Description

The present invention relates to a device for combined delivery of heat radiation and light, having the features of the preamble of claim 1.

Both devices having a two-dimensional light delivery region as well as devices for delivering heat radiation are known. The disadvantage is that simultaneous lighting and heating has a large space requirement, requires separate connections for lighting and heating and entails a high installation cost.

CN 203099772 U discloses a device for the combined delivery of heat radiation and light, which comprises luminous elements, preferably LED, and a transparent base body ("light guide plate 8") with a lateral surface, cover surface and base surface, wherein the luminous elements (4, 5) are arranged on the lateral surface of the base body such that light emitted enters into the base body, and wherein a scattering device (6) is provided, which decouples the light that has entered at the cover surface or base surface of the base body.

WO 2015/124296 A1 relates to a device for delivery of light, comprising a luminous element, which comprises a plurality of LED. The device has an at least partially transparent, plate-shaped base body (12), which has a lateral surface (16), a cover surface (42) and a base surface (43). The luminous element (14) comprises a plurality of LED (20), which are arranged on the lateral surface (16) of the base body (12), so that light (24) emitted from the luminous element (14) enters into the base body. A scattering device ("Streukörper" 54) is provided in the base body (12), which, on the cover surface, decouples light entered into the base body.

Devices of the prior art are known from EP 2 412 521, GB 2 361 990 and JP 2005 337697.

The problem addressed by the invention is that of providing a device of the type in question, having a compact design and being easy to install.

This problem is solved by a device having the features of claim 1. Advantageous embodiments of the invention are defined in the dependent claims.

In accordance with the invention, the device combines at least one heat source (heating mat and/or at least one IR-LED) and at least one luminous element in an extremely compact manner, because the dimensions of the device are given substantially by the dimensions of the plate-shaped base body and since the base body, at least for the most part, is available for lighting as well as for heating. The base body is designed to be opaque or at least

partially transparent (e.g. with a transmittance of approximately 70% to approximately 100%). At least a part of the light emitted by a luminous element enters into the base body via the lateral surface and, because of the scattering due to a scattering device arranged in the base body, at least partially leaves through the cover surface.

In order to emit light in the direction of the cover surface, which is scattered in the direction of the base surface, a light reflector layer, preferably made of plastic material, is arranged adjacent to base surface of the base body. Provision can be made for the light reflector layer to be arranged between the heat source and the base body.

Provision can be made for the at least one heat source to comprise a heating mat. In this case, provision can be made for at least one of the surfaces of the heating mat to be designed to reflect light, so that the arrangement of a separate light reflector layer between the heat source and the base body is not required.

Provision can be made for the at least one heat source to comprise at least one, preferably a plurality of IR-LED (infrared light emitting diode).

If the heat source comprises at least one IR-LED, its radiation can also be reflected from the light reflector layer towards the cover surface.

Provision can be made for the at least one heat source to be arranged adjacent to or on the base surface, and/or adjacent to or on the cover surface, and/or adjacent to or on a second portion of the lateral surface of the base body. The at least one heat source can, for example, be arranged on or adjacent to the base surface of the base body, while the at least one luminous element is arranged at or adjacent to a first portion of the lateral surface of the base body. Alternatively or additionally, provision can be made for the at least one heat source to be arranged at or adjacent to a second portion of the lateral surface of the base body and therefore likewise separated from the at least one luminous element. Through the separation, the function of the at least one luminous element is not disturbed by the heat of the heat source, which is of particular importance if the at least one luminous element comprises at least one LED (light-emitting diode) and the heat source comprises a heating mat. If the heat source comprises at least one and preferably a plurality of IR-LED, these can be arranged in the same region as the at least one luminous element.

Provision can be made for the base body to be designed to be prismatic with a polygonal base surface.

Provision can be made for a diffuser layer to be arranged adjacent to the cover surface of the base body, or to be formed in the cover surface of the base body. This results in a more uniform delivery of light.

Provision can be made for the base body to be at least partially arranged in a frame. The frame preferably has a circumferential design. The frame can be made from a metal, for example aluminium. The frame provides a mechanical stabilization of the base body in which mechanical stresses arise due to the heat flowing through. In addition, the frame can be designed as a mounting surface for the device. Provision can be made for the at least one luminous element and/or IR-LED to be arranged in the frame (here the frame acts as a heat dissipation device for waste heat from the luminous element). The frame can be used for positioning of a control for the at least one luminous element and/or the at least one heat source. The frame can be used for positioning of electrical connections for powering the at least one luminous element and/or the at least one heat source and/or the controller or other power connections.

The device can be mounted by magnetic means. For example, at least one means made of a magnetizable material can be arranged on the device. On the surface on which the mounting should be carried out, at least one magnet can be arranged, for example by means of a spacer, which holds the device by contact with the means made of a magnetizable material. The arrangement of the magnet and the means made of a magnetizable material can of course be described in reverse to that above.

Provision can be made for the device for delivery of heat to be designed with a temperature of approximately 20°C to approximately 80°C. If appropriate, the user can select the temperature in steps or continuously.

A control can be provided for selecting the temperature of the at least one heat source and/or the colour and/or the intensity of the delivered light. The control can be accessed, for example, via a receiver, so that a wireless operation can be carried out by means of a transmitter (for example a smartphone or tablet).

