(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 639 519 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.09.2013 Bulletin 2013/38

(51) Int Cl.:
F24F 7/00 *(2006.01)* ***F24H 3/00*** *(2006.01)*

(21) Application number: **13154233.4**

(22) Date of filing: **06.02.2013**

(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

(30) Priority: **14.03.2012 NL 2008487**

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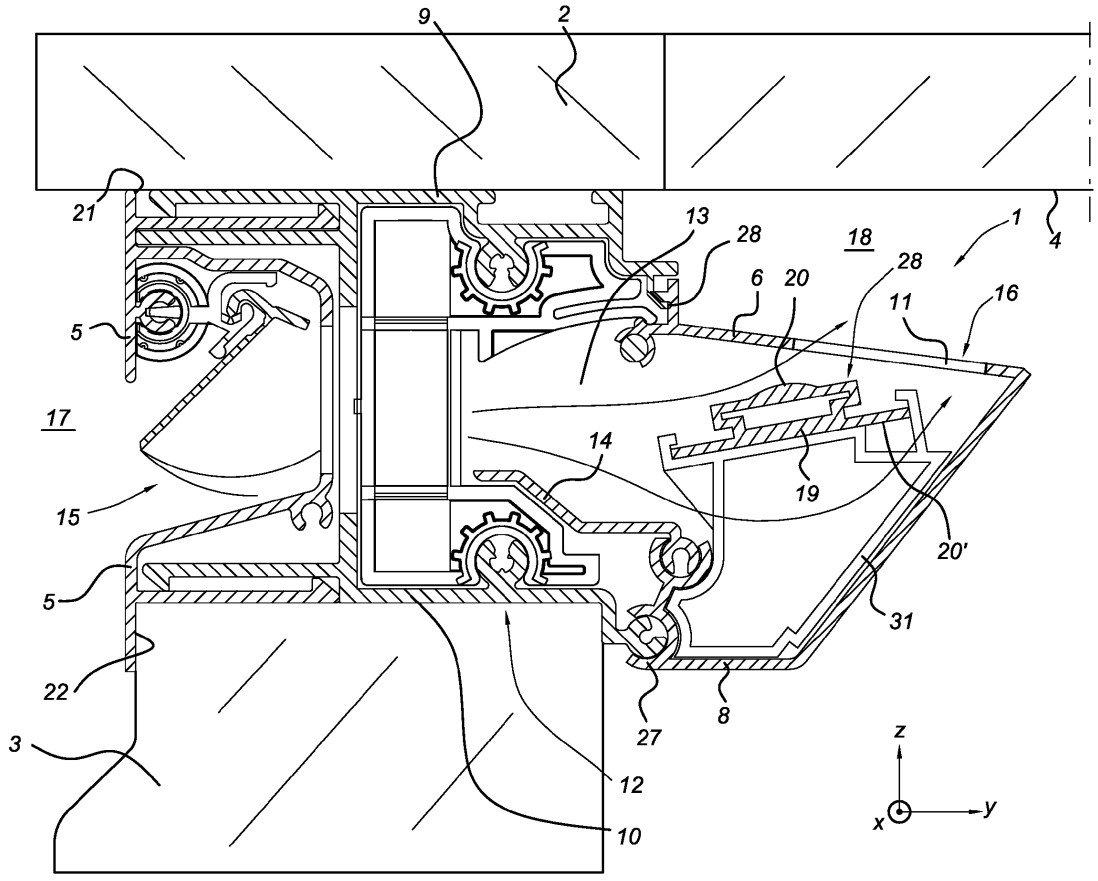
(54) Ventilation device with internal heating system

(57) A passive ventilation device for use in a building comprises a housing (12), a ventilation passage (13) which extends through the housing between an inlet (15) of the housing which can be turned towards the exterior of the building and an outlet (16) of the housing which can be turned towards the interior of the building in order to provide an airflow between the inlet and the outlet, a flap (14) for closing or opening the ventilation passage, as well as heating means (20) accommodated in the housing. The heat-exchanging means is suspended from a thermally insulated support means (31).



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Description

[0001] The invention relates to a passive ventilation device for use in a building, comprising a housing, a ventilation passage which extends through the housing between an inlet of the housing which is to be turned towards the exterior of the building and an outlet of the housing to be turned towards the interior of the building in order to provide an airflow between the inlet and the outlet, a flap for closing or opening the ventilation passage, as well as a heating means incorporated in the housing.

[0002] Such a ventilation device is known from DE-A-3419001. On the side turned towards the interior of the building, this known ventilation device has a grate comprising grate openings via which the outside air can flow into the building. In order to prevent outside air at too low a temperature from entering the building and adversely affecting the comfort, a heating foil is attached to the inner surface of the grate. By applying an electrical voltage across said heating foil, the temperature of the foil and of the grate increases, as a result of which the air is heated before flowing into a building via the grate. This is intended to prevent draughts and/or cold air streams.

