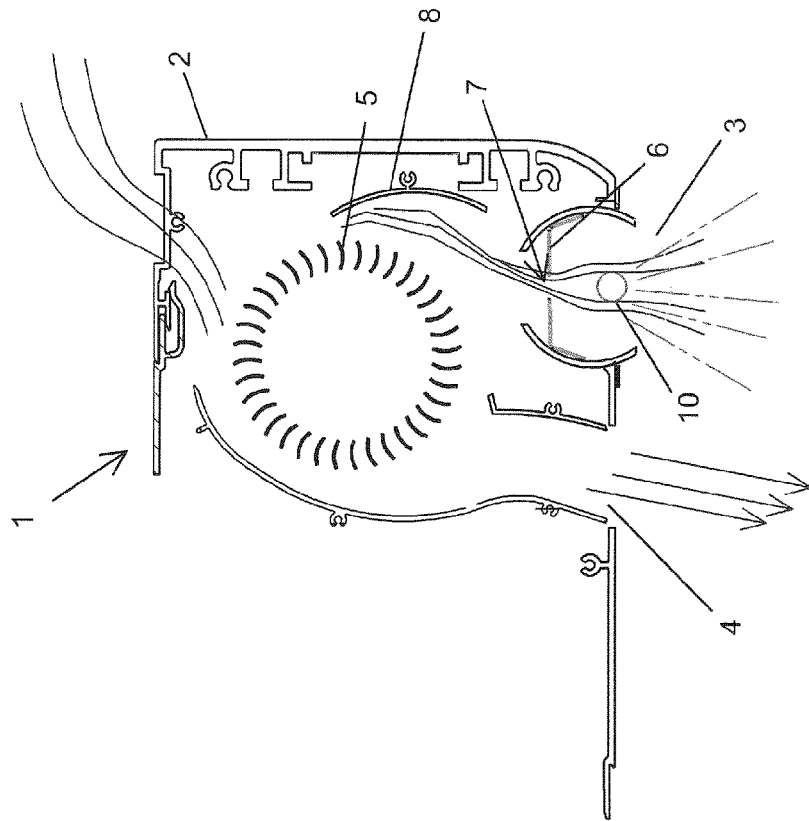


Fig. 2





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Application Number

EP 23 15 7193

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EPO FORM 1503 03.82 (P04C01)

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 March 2023	Examiner Ast, Gabor
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-03-2023

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