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(54) **SKYLIGHT WITH IMPROVED THERMAL INSULATION**

DECKENLEUCHTE MIT VERBESSERTER WÄRMEDÄMMUNG

LANTERNEAU À ISOLATION THERMIQUE AMÉLIORÉE

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Description

Field of the Invention

[0001] The invention concerns skylights, especially roof skylights and light tubes where the light is carried in a tube from the input light collector to the building inside area, while the input light collector is placed on the roof as a rule, the inside of the light carrying tube is equipped with a layer providing the best possible reflection of the light and on the outside, at the place of the roof passage, it is adapted in order to allow its sealing against humidity, and as a rule, the tube is terminated with the diffuser inside the building.

Background of the invention

[0002] EP 1662 063 A2, US 2005/039410 A1, JP 2000 075 238 A and WO 2007/0385 90 A1 disclose skylights according to the state of the art.

[0003] At present, those skylights and light tubes used to carry light from the roof to areas within a building have been known where the entire structure of the tube with its inside surface equipped with good light reflection is always used as the base, and where various types of light collectors are placed at the input, usually dome-shaped, made of resistant plastic material, and where diffusers are usually placed at the output and are used for suitable light diffusion in the illuminated inside area of the building. Besides the best possible light-reflecting adaptation of the inside surface of the light tube, an effort has been developed to minimise light loss at the tube input and also output from the tube. As for heat loss, no special modifications to increase heat insulation are performed in the majority of present skylights and light tubes of the type described above; and only a thickened material layer at the input light collector or at the diffuser and/or a doubled layer is used sometimes. At the same time, as regards known light tubes of this type, roof passage is designed only using a regular sealing material that surrounds the roof entrance point, and/or a flange is created in the light tube part, which serves as the roof passage. Regarding the sealing of the light tube where it passes through the roof, those structures or seals are used, which are analogical e.g. to the sealing of smoke-stack passages or ventilation pipelines or air conduits. However, an increased risk of imperfect sealing against humidity on one hand and on the other, as regards heat loss, excessive heat loss in general or failure to comply with the standards in terms of heat loss, respectively, still remain as disadvantages. At the same time, for example, resolving this problem, especially the problem of heat loss, by choosing stronger or double walls both for the light collector at the tube input and for the diffuser at the light output from the tube, allows increased light absorption and moreover none of the positions of the thus chosen point of improving heat insulation provides optimal efficiency, namely for the following reasons. Improved heat insulation at the diffuser causes heat loss along the tube passage through the building, and improved heat insulation must be implemented along the whole tube in the building. In this variant, the relatively colder inside area of the tube moreover protrudes more into the building and thus increases the probability of vapour condensation on the lustrous, colder surface of the tube, which, however, worsens its light conduction characteristics significantly. When applying improved heat insulation at the light collector, a relatively higher portion of the tube with higher inside temperature is the result, which, although limiting the risk of vapour condensation in the tube, also causes higher heat loss because a part of the tube, for example, between the last heat insulated ceiling and the roof, passes through a relatively colder area.

Summary of the Invention

[0004] The aforementioned disadvantages are resolved substantially. The object of the present invention is solved by the technical features of claim 1. A lighting system with an optimized structure, both in terms of thermal insulation and thanks to its reliable sealing against humidity, is obtained with the skylight with improved thermal insulation in accordance with the presented invention where the light tube consists of its input part with the light collector and an upper tube, of the roof passage part, and of the lower tube with the diffuser, while the fundamental principle is that the roof passage part contains an insulation double glazing unit. The fact that the insulation double glazing unit is fixed directly into the collar made of foam insulation material is beneficial. As an alternative, it is beneficial if the insulation double glazing unit is fixed in the collar made of a foam insulation material including at least one plastic anchoring holder that embraces the double glazing unit perimeter and extends, with at least some of its parts, above and below the insulation double glazing unit, and projects laterally toward the perimeter of the collar made of the foam insulation material. As an advantage, the anchoring holder extends vertically up and down not more than up to 20 to 80 % of the distance in which the collar extends above and below the insulation double glazing unit, and in terms of the perimeter, not more than up to 25 to 75 % of the width of the collar made of the foam insulation material. Furthermore, it is beneficial for both these alternatives if the heat passage coefficient of the light collector at the light input into the upper light tube, and also the heat passage coefficient of the diffuser at the light output from the lower light tube, is lower than the heat passage coefficient of the insulation double glazing unit of the roof passage part of the light tube. In particular, providing sealing of the insulation double glazing unit in the collar against vapour passage between the lower tube and upper light tube is advantageous. This insulation double glazing unit has round shape in the ground plan, which is another advantage. And yet another advantage can be obtained if the collar has rectangular shape in the ground plan, and at the