[0003] Despite the positive effect of such a heating system, there are nevertheless various drawbacks associated with this known ventilation device. Thus, the heating foil covers a part of the grate openings, which adversely affects the ventilation capacity. If desired, openings can be made in the foil, but this is a difficult operation which also carries the risk that the foil is damaged to such a degree that it no longer functions well. A further important drawback is that the grate itself also becomes hot. Since the grate is freely accessible from the space in the building, there is a risk that the user may bum himself when operating the ventilation device.

[0004] A further ventilation device is known from DE-U-20110569. This is configured as a piece of pipe inside which an electrical heating resistor is suspended. This piece of pipe may be configured to be thermally insulated, so that it does not heat up, or only to a limited degree. Thus, the air is only heated along the free surface of the heating resistor, as a result of which the heating capacity is limited.

[0005] US- A- 2100/0143643 discloses a ventilation port for a closable cooling device. A heating system is provided with the aim of preventing the closure element from freezing onto said cooling device. Said heating system is fitted to a heat- conducting support, so that the heat can readily heat the flap and the flap seat of the closure element.

[0006] It is therefore an object of the invention to provide a ventilation device of the abovementioned type, wherein the air can be heated sufficiently, the flow rate in the ventilation passage can be maintained at the desired level and the risk of burning of the user is also prevented. This object is achieved by the heating means being suspended from a thermally insulated support means and by the heating means having heat-exchanging surfaces facing away from each other, preferably two of such heat-exchanging surfaces.

[0007] The ventilation device according to the invention can heat the incoming air before it reaches the space in question, without the temperature of the housing increasing significantly. The thermally insulated suspension ensures that the relatively high temperatures which the heating means has to reach to effectively heat the air, do not impact on the housing. Thus, the problem of the user burning himself is eliminated.

[0008] Such a thermally insulated support means may be configured in many different ways. Preferably, the thermally insulated support means has a thermal conduction ($W.m^{-1}.K^{-1}$, watt per metre Kelvin) which is lower than that of the housing, given otherwise identical circumstances. The desired thermal insulation of the heating means with respect to the housing can be achieved in different ways. Thus, it is for example possible to fit the heating means on the inside of the housing by means of an insulating layer. However, it is not always necessary to use such an insulating layer. Preference is given to an embodiment in which the heating means is supported in the housing by supports which are spaced apart in the longitudinal direction.

[0009] Such supports may be formed in many ways, depending on the internal configuration of the housing. Preferably, the supports comprise thermally insulated material which has a lower thermal conduction ($W.m^{-1}.K^{-1}$) than metal, such as a plastic. By way of example, a thermal conduction at room temperature having a value of $\leq$ 10 $W.m^{-1}.K^{-1}$, preferably $\leq$ 1 $W.m^{-1}.K^{-1}$ is mentioned.

[0010] The heating means furthermore preferably has two heat-exchanging surfaces facing away from each other. Due to the orientation of the heating means, the incoming air flows freely across both said surfaces in the transverse direction. Due to the spaced-apart supports, the air can flow both underneath and over the heating means, in such a way that it can be heated effectively. These heat-exchanging surfaces may run parallel to each other, but this is not obligatory.

[0011] The heating means may be configured in the form of a foil or sheet of electrically conductive material. Although the heating means may be flat, it does not have to be completely flat. The heating means may have a partly or completely curved surface. The surface may also comprise small indentations or small projections. Furthermore, an auxiliary profile may be provided from which the heating means is suspended. This auxiliary profile may itself also be heated by the heating means, and thus serve as a source of heat for the air flowing across it.

[0012] The ventilation device may have different shapes. In particular, the ventilation device may have an elongate housing which defines a longitudinal direction x, a vertical direction z at right angles to the longitudinal direction and a transverse direction y at right angles to the longitudinal direction and vertical direction, which

housing comprises mutually coupled profiles which are directed in the longitudinal direction. In this case, the heating means is situated inside the profiles defining the housing. According to another embodiment, the ventilation device may be circular in shape in order to be accommodated in a hole in a façade.

[0013] At least one heat-exchanging surface extends in the transverse direction in such a manner that the incoming air can readily flow across it. Such a surface can also extend obliquely with respect to the transverse direction. At least one heat-exchanging surface may be straight in cross section or curved in cross section.

[0014] Preferably, the heat- exchanging means is situated in the housing. As a result thereof, the user can no longer come into contact with the heating means, so that the risk of injury from burning is prevented.

[0015] The invention will now be explained in more detail below with reference to the exemplary embodiment illustrated in the figure.

