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

(11) **EP 2 541 134 A2**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.01.2013 Bulletin 2013/01

(21) Application number: **12173619.3**

(22) Date of filing: **26.06.2012**

(51) Int Cl.:
F21V 5/00 *(2006.01)* ***F21S 8/08*** *(2006.01)*
F21W 111/00 *(2006.01)* *F21W 131/10* *(2006.01)*
F21Y 101/02 *(2006.01)* *F21Y 111/00* *(2006.01)*

(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: **30.06.2011 FI 20115695**

(71) Applicant: **Obelux Oy**
00380 Helsinki (FI)

(72) Inventor: **Puikkonen, Hannu**
00380 Helsinki (FI)

(74) Representative: **Hovi, Simo Pekka Tapani**
Seppo Laine Oy,
Itämerenkatu 3 B
00180 Helsinki (FI)

(54) Aviation obstacle light

(57) A LED-operated horizontally ominidirectional flight obstruction light, wherein at least two superimposed rings (3, 4) formed by individual lenses (6) are arranged so that the lenses (6) of at least one ring are arranged so that seen from the direction of the central axes (K_{Linssi}) of the rings (3, 4) are moved in the direction of a circumference drawn around the central axes in relation to the lenses of at least one other ring.

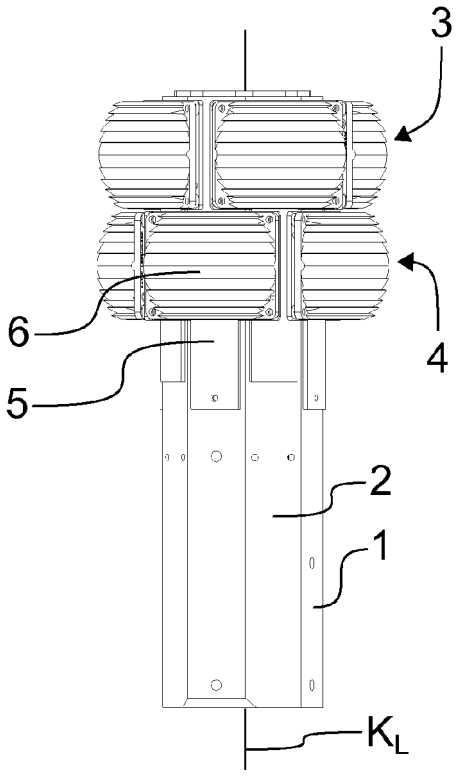

FIG. 1

EP 2 541 134 A2

Description

[0001] The present invention relates to a flight obstruction light with a light pattern extending horizontally omnidirectionally and working with LEDs.

[0002] Flight obstruction lights are lighting apparatuses attached to high buildings or the like for preventing aircraft from colliding with the structures. The lights increase the visibility of high structures and they are mainly used in the nighttime, but they are also used during the day, if necessary. Typically the lights are continuously-lit or blinking red lights or white blinking lights. The type, application, lighting, method, intensity and several other aspects are determined by national and international air traffic regulations, such as those by ICAO and FAA.

[0003] The advantages of LED lighting are long service intervals, good reliability and long service life. Thus they are especially well suited for use in places with difficult access either due to structural reasons or long distances.

[0004] WO 97/29320 discloses a flight obstruction light in which the light source is formed by LEDs located on e.g. superimposed printed circuit boards, on their circumference, so that a light with a light pattern extending horizontally omnidirectionally and emitting light into a light beam is formed. DE 3806217 discloses an LED light having a cylindrical tubular body, around which the LEDs are arranged in three layers with certain intervals around the body. In the solution disclosed in GB2350176 the LED light sources are arranged on a circular printed circuit board fastened in a flange-like way to the edge of the plate-like body pieces. There the light is emitted upwards from the LEDs and directed to the sides by means of lenses. The solution allows producing a modular structure in which a number of light units can be stacked above each other.

[0005] The light beams of flight obstruction lights must meet requirements of very precise regulations. Such requirements include, among others, the light power and the width of the beam. In a horizontally omnidirectional light the intensity of the light beam should be as even as possible along the whole circle lit by the light beam. In LED lights the widely emitted light of the light source is controlled by means of lenses. For example, a beam with a vertical extension of three degrees and having a good efficiency requires a large lens. The horizontal light distribution of e.g. a fresnel lens is about 120 degress.

[0006] Because the intensity of the light emitted from the lens is reduced towards the edges of the light, an area having a lower intensity is formed between two lenses. In order to produce an even light beam ring along the circumference of the circle, a number of lenses, such as eight lenses with 45 degree distances, must be installed on the circumference, whereby their light beams partly overlap. This allows producing a good and consistent omnidirectional ring of light, but the lenses form a large circle. Simultaneously the cost effectiveness, weight and ease of handling during installation are decreased.