same time, its thickness ranges between 10 and 30 cm.

[0005] This makes it possible to create a skylight and light tube where a high degree of thermal insulation is achieved, while at the same time, providing a guarantee of high resistance against vapour condensation on the inside surface of the light tubes. At the same time, insulation double glazing unit can be chosen to be based on glass with minimum light absorption, which is beneficial for high efficiency of light conduction; also, the shape of the double glazing unit is selected as planar, which is not at variance with the light function in this position, unlike the diffuser and particularly unlike the light collector where the convex shape is often opted for, which, especially with higher thickness of the material or with doubled walls, would be disadvantageous for light transmission. When building in a thus designed skylight and light tube in the roof and/or ceiling, it is advantageous that the essential thermal insulation element in the light tube, namely the insulation double glazing unit, is placed generally within the plane of the main thermal insulation of the ceiling part of the building, and also, its assembly can be easily connected in this thermal insulation plane to the collar mentioned above, which, in order to allow for such a connection, is equipped with an adapted shape of its perimeter and also its thickness that correspond to the usual span of ceiling or roof thermal insulations.

Brief Description of the Drawings

[0006] The presented invention is described further in more detail, and also explained using its preferred embodiment, and also using the drawings attached where Fig. 1 shows the general situation of the skylight and light tube in its vertical cross-section; Fig. 2 shows the ground plan of the roof passage part of the light tube with an indication of the cut point visible in Fig. 1; and finally, Fig. 3 shows the same roof passage part of the light tube, this time in the axonometric view.

Detailed Description of Preferred Embodiment

[0007] Skylight and light tube built in a flat-roofed building with is described and shown herein as sample embodiment. The light tube consists of its input part 1 with the light collector 11 and with the upper tube 12, of the roof passage part 2 and the lower tube 3 with the diffuser 31. An important fact is that the roof passage part 2 contains the insulation double glazing unit 21. This insulation double glazing unit 21 is fixed in the collar 22 made of the injected foam insulation material, where the glazing unit 21 being fixed in the collar 22 using the plastic anchoring holder 23 which embraces the perimeter of this insulation double glazing unit 21, and its anchoring projections not shown here in the detail, above and below the insulation double glazing unit 21, and at the same time, it projects laterally toward the perimeter of the collar 22 made of the foam insulation material. The anchoring holder 23 is extended vertically up and down to 50 % of the distance in which the collar 22 extends above and below the insulation double glazing unit 21, and in terms of the perimeter, it extends to 50 % of the width of the collar 22 made of the foam insulation material. The heat passage coefficient of the light collector 11 at the light input to the upper tube 21 of the light tube and the heat passage coefficient of the diffuser 31 at the light output from the lower tube 3 of the light tube is lower than the heat passage coefficient of the insulation double glazing unit 21 of the roof passage part 2 of the light tube. As regards the fixing in the foam polyurethane, it is reliably ensured that the insulation double glazing unit 21 is sealed in the collar 22 against vapour penetration between the lower tube 3 and the upper tube 12 of the light tube. In connection with the assumed stress of the seating of the double glazing unit 21 in the collar 22 and especially in connection with the requirements for the sleeve piece strength of the roof passage part 2 in relation to the fastening of the upper tube 12 and lower tube 3, lateral projection of the double glazing unit 21 into the collar 22 is dimensioned, and possibly the square or round ground plan shape of the double glazing unit 21 is also selected. The round shape is more complicated to produce, but in terms of material and weight savings and also in terms of undesirable lateral light dispersion, the round shape of the insulation double glazing unit 21, exceeding only minimally the inner diameter of the light tube, is more beneficial. The collar made of the foam insulation material shows the rectangular shape in the ground plan, or more specifically the square shape, and its thickness is chosen as 26 cm, which allows for good assembly connection to the surrounding thermal insulation of the roof including any beams or battens.