Provision can be made for a heat insulating layer to be arranged adjacent to the base surface of the base body.

Provision can be made for the base body to be made from a plastic material, for example from PMMA (acrylic glass).

The scattering device can be created, for example, by lasering the base body.

Provision can be made for the scattering device to comprise a plurality of scattering centres, which are preferably arranged in a grid. A disordered arrangement can also be provided. The depth of the scattering centres (distance from the cover surface) can be different. Provision can be made for the concentration of the scattering centres in a central region of the base body to be greater than in an edge region of the base body. If the at least one heat source comprises at least one IR-LED, the radiation thereof can likewise be decoupled from the base body through the scattering device.

Provision can be made for a decorative layer to be arranged adjacent to or on the cover surface of the base body or, if appropriate, of the diffuser layer, preferably in the form of a printing and/or coating (e.g. thin wood panels) of the cover surface and/or diffuser layer.

Provision can be made for a heat-activatable substance, activatable through the heat of the heat source, for dispensing fragrances, to be arranged adjacent to or on the cover surface of the base body or, if appropriate, the diffuser layer.

The device can be designed, for example, with an area of the cover surface of approximately 0.15 m^2 to approximately 6 m^2.

Exemplary embodiments of the invention are illustrated in figures 1 to 3. The drawing shows:

figure 1a and 1b, perspective views of a device according to the invention;

figure 2, an exploded view of figure 1;

figure 3, a sectional view of figure 1;

figures 4a and 4b, an alternative design of the base body in cross-sectional view.

An exemplary embodiment of the device 1 according to the invention is illustrated in a view of the light-emitting front side (figure 1a) and/or the rear side (figure 1b), serving in this case as the mounting side. The circumferentially designed frame 5 and the cover surface 9 of the base body 2 can be seen here. The intrinsically present diffuser layer 14 is illustrated in figures 2 and 3. In this case, four (the number can vary) means 12 made of a magnetic material are arranged on the rear side. The attachment of the device 1 to a desired surface is achieved by means of magnets that are not shown. Apart from the frame 5, the rear side is formed by a heat insulating layer 7. As shown in figure 3, in addition a backplate 15 can be provided, on which the means 12 are then arranged and which is surrounded by the frame 5.

Figure 2 shows an exploded view of figures 1a and 1b, which illustrates the structure of this exemplary embodiment. For clarity, the frame 5 is not shown here. This exemplary embodiment provides a maximum version of the invention, in the sense that both a heat source 3 in the form of a heating mat (powered via electrical connections 13) as well as a heat source 3 in the form of two strips with IR-LED are provided. In this case, the light source 4 is designed as two strips with LED (optical LED). The strips with IR-LED and the strips with LED are arranged in a second portion 11 (IR-LED) or in a first portion 10 (optical LED) of the lateral surface of the base body 2. Different from the illustration, strips can also be used which carry both IR-LED as well as optical LED. The heat source 3 designed as a heating mat is arranged adjacent to the base surface 8 of the base body 2. A reflector layer 6 is arranged between the heating mat and the base surface 8 of the base body 2. It is also conceivable, alternatively or additionally, to assign the heating mats to the cover surface 9 of the base body 2, provided that these do not completely cover the cover surface 9. The electrical connections of the light source 4 and of the heat source 3 are not shown for reasons of clarity.

In this embodiment, a diffuser layer 14 is arranged on the cover surface 9.

Different from the illustration, at least those surfaces of the heating mat which are facing the base body 2 could be designed to reflect light. Known heating mats have a structure comprising a foil with a high graphite content, which is covered on both sides by a protective film. One or both protective films can be designed to reflect light. The arrangement of a separate reflector layer 6, in which a layer of air can be located between the heating mat and the reflector layer 6, can then be omitted, which can lead to an increase in the output temperature of 3-5°C for the same heat output.

Figure 3 shows a section through the device 1 in the region of the first portion 10 of the lateral surface, wherein, in particular, the frame 5 and the arrangement of the light element 4 in the frame 5 can be seen. The design in the region of the second portion 11 of the lateral surface can also be selected. The backplate 15 provided in this case can also be seen in figure 3.

The scattering device, which is located inside the base body 2, is not illustrated in figures 1 to 3.

For reasons of clarity, figure 4a shows the base body 2 in isolation. The scattering device arranged in the region of the base surface 8 of the base body 2 can be seen, which is designed here in the form of point-like depressions in the base body 2 introduced near the surface (which extend over the entire base surface 8 of the base body 2). A diffuser layer is

formed in the region of the cover surface 9 of the base body 2 (here in the form of two intersecting prismatic structures, resulting in an area of pyramids - see figure 4b), so that the arrangement of a separate diffuser layer 14 is not required. In general, a diffusing effect can result through a rough design of the cover surface 9 of the base body 2. In comparison to the arrangement of a separate diffuser layer 14, the design of the diffuser layer in the cover surface 9 of the base body 2 allows an improved output of heat radiation and light.

In the exemplary embodiment, the base body 2 is designed as a cuboid. Other designs are conceivable, such as prisms in general with a polygonal base surface 8, or with a curved lateral surface.

Different from the illustration, the illustrated layers and/or the base body 2 do not need to be flat.