[0007] Thus there is a need to provide an omnidirectional flight obstruction light that can be realized more cost-effectively than previously.

[0008] The purpose of this invention is to provide a mechanically smaller flight obstruction light by means of which it is possible to provide a sufficiently even omnidirectional light beam more cost-effectively than previously.

[0009] The invention is based on providing at least two rings one above the other consisting of individual lenses so that the lenses of at least one ring are moved in the direction of a circumference drawn around the central axes in relation to the lenses of the at least one other ring when seen from the direction of the central axes.

[0010] According to one advantageous embodiment of the invention the lenses are fastened to a body tube the amount of sides of which in the cross-section corresponds with the amount of lenses of two superimposed lens rings.

[0011] According to an advantageous embodiment the number of superimposed rings is two.

[0012] According to one advantageous embodiment the lenses are positioned so that when seen from the direction of the central axis the lenses od superimposed rings are alternating evenly.

[0013] Further according to an advantageous embodiment the number of superimposed rings is two with both having four lenses.

[0014] According to an embodiment the lens rings are concentric and of similar dimension.

[0015] According to an especially advantageous embodiment the light source is formed by attaching at least one LED to a printed circuit board and by attaching a lens to this printed circuit board.

[0016] More specifically, the arrangement according to the invention is characterized by what is disclosed in the characterizing parts of the independent claim.

[0017] The preferred embodiments of the invention are defined in more detail in the dependent claims.

[0018] Considerable advantages are achieved by means of the invention.

[0019] The invention allows producing an even circular ring or beam of light with a small outer diameter of the lighting apparatus. When compared with known solutions the diameter needed by the flight obstruction light can be reduced by 30 to 50 %, even to a half, which has a dramatic effect on weight, costs and installability. The price of the lighting apparatus is, naturally, a competitive advantage, but as these apparatuses are typically installed in high places with difficult access, the weight and size of the light has a great effect on the installation work. It will always be advantageous if heavy lifting and fastening means are not required and it is also easier in other ways to handle less heavy apparatuses.

[0020] In the following, the invention is disclosed in more detail by means of reference to the appended drawings.

Figures 1 to 4 illustrate one embodiment of the in-

vention in different positions.

Figures 5 yo 8 illustrate the embodiment of figures 1 to 4 with the lenses removed.

[0021] In the example of the figures 4+4 lenses are arranged on a polygonal body 1 to form two rings 3, 4 one above the other. The center axis K_{Linssi} of each lens is between the central axes K_{Linssi} of the the two lenses above or below it, whereby the so-called optical central axes of the lenses are in an angle of 45 degrees seen from the direction of the central axis Kv of the lighting apparatus. Thereby the center of the wedge-like light beam of each lens will be located between two lenses above or below it and it will light the area between them. The beams of the superimposed lens rings 3, 4 will slightly overlap at their edges. The shape of the beam of light formed by the lens naturally depends on the structure and execution of the lens. Here, the optical center axis means the axis of the beam of light on both sides of which the beam of light is as symmetrical as possible. In the structures according to the invention it is advantageous to try to achieve symmetricity and similarity between the lenses. Thereby the structure and costs can be be kept advantageous. There are no reasons as such for not using asymmetrical structures as long as the superimposed lenses are arranged staggered in relation to each other so that the area between the lenses of the first ring is lit with the lenses of the second ring. It is also possible to consider having three, four or more lenses staggered with each other according to the necessary lenses. Thereby the staggering can be made incrementally with small steps or in pairs as in the shown example. The most even light distribution so far has been produced by two superimposed rings having four lenses in each ring. Other advantageous alternatives are 2+2, 3+3 and 5+5 lenses, but as such nothing prevents using other alternatives as well and even a totally different amount of lenses above each other in the different rings. Thereby, however, it might be necessary to use a fairly large number of lenses to provide an even lighting. The lens rings 3, 4 can also have different diameters.

[0022] The invention utilizes the previous hollow body structure of the applicant. Therein the sides of the body comprise flat surfaces 2 forming fastening surfaces 5, 6, 9 for the printed circuit boards 6. An octagonal body 1 is needed for a flight obstruction light having 4+4 lenses. Preferably in connection with the invention an earlier body structure of the applicant is used, wherein there is a longitudinal cooling channel 7 in the middle of the body 1. The inner surface of the cooling channel can be provided with fins 8 for improving heat transfer.