[0008] In general, the thus optimized structure of the skylight and light tube shows improved characteristics compared to the current state of the art, based on comparison of the heat passage coefficients as well as in respect of the distribution of temperatures, humidity values, and tendency for humidity condensation in individual parts of the light tube.

Industrial Applicability

[0009] A skylight and light tube designed in accordance with the presented invention can be used as built-in in constructions where it is desirable to bring daylight to areas where daylight illumination is insufficient or where it is not present at all due to technical reasons. At the same time, this device also provides general savings of heat energy or from the legislative point of view, respectively, this device is associated with better qualification for complying with the standards in the field of the defined maximum heat passage coefficients in buildings and their structural elements.

Claims

1. Skylight with improved thermal insulation, where a light tube consists of a input part (1) with a light collector (11) and an upper tube (12), of a roof passage part (2), and of a lower tube (3) with a diffuser (31), where the roof passage part (2) contains an insulation double glazing unit (21) which is fixed into a collar (22) made of foam insulation material, **characterized in that** the insulation double glazing unit (21) is fixed in the collar (22) made of a foam insulation material including at least one plastic anchoring holder (23) that embraces the double glazing unit (21) perimeter and extends, with at least some of its parts, above and below the Insulation double glazing unit (21), and projects laterally toward the perimeter of the collar (22) made of the foam insulation material, where the anchoring holder (23) extends vertically up and down not more than up to 20 to 80 % of the distance in which the collar (22) extends above and below the insulation double glazing unit (21), and in terms of the perimeter, not more than up to 25 to 75 % of the width of the collar (22) made of the foam insulation material.

2. Skylight according to claim 1, **characterized in that** the heat passage coefficient of the light collector (11) at the light input into the upper light tube (12), and also the heat passage coefficient of the diffuser (31) at the light output from the lower light tube (3), is lower than the heat passage coefficient of the Insulation double glazing unit (21) of the roof passage part (2) of the light tube, and simultaneously a sealing of the insulation double glazing (21) unit in the collar (22) against vapour passage between the lower tube (3) and upper light tube (12) is provided.

Patentansprüche

1. Deckenleuchte mit verbesserter Wärmeisolierung, wobei eine Lichtröhre aus einem Eingangsteil (1) mit einem Lichtkollektor (11) und einer oberen Röhre (12) eines Dachübergangsteils (2) besteht; und aus einer unteren Röhre (13) mit einem Diffusor (31), wobei das Dachübergangsteil (2) eine Isolier-Doppelverglasungseinheit (21) enthält, die in einem Kragen (22) befestigt ist, der aus Schaumstoff-Isoliermaterial hergestellt ist, **dadurch gekennzeichnet, dass** die Isolier-Doppelverglasungseinheit (21) in dem Kragen (22) befestigt ist, der aus Schaumstoff-Isoliermaterial hergestellt ist, das wenigstens einen Kunststoff-Ankerhalter (23) aufweist, der den Umfang der Isolier-Doppelverglasungseinheit (21) umschließt und sich, mit wenigstens einigen seiner Teile, über und unter der Isolier-Doppelverglasungseinheit (21) erstreckt und seitlich in Richtung des Umfangs des Kragens (22), der aus dem Schaumstoff-Isoliermaterial hergestellt ist, vorsteht, wobei sich der Ankerhalter (23) nicht mehr als 20 bis 80 % des Abstands, in dem sich der Kragen (22) über und unter der Isolier-Doppelverglasungseinheit (21) erstreckt, vertikal nach oben und nach unten erstreckt, und in Bezug auf den Umfang nicht mehr als bis zu 25 bis 75 % der Breite des Kragens (22), der aus dem Schaumstoff-Isoliermaterial hergestellt ist.

