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(54) Title: CEILING ELEMENT

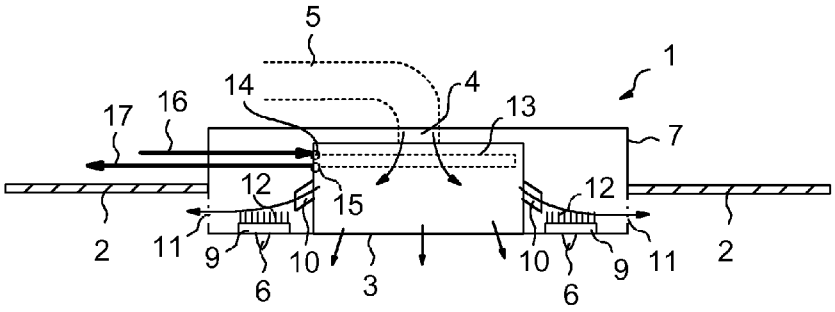


FIG. 1

(57) Abstract: This invention relates to a ceiling element (1) comprising: an inlet (4) for receiving an air flow; an air supply opening (3) for supplying an air flow into a space; temperature control means (13 to 15) for changing the temperature of the air flow flowing from the inlet (4) to the air supply opening (3); and at least one light source (6) for illuminating the surroundings of the ceiling element (1). In order for the ceiling element to be able to utilize light sources whose electric energy consumption is as low as possible, the ceiling element (1) comprises a nozzle (10) for generating a cooling flow to said at least one light source (6) by utilizing the air flow received from the inlet (4).

CEILING ELEMENT

FIELD OF THE INVENTION

[0001] This invention relates to a ceiling element intended for forming a part of the suspended ceiling of a space and having temperature control means for controlling the temperature of the space.

DESCRIPTION OF PRIOR ART

[0002] Prior art discloses a ceiling element to be arranged on the ceiling of a room or another space, the element forming a part of the suspended ceiling of the space and being provided with temperature control means for controlling the temperature of the space via a warm air flow flowing from the ceiling element. In this known solution, the ceiling element is provided with a pipe system for supplying warm fluid, such as warm water, via the inlet of the ceiling element into the flow channel of the ceiling element. The flow channel or a heat exchanger forming a part of it is positioned in an air flow supplied via the air supply opening of the ceiling element into the space for warming the space. The cooled fluid is removed from the flow channel via an outlet opening to a separate heating apparatus for reheating.

[0003] In connection with the above-described known ceiling element, one or more light sources are also arranged for illuminating the surroundings. To minimize electricity consumption, it would be preferable if the ceiling element could utilize light sources consuming as little electric energy as possible. Light sources consuming the least energy, such as LED (Light Emitting Diode) lamps are not, however, suitable to be used as light sources in connection with known ceiling elements because they heat too much, which means that their service life is too short.

SUMMARY OF THE INVENTION

[0004] An object of this invention is to solve the above problem and to provide a solution which allows light sources consuming as little electric energy as possible to be used in a ceiling element. This object is achieved with a ceiling element according to independent claim 1.

[0005] The invention utilizes an air flow flowing from the inlet of the ceiling element towards the air supply opening, part of the air flow being separated to a nozzle. The nozzle generates a cooling air flow to the light source of the ceiling element. Thanks to the air flow provided for the light

source by the nozzle, the thermal stress generated by the light source can be efficiently taken away from the light source along with the air flow, so that the temperature of the light source can be controlled better than before and its service life can be made longer.

[0006] Preferred embodiments of the ceiling element according to the invention become apparent from the attached dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] In the following, the invention will be described in greater detail by way of example, referring to the attached figures, of which:

[0008] Figure 1 illustrates a first embodiment of the ceiling element according to the invention;

[0009] Figure 2 illustrates a second embodiment of the ceiling element according to the invention; and

[0010] Figure 3 illustrates a third embodiment of the ceiling element according to the invention.

DESCRIPTION OF AT LEAST ONE EMBODIMENT

[0011] Figure 1 illustrates a first preferred embodiment of a ceiling element 1. The ceiling element 1 is arranged in connection with a suspended ceiling 2 of a room or space, and it comprises an air supply opening 3 for supplying an air flow into the space located below the ceiling element 1. The ceiling element 1 may be suspended on the actual ceiling of the space, for example.

[0012] In the example of Figure 1, the air flow is conveyed to an inlet 4 of the ceiling element 1 along a pipe 5. The pipe 5 may be attached to the ventilation installation of the real estate, by means of which installation fresh air is brought to the space where the ceiling element 1 resides. Thus, the air flow is generated by a fan belonging to the ventilation installation of the real estate.

