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(54) **LIGHTING MODULE FOR AN AUTOMOTIVE HEADLAMP**

(57) The invention provides a lighting module (1) for an automotive headlamp, the lighting module comprising a first-type primary optical element (2) projecting a primary low beam from a low beam light source (21), a second-type primary optical element (3), projecting a primary side beam from a side beam light source (31), a diaphragm element (4) and a main optical element (5). The main optical element (5) is suitable for receiving the primary side beam and projecting a side beam pattern, and

suitable for receiving a part of the primary low beam which has not been reflected by the diaphragm element (4) and projecting a low beam pattern, wherein primary low beam rays corresponding to the front edge (41) are projected as a cut-off line of the low beam pattern. The first-type primary optical element (2), the second-type primary optical element (3), the diaphragm element (4) and the main optical element (5) are integral to each other, thereby forming the lighting module (1).

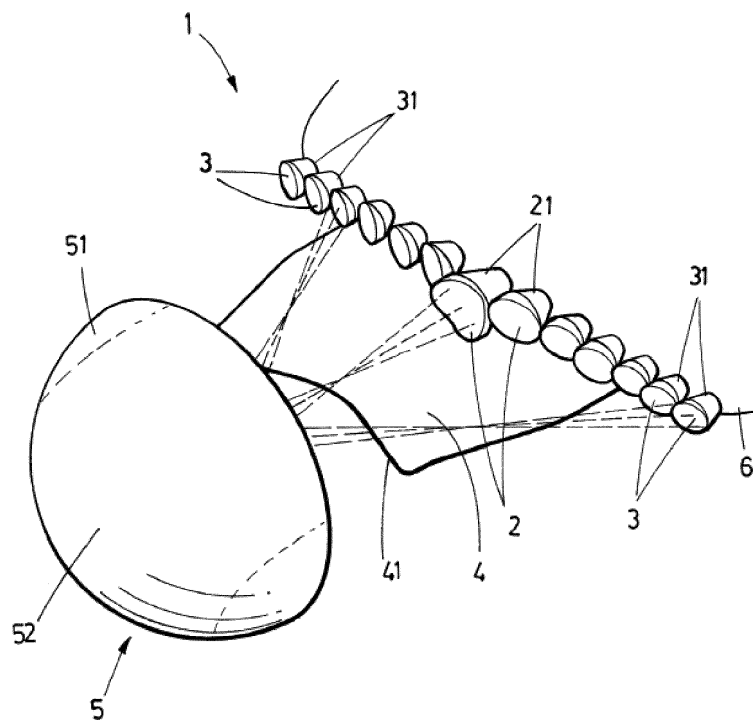


FIG.1

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Description

TECHNICAL FIELD

[0001] The present invention belongs to the field of lamps for automotive vehicles, and more specifically, to the lamps using laser diodes as a light source.

STATE OF THE ART

[0002] Light emitting diodes (LEDs) and laser diodes have been intended to provide lighting functions in automotive headlamps since several years ago.

[0003] Due to the increasing number of lighting functionalities (low beam, high beam, anti-glaring functionalities, turn indicators, DRL, cornering light...), there is a wide range of possibilities of combining light sources in order to achieve the optimal result. Further, car manufacturers also request that these devices reduce their size, so an increasing number of functionalities is requested in a reduced size.

[0004] The internal arrangement of light sources and their circuitry, together with the optical elements intended to project the final light beam is a problem which needs to be solved.

DESCRIPTION OF THE INVENTION

[0005] The invention provides a solution for this problem in a lighting module for an automotive headlamp according to claim 1. Preferred embodiments of the invention are defined in dependent claims.