[0016] The figure shows a variant of the ventilation device 1 which is constructed from a number of profiles which are coupled to one another, including the outer profile 5, the inner profile 8 and the connecting profiles 9, 10. The inner profile 8 has a punched-out grate 11 and is attached to the top and bottom profiles 9, 10 by means of a click-action fastening 27, 28. Together, these profiles form the housing 12 of the ventilation device. The ventilation passage 13 extends through this housing 12 between the inlet 15 and the outlet 16. The ventilation passage 13 can be closed by means of the flap 14 which is rotatably suspended from the bottom inner profile 8.

[0017] The ventilation device 1 forms the connection between the exterior 17 and the interior 18 of the building and, when the flap 14 is open, supplies fresh outside air to the space which is situated in the interior of the building. However, in particular when the outside air is cold, an unpleasant cold draught may be caused in said space. In order to prevent such a cold draught, an auxiliary profile 19 with a heating foil 20 is attached on the side of the housing 12 facing the outlet.

[0018] If the temperature of the supplied outside air is too low, said heating foil can be heated electrically. The outside air originating from the outlet 16 and flowing past the heating foil (see arrows) can then be heated to such a temperature that no unpleasant draught or cold air stream results in the space to be aerated. Incidentally, the action of the ventilation device is not affected, or hardly at all, by the advantageous arrangement of the heating system parallel to the direction of flow. Thus, the desired ventilation of the space situated behind it can also be ensured at relatively low outside temperatures.

[0019] The auxiliary assembly 26 consisting of the auxiliary profile 19 and the heating foil 20 is supported in the centre of the housing 12 by supports 31 which are spaced apart from each other. Said supports preferably consist of heat-resistant plastic and insulate the heating means 19, 20 with respect to the various profiles of the housing. Due to this arrangement of the heating means 19, 20, the air can flow along both surfaces thereof running in the transverse direction, as a result of which an optimum exchange of heat is effected. On the top surface, the air flows directly along the heating foil 20 itself. This heating foil 20 also heats the auxiliary profile 19, so that the air which flows along the underside is heated by said auxiliary profile. If desired, a second heating foil 20' may be arranged along the underside of the auxiliary profile in order to heat the air flowing along the underside.

[0020] List of reference numerals

1.	Ventilation device
2.	Façade
3.	Casing
4.	Ceiling
5., 6.	Outer profile
7., 8.	Inner profile
9., 10.	Connecting profile
11.	Inner grate
12.	Housing
13.	Ventilation passage
14.	Flap
15.	Inlet
16.	Outlet
17.	Building exterior
18.	Building interior
19.	Auxiliary profile
20., 20'.	Heating foil
21.	Housing attachment means
22.	Housing attachment means
26.	Auxiliary assembly
27., 28.	Click-action fastening
31.	Heating means support
32.	Sound-insulating material

Claims

1. Passive ventilation device for use in a building, comprising a housing (12), a ventilation passage (13) which extends through the housing (12) between an inlet (15) of the housing (12) which is to be turned towards the exterior (17) of the building and an outlet (16) of the housing to be turned towards the interior (18) of the building in order to provide an airflow between the inlet and the outlet, a flap (14) for closing or opening the ventilation passage (13), as well as a heating means (20, 20') incorporated in the housing (12), **characterized in that** a thermally insulated support means (31) is provided from which the heating means (20, 20') is suspended and **in that** the heating means (20, 20') has heat-exchanging surfaces facing away from each other.

2. Ventilation device according to Claim 1, wherein the

heating means (20, 20') is supported in the housing (12) by supports (31) which are spaced apart in the longitudinal direction.

3. Ventilation device according to Claim 2, wherein the supports (31) comprise thermally insulated material which has a lower thermal conduction ($W.m^{-1}.K^{-1}$) than metal, such as a plastic.

4. Ventilation device according to one of the preceding claims, wherein the heating means is configured in the form of a foil or sheet of electrically conductive material.

5. Ventilation device according to one of the preceding claims, wherein an auxiliary profile (19) is provided from which the heating means (20) is suspended.

6. Ventilation device according to one of the preceding claims, comprising an elongate housing (12) which defines a longitudinal direction x, a vertical direction z at right angles to the longitudinal direction and a transverse direction y at right angles to the longitudinal direction and vertical direction, which housing (12) comprises mutually coupled profiles (5-11) which are directed in the longitudinal direction, wherein the heating means (20) is situated inside the profiles (5-11) defining the housing (12).

7. Ventilation device according to Claim 6, wherein at least one heat-exchanging surface (20, 20') extends obliquely with respect to the transverse direction.

8. Ventilation device according to Claim 7, wherein at least one heat-exchanging surface (20, 20') coincides with the transverse direction.

9. Ventilation device according to one of Claims 6-8, wherein at least one heat-exchanging surface (20, 20') is straight in cross section or curved in cross section.

10. Ventilation device according to one of the preceding claims, wherein the housing is made of metal, such as of aluminium.