[0013] The ceiling element 1 of Figure 1 also comprises light sources 6. In this example, it is assumed that these sources are formed specifically by LED lamps comprising a plurality of light emitting diodes arranged close to each other and illuminating the surroundings of the ceiling element 1, i.e. the space where the ceiling element resides. The electric connections of the light sources 6 are implemented in the inside of a housing 7 of the ceiling element 1, to which a body 9 of the light sources 6 extends. To

guarantee sufficient cooling efficiency for the light sources 6, the ceiling element comprises nozzles 10 which generate, out of some of the air flow flowing from the inlet 4 of the ceiling element, a cooling flow to the light sources 6. At their simplest, the nozzles may be formed of openings arranged at appropriate points to enable an air flow to the light sources. However, in the example of Figure 1, it is assumed that the nozzles 10 comprise a tubular portion with which a cooling flow can be accurately directed towards the body 9 of the light sources 6 extending to the inside of the housing 7.

[0014] In order to transfer thermal stress generated by the light sources as efficiently as possible to the cooling flow generated by the nozzles 10, the body 9 of the light sources 6 may be provided with cooling elements 12, which may be formed of adjacent cooling fins increasing the area to be cooled. However, this is not necessary in embodiments in which the air flow directed at the body provides sufficient cooling efficiency.

[0015] The cooling air flow ending up in the housing 7 of the ceiling element from the nozzles 10 is conveyed out of the housing 7 via outlet openings 11. It is assumed in the example of Figure 1 that the air flow from the outlet openings 11 ends up in the space where the ceiling element resides. In such a solution, the area of the outlet openings 11 is preferably smaller than the area of the nozzles 10, whereby overpressure is generated in the housing 7, where the bodies 9 of the light sources 6 to be cooled are positioned.

[0016] The ceiling element 1 comprises temperature control means which change the temperature of the air flow flowing from the inlet 4 to the air supply opening 3. In the example of Figure 1, the temperature control means comprise a flow channel 13 to an inlet 14 of which fluid, such as water, is supplied by means of a pipe 16 and from an outlet 15 of which fluid having flown through the flow channel is removed by means of a pipe 17. The flow channel 13 or a heat exchanger forming a part of it is arranged in the air flow flowing from the inlet 4 to the air supply opening 3 to change the temperature of this air flow.

[0017] If the ceiling element 1 is used to cool the space where the ceiling element resides, the fluid to be supplied to the inlet 14 of the flow channel 13 is cold. Thus, in the example of Figure 1, the temperature control means cool the air flow before it ends up in the nozzles 10, whereby cooling of the light sources is at its most efficient. If the ceiling element 1 is, by contrast, used to heat the space where the ceiling element resides, the fluid to be

supplied to the inlet of the flow channel 13 is hot. Thus, in the example of Figure 1, the temperature control means heat the air flow before it ends up in the nozzles 10, whereby cooling of the light sources is not quite as efficient as in connection with cold fluid. In practice, however, the temperature of the air flow required for heating the room or space is sufficiently low, so that this air flow is applicable to cooling the light sources. The ceiling element according to the invention can be utilized in both cases. In other words, one single ceiling element can be provided with hot fluid to heat the space during the cold season and with cold fluid to cool the space during the warm season.

[0018] Above, it has been described in accordance with Figure 1 that the temperature control means are arranged to heat or cool the air flow before some of it is separated to the nozzle 10. However, it is also feasible that the nozzles 10 are positioned in the flowing direction of air before the temperature control means. Thus, the temperature of the air flow ending up at the nozzles 10 is the same as the temperature of the air flow to be supplied to the inlet, and only the temperature of the air flow flowing further to the inlet opening 3 is changed.

[0019] Figure 2 illustrates a second preferred embodiment of a ceiling element 1' according to the invention. The embodiment of Figure 2 corresponds to a great extent to the embodiment of Figure 1, due to which the embodiment of Figure 2 is described in the following primarily by bringing forth differences between the embodiments.

[0020] In the case of Figure 2, the ceiling element 1' also comprises a fan 18 to generate an air flow from the inlet 4 to the air supply opening 3. By way of example, it is assumed in the case of Figure 2 that the air intake opening of the fan opens to above the ceiling element 1', i.e. in practice to the space between the suspended ceiling 2 and the actual ceiling of the space or room. In accordance with the invention, the air intake may alternatively take place from the room or space itself, in which case the suspended ceiling, for example, may have an opening connected via a pipe to the air intake opening of the fan 18. In both cases, the ceiling element 1' generates a closed cycle in the room or space where it resides. In such a solution, fresh air is conveyed to the room or space in another way.

[0021] Deviating from the case of Figure 2, it is also feasible that also a pipe 5 supplying fresh air leads to the air inlet opening of the fan 18, as in the case of Figure 1. In such a case, some of the air ending up in the air inlet

opening of the fan 18 may be fresh air to be supplied along the pipe 5, and some may be air to be recycled, originating from the room or space (from above or below the suspended ceiling 2) where the ceiling element resides.