[0023] The lenses and the LEds or other similar semiconductor light sources form a light sector having a certain lighting angle opening in the horizontal direction. For example, with a fresnel lens the lighting angle is about 120° in the horizontal direction. The shape and dimensioning of the lens determines its beam in the vertical direction and it usually opens 3°. The lenses are assembled so as to be supported by the printed circuit board 5. In this example the printed circuit board 5 is T-shaped, wherein the crossbeam forms a fastening surface for the LED components 9 as well as for the lens 6. The LED is located in the center of the T-beam and the lens surrounds it symmetrically. As the size of the lens in horizontal direction is determined by the lighting power and the structure of the lighting sector, the width of the T-beam of the printed circuit board is determined by the width of the lens and it also determines the horizontal extension of the printed circuit board. The vertical portion 11 of the T-piece is mainly for attachment to the body 12 of the printed circuit board. As can be seen in figures 5 to 8, the vertical portions 11 of the upper printed circuit boards extend downwards along the body between the T-beams. Correspondingly, the outer ends of the T-beam extend over the length of each side surface 2 on the sides of the body 1. This allows forming a very compact structure in which each lens ring 3, 4 forms a square. In order to form an omnidirectional light ring the second lens ring is positioned below the first one so that its printed circuit boards and light sectors are fastened to the surfaces 2 between the surfaces 2 of the body 1 to which the printed circuit boards of the first lens ring are fastened.

[0024] The structure works in a corresponding way with other cross-sections and number of lenses as well. This solution uses only one LED but more LEDs can as well be used. Preferably the LEDs can be located horizontally side by side on the printed circuit board, whereby even a small-sized lens can provide a large lighting power by using up to five LED light sources. The desired lighting power can be changed by using a different number of LEDs or different types of LEds in different sectors. The lens structure can be varied from the above description within the invention. A transparent protective cover is provided around the lenses and other structures to protect them.

[0025] The power supply, control and other structures of the flight obstruction light are not described in more detail here as they do not form a part of the invention.

Claims

1. A flight obstruction light, comprising,

- a body (1) having sides (2) forming attachment surfaces
- light sectors attached to the body and comprising:
- at least one LED (9) and at least one lens (6) for directing the light,

characterized in that the flight obstruction light comprises at least two light sectors arranged one above the other in vertical direction, the sectors being arranged so that the total number of sectors is at least four and the lens of each light

sector is wider than the side (2) of the body (1).

2. A flight obstruction light according to claim 1, **characterized in that** at least one LED is located under one lens and that a different amount of LEDs can be provided under one lens in different layers or different light sectors.

3. A flight obstruction light according to claim 1, **characterized in that** the lenses (6) and the LEDs (9) are attached to a printed circuit board (5), the extension of which in the horizontal direction of the lens (6) corresponds with the width of the lens (6) and is larger than the attachment side of the body (1).