2. Deckenleuchte nach Anspruch 1, **dadurch gekennzeichnet, dass** der Wärmeübertragungskoeffizient des Lichtkollektors (11) am Lichteingang in die obere Lichtröhre (12) und auch der Wärmeübertragungskoeffizient des Diffusors (31) am Lichtausgang aus der unteren Lichtröhre (3) geringer ist als der Wärmeübertragungskoeffizient der Isolier-Doppelverglasungseinheit (21) des Dachübergangsteils (2) der Lichtröhre, und dass gleichzeitig eine Dichtung der Isolier-Doppelverglasungseinheit (21) in dem Kragen (22) gegenüber Dampfdurchtritt zwischen der unteren Röhre (3) und der oberen Lichtröhre (12) bereitgestellt ist.

Revendications

1. Lanterneau avec isolation thermique améliorée, où un tube à lumière est constitué d'une partie d'entrée (1) avec un collecteur de lumière (11) et un tube supérieur (12), d'une partie de passage de toit (2), et d'un tube inférieur (3) avec un diffuseur (31), où la partie de passage de toit (2) contient une unité à double vitrage d'isolation (21) qui est fixée dans un collier (22) fait de matériau d'isolation en mousse, **caractérisé en ce que** l'unité à double vitrage d'isolation (21) est fixée dans le collier (22) fait d'un matériau d'isolation en mousse comprenant au moins un support d'ancrage en plastique (23) qui épouse le périmètre de l'unité à double vitrage (21) et s'étend, avec au moins certaines de ses parties, au-dessus et en dessous de l'unité à double vitrage d'isolation (21), et fait saillie latéralement vers le périmètre du collier (22) fait du matériau d'isolation en mousse, où le support d'ancrage (23) ne s'étend verticalement vers le haut et vers le bas pas plus qu'un maximum de 20 à 80 de la distance sur laquelle le collier (22) s'étend au-dessus et en dessous de l'unité à double vitrage d'isolation (21), et, en ce qui concerne le périmètre, pas plus qu'un maximum de 25 à 75 % de la largeur du collier (22) fait du matériau d'isolation en mousse.

2. Lanterneau selon la revendication 1, **caractérisé en ce que** le coefficient de passage de chaleur du collecteur de lumière (11) à la lumière entrée dans le tube supérieur à lumière (12), et également le coefficient de passage de chaleur du diffuseur (31) à la lumière sortie du tube inférieur à lumière (3) est in-

férieur au coefficient de passage de chaleur de l'unité à double vitrage d'isolation (21) de la partie de passage de toit (2) du tube à lumière, et simultanément une étanchéité de l'unité à double vitrage d'isolation (21) dans le collier (22) contre le passage de vapeur entre le tube inférieur (3) et le tube supérieur à lumière (12) est prévue.