[0022] Figure 3 illustrates a third preferred embodiment of the ceiling element according to the invention. The embodiment of Figure 3 corresponds to a great extent to the embodiment of Figure 1, due to which the embodiment of Figure 3 is described in the following primarily by bringing forth differences between the embodiments.

[0023] In the embodiment of Figure 3, the light sources 6 are arranged on a ceiling element 1" in such a way that their bodies 9 are positioned completely or nearly completely outside the housing 7 of the ceiling element 1". Thus, nozzles 10' are arranged to project out of the housing of the ceiling element 1" to control some of the air flow originating from the inlet 4 towards the light sources 6. Openings 11 according to the preceding embodiments are thus not needed in this embodiment.

[0024] In Figure 3, the body 9 of the light source 6 is shown without the cooling element 12 according to the preceding embodiments, although also in this embodiment the body of the light source may be provided with a cooling element increasing the area to be cooled.

[0025] In the embodiment of Figure 3 it is assumed, by way of example, that the ceiling element 1" has no fan but that the flowing air is conveyed along the pipe 5 to the inlet of the ceiling element 1". Deviating from what is shown in Figure 3, the solution described in the context of Figure 2 may be used, whereby the ceiling element 1" comprises a fan which is similar to the one in Figure 2 and whose air intake opening takes some or all of the required air from the space or room where the ceiling element 1" resides.

[0026] It is to be understood that the above description and the related figures are only intended to illustrate the present invention. Different variations and modifications of the invention will be obvious to a person skilled in the art without deviation from the scope of the invention.

CLAIMS

1. A ceiling element (1, 1', 1''), comprising:

an inlet (4) for receiving an air flow;

an air supply opening (3) for supplying an air flow into a space;

temperature control means (13 to 15) for changing the temperature of the air flow flowing from the inlet (4) to the air supply opening (3); and

at least one light source (6) for illuminating the surroundings of the ceiling element (1, 1', 1''), characterized in that

the ceiling element (1, 1', 1'') comprises a nozzle (10, 10') for generating a cooling flow to said at least one light source (6) by utilizing the air flow received from the inlet (4), whereby said temperature control means (13 to 15) change the temperature of the air flow flowing from the inlet (4) before the air flow is conveyed via said nozzle (10, 10') to said at least one light source (6).

2. A ceiling element according to claim 1, characterized in that said light source (6) is a LED lamp.

3. A ceiling element according to claim 1 or 2, characterized in that the light source (6) comprises a cooling element (12) for transferring thermal stress generated by the light source to the surrounding air, and that said nozzle (10) is directed to generate a cooling flow to the cooling element.

4. A ceiling element according to any one of claims 1 to 3, characterized in that the ceiling element (1') comprises a fan (18) for generating an air flow from the inlet (4) to the air supply opening (3) and the nozzle (10).

5. A ceiling element according to any one of claims 1 to 4, characterized in that the temperature control means (13 to 15) heat the air flow flowing from the inlet (4) to the air supply opening (3).

6. A ceiling element according to any one of claims 1 to 4, characterized in that the temperature control means (13 to 15) cool the air flow flowing from the inlet (4) to the air supply opening (3).

7. A ceiling element according to any one of claims 1 to 6, characterized in that the temperature control means of the ceiling element (1, 1', 1'') comprise

a flow channel (13) arranged in the air flow flowing from the inlet (4) to the air supply opening (3);

an inlet (14) for receiving a warm or a cold fluid, respectively, and for conveying it to the flow channel (13); and

an outlet (15) for supplying the fluid having flown through the flow channel (13) from the flow channel onwards.

8. A ceiling element (1, 1') according to any one of preceding claims 1 to 7, characterized in

that a part (9, 12) of said at least one light source (6), at which the cooling flow is directed, is arranged in a housing (7) to which the nozzle or nozzles (10) open to generate a cooling flow to said at least one light source (6);

that said housing (7) has an outlet opening or outlet openings (11) for removing the air having flown into it from the nozzle or nozzles (10), the air being removed out of the housing (7) to the surroundings of the ceiling element (1, 1') and

that the area of the outlet opening or outlet openings (11) of the housing is smaller than the area of the nozzle or nozzles (10) to generate overpressure in said housing (7).