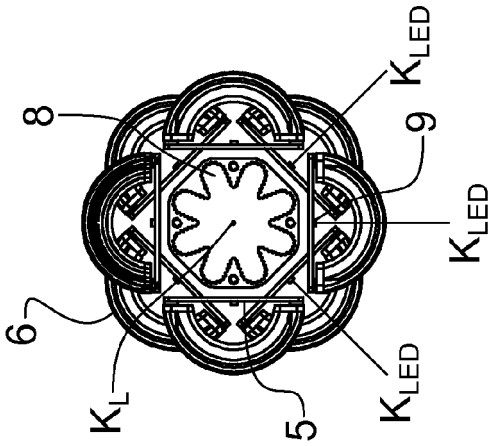

FIG. 4

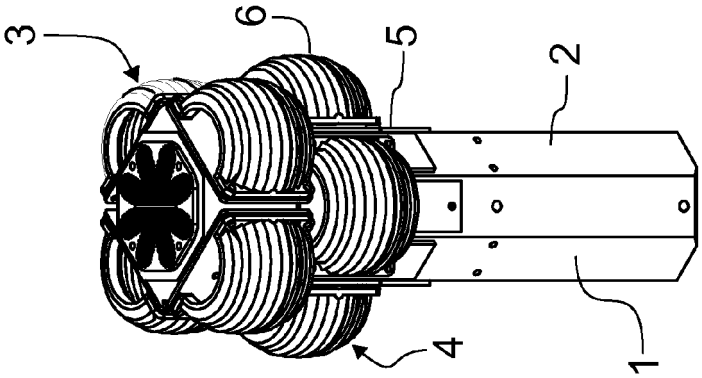

FIG. 3

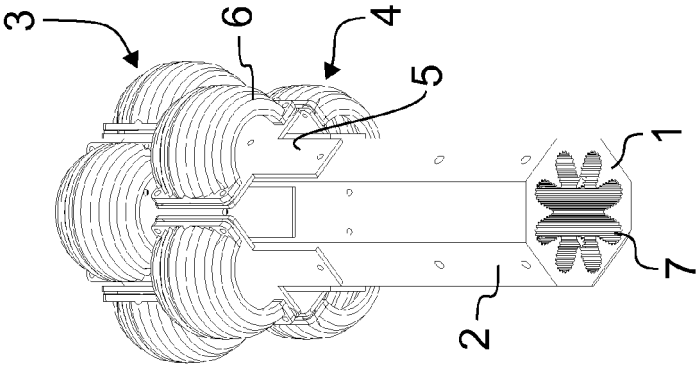

FIG. 2

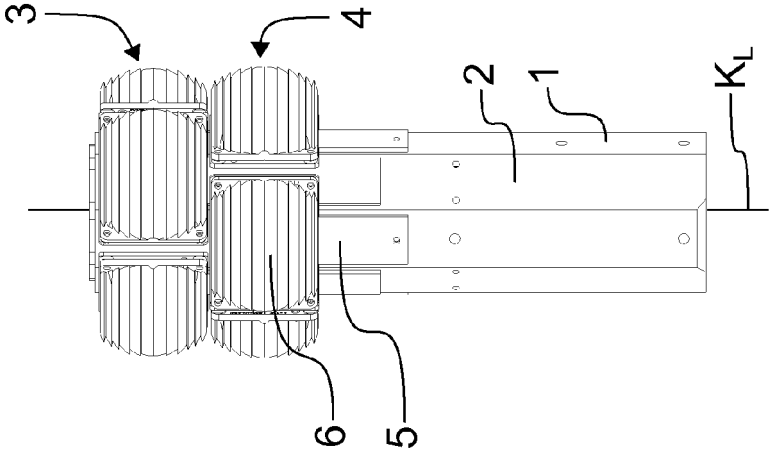

FIG. 1

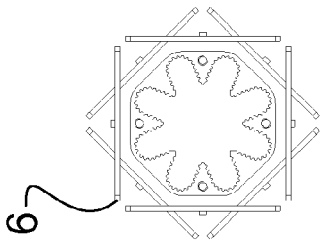

FIG. 8

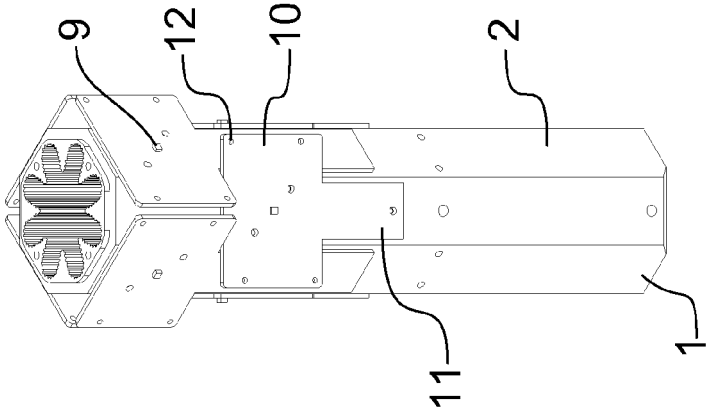

FIG. 7

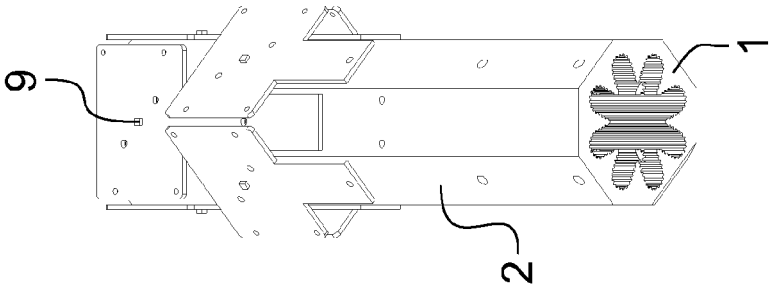

FIG. 6

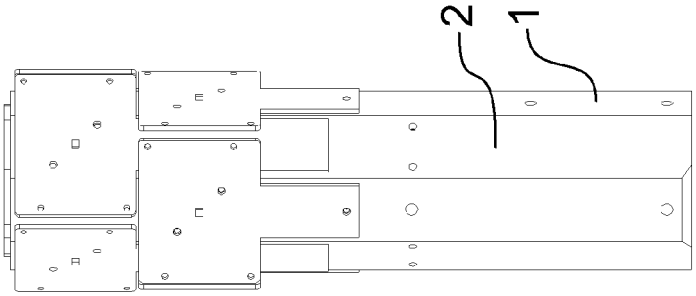

FIG. 5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 9729320 A **[0004]**
- DE 3806217 **[0004]**
- GB 2350176 A **[0004]**