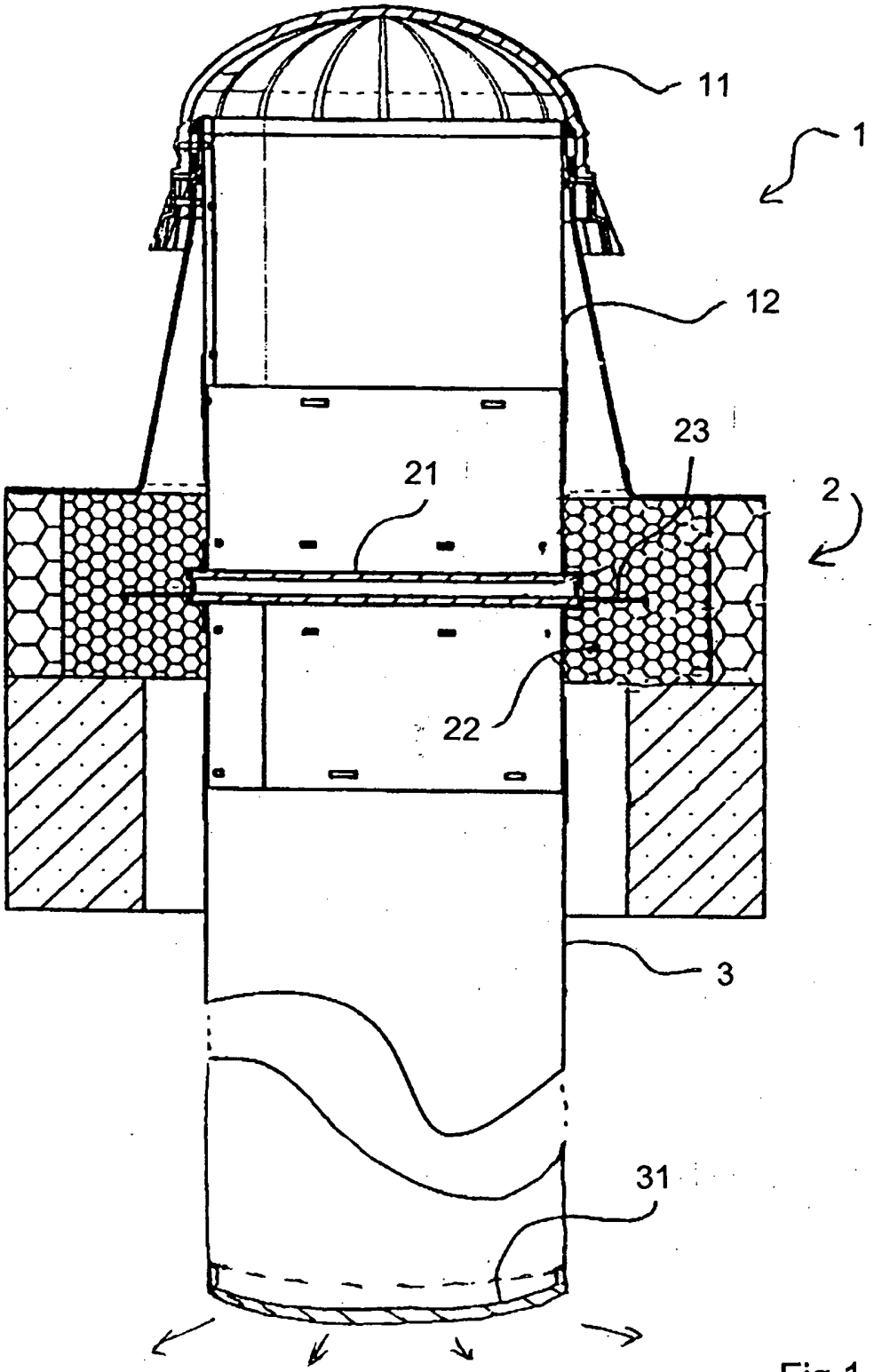

Fig.1

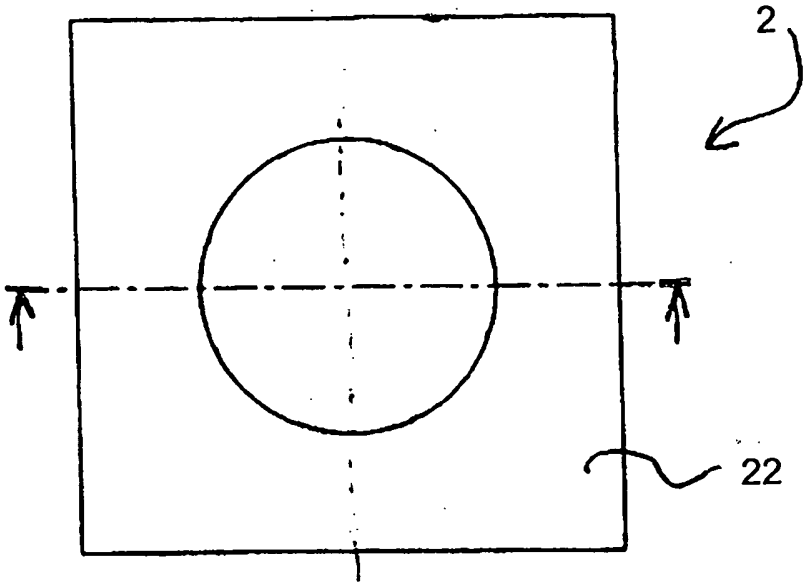

Fig.2

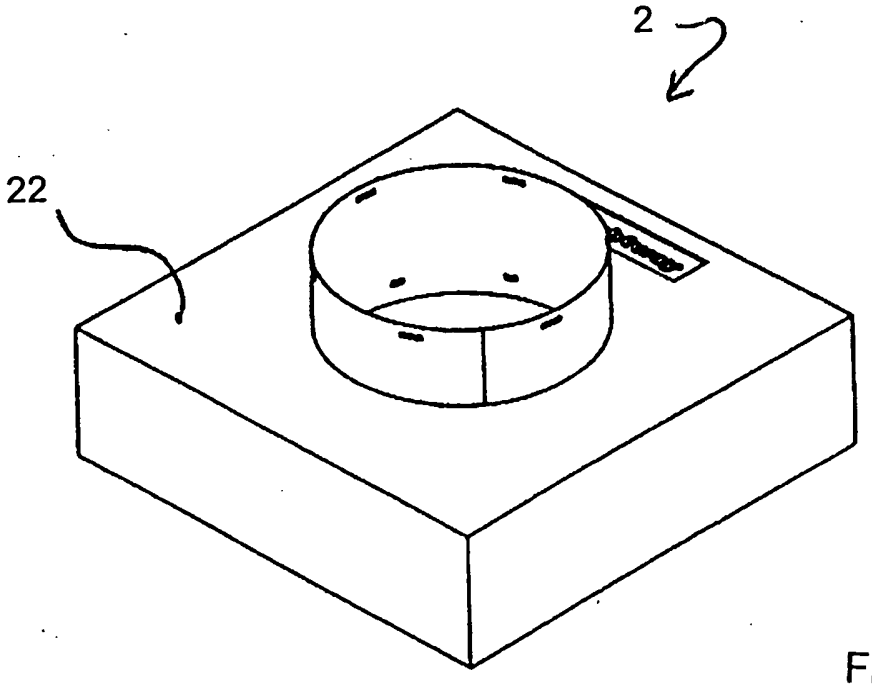

Fig.3

REFERENCES CITED IN THE DESCRIPTION

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TETŐABLAK JAVÍTOTT HŐSZIGETELÉSSEL

SZABADALMI IGÉNYPONTOK

1. Tetőablak (skylight) javított hőszigeteléssel, ahol egy fénycső (light tube) áll egy bemeneti részből (1) egy tető átjáró rész (passage part) (2) fénygyűjtőjével (light collector) (11) és felső csövével (12), és áll egy alsó csőből (3) egy diffúzorral (31), ahol a tető átjáró rész (2) tartalmaz egy szigetelő kettős üvegezési egységet (insulation double glazing unit) (21), amely rögzítve van egy hab szigetelő anyagból készült peremhez (collar) (22), **azzal jellemezve, hogy** a szigetelő kettős üvegezési egység (21) egy hab szigetelő anyagból készült peremhez (22) van rögzítve, amely magában foglal legalább egy műanyag lehorgonyzó tartót (anchoring holder) (23), amely körülöleli a kettős üvegezési egység (21) kerületét (perimeter), kiterjed (extend), legalább bizonyos részeivel, a szigetelő kettős üvegező egység (21) fölé és alá, és kinyúlik (projekt) oldalirányban (laterally) a hab szigetelő anyagból készült perem (22) kerülete irányában, ahol a lehorgonyzó tartó (23) függőlegesen kiterjed (extend) fel és le nem jobban, mint annak a távolságnak 20-80%-a, amelyben a perem (22) kiterjed (extend) a szigetelő kettős üvegező egység fölé és alá, és a kerület szempontjából nem jobban, mint a hab szigetelő anyagból készült perem (22) szélességének 25-75%-a.

2. Az 1. igénypont szerinti tetőablak, **azzal jellemezve, hogy** a fénygyűjtő (11) hőátbocsátási együtthatója (heat passage coefficient) a fénybemenetnél (light input) a felső fénycsőbe (12), és a diffúzor (31) hőátbocsátási együtthatója is a fénykimenetnél (light output) kisebb, mint a fénycső tető átjáró része (2) szigetelő kettős üvegező egységének (21) hőátbocsátási együtthatója, és együttal szolgáltatva van egy szigetelő kettős üvegező egység lezárása (sealing) is a peremhez (22) a páraáthatolással (vapour passage) szemben az alsó cső (3) és a felső fénycső (12) között.