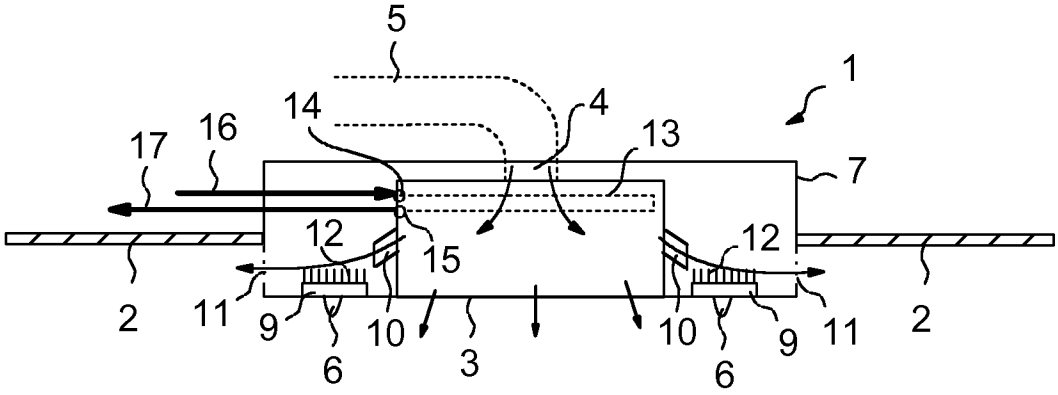


FIG. 1

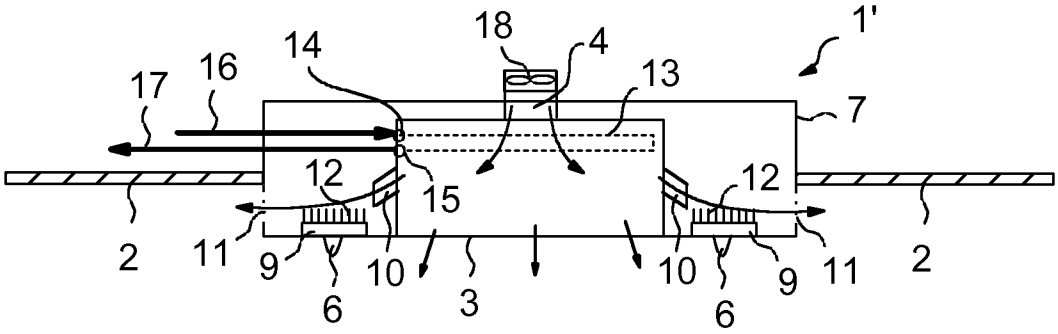


FIG. 2

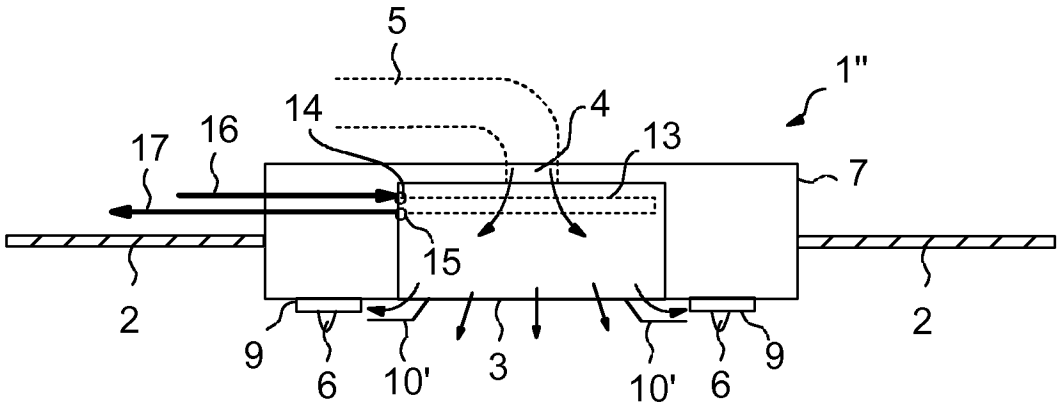


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2009/050845

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007148280 A1 (KONINKL PHILIPS ELECTRONICS NV et al.) 27 December 2007 (27.12.2007) Abstract; page 4, rows 27-30; figures 1 and 2	1-8
Y	GB 1468754 A (LTG LUFTTECHNISCHE GMBH) 30 March 1977 (30.03.1977) Page 1, rows 9-47	1-8
A	US 2210589 A (KURTH FRANZ J) 06 August 1940 (06.08.1940) Whole document	1-8
A	DE 10219669 A1 (ROSEL VALENTIN) 19 February 2004 (19.02.2004) Whole document	1-8
A	DE 3321612 A1 (HOWALDTSWERKE DEUTSCHE WERFT) 20 December 1984 (20.12.1984) Whole document	1-8

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 January 2010 (27.01.2010)	08 February 2010 (08.02.2010)

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008213094 A1 (OKIMURA KATSUYUKI) 04 September 2008 (04.09.2008) Whole document	1-8

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2009/050845

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