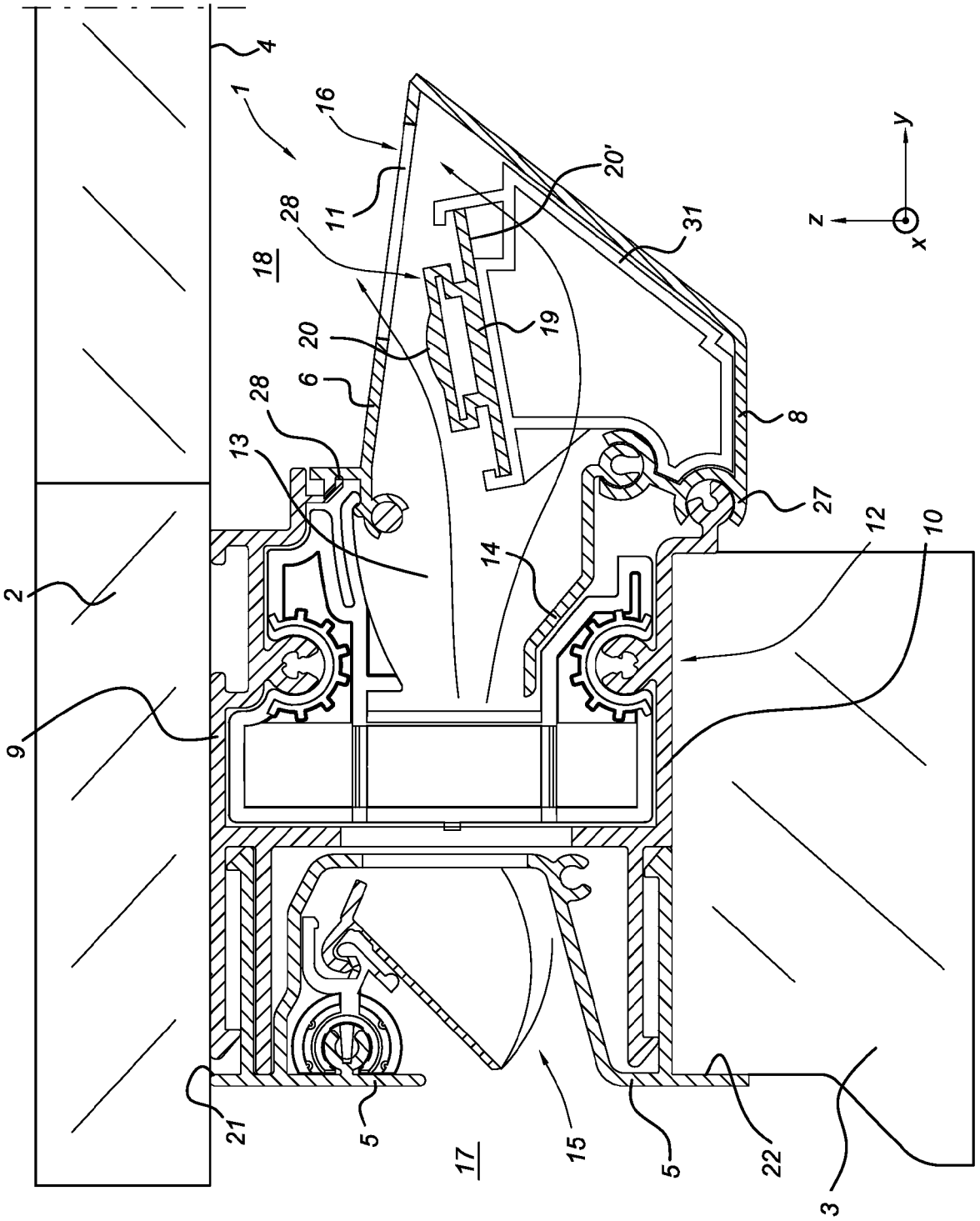
11. Ventilation device according to one of the preceding claims, wherein the thermal conduction of the support means has a value of $\leq 10\ W.m^{-1}.K^{-1}$, preferably of $\leq 1\ W.m^{-1}.K^{-1}$.

12. Ventilation device according to one of the preceding claims, wherein the heat-exchanging means (20, 20') is situated inside the housing (12).

13. Ventilation device according to one of the preceding claims, wherein at least one heat-exchanging surface (20, 20') is straight in longitudinal section.

14. Ventilation device according to one of the preceding claims, wherein at least one heat-exchanging surface (20, 20') is flat.

15. Ventilation device according to one of the preceding claims, wherein heat-exchanging surfaces (20, 20') turned away from each other are mutually parallel.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EUROPEAN SEARCH REPORT

Application Number
EP 13 15 4233

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 June 2013	González-Granda, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 15 4233

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