[0006] In an inventive aspect, the invention provides a lighting module for an automotive headlamp, the lighting module comprising

a first-type primary optical element;
 at least a low beam light source, adapted for emitting a low beam, the low beam light source being oriented so that at least part of the low beam is directed to the first-type primary optical element, so that the first-type primary optical element is intended to project a primary low beam;
 a second-type primary optical element, different from the first type of optical elements;
 at least a side beam light source, adapted for emitting a side beam, the side beam light source being oriented so that at least part of the side beam is directed to the second-type primary optical element, so that the second-type primary optical element is intended to project a primary side beam laterally beyond the primary low beam;
 a diaphragm element with a front edge, the diaphragm element being arranged for receiving at least part of the primary low beam, in such a way that when the primary low beam is projected by the first-type primary optical element, part of the primary low beam is reflected by the diaphragm element;

a main optical element, suitable for receiving the primary side beam and projecting a side beam pattern, and suitable for receiving a part of the primary low beam which has not been reflected by the diaphragm element and projecting a low beam pattern, wherein primary low beam rays corresponding to the front edge are projected as a cut-off line of the low beam pattern,

10 wherein the first-type primary optical element, the second-type primary optical element, the diaphragm element and the main optical element are integral to each other, thereby forming the lighting module.

[0007] The person skilled in the art would understand that, since the low and side beams are standard concepts, the term "laterally beyond" refers to the direction from the low beam light source to the side beam light source, substantially perpendicular to the direction where the primary low beam is projected.

20 **[0008]** The primary low beam rays corresponding to the front edge must be construed as the primary low beam rays resulting from a limit angle of projection of the low beam light source below which the primary low beam is reflected by the diaphragm element.

25 **[0009]** The diaphragm element does not need to be an opaque element, but just adapted for reflecting at least part of the secondary low beam (such as a transparent element intended for reflecting light by total internal reflection).

30 **[0010]** This lighting module provides a way of incorporating cornering light functionalities into a single lighting module. A compact lighting module according to the invention provides low beam and cornering light, i.e., side beam, projected by the same main optical element.

35 **[0011]** In some particular embodiments, the main optical element comprises a first portion suitable for receiving the primary side beam and projecting the side beam pattern, and a second portion suitable for receiving the part of the primary low beam which has not been reflected by the diaphragm element and projecting the low beam pattern.

40 **[0012]** The main optical element of these embodiments is therefore optimized to perform these two functions: low beam and side beam. However, there is no need of separate optical elements, but these two functions may be carried out by a single part.

[0013] In some particular embodiments, the main optical element is an outer lens.

45 **[0014]** The outer lens of an automotive lighting device may perform this function, in such a way that no more additional parts are needed.

50 **[0015]** In some particular embodiments, the second-type primary optical element is suitable for providing cornering light functions, all-weather light or fixed bending light functions.

55 **[0016]** These types of light functions are useful in current automotive vehicles, and all of them may be performed in a lighting device according to the invention.

[0017] In some particular embodiments, the second-type primary optical element are located at both sides of the first-type primary optical element.

[0018] This location is optimal for optical elements intended to project a side beam, since this projected side beam reaches the main optical element in an angle which is suitable for being projected as a side beam pattern.

[0019] In some particular embodiments, the lighting module further comprises a main heat sink, intended to dissipate heat from the low beam and side beam light sources.

[0020] A main heat sink helps to improve the global heat dissipation of the module, since current light sources have severe restrictions regarding heat dissipation and operation conditions.

[0021] In some particular embodiments, at least one of the first-type primary optical element and second-type primary optical element is a collimator.

[0022] A collimator provides an optimal optical behaviour for this application. The collimator is able to transform the divergent beams of light coming from a unique light source into a parallel distribution of light beams.

[0023] In some particular embodiments, the diaphragm element is an opaque folder. Alternatively, the diaphragm element is an element having a transparent surface, such as light guide, the transparent surface playing the role of diaphragm falling back on the principle of total internal reflection.

[0024] Another inventive aspect of this invention provides an automotive headlamp comprising a lighting module according to the previous inventive aspect.

[0025] In some particular embodiments, the automotive lighting device further comprises a housing accommodating the lighting module and auxiliary systems.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

Figure 1 shows a top view of a particular embodiment of an automotive lighting module according to the invention.

Figure 2 shows an automotive headlamp comprising the lighting module described in the previous figure.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Figure 1 shows a top view of a particular embodiment of an automotive lighting module according to the invention, as seen from above.

[0028] This lighting module 1 comprises first-type primary optical elements 2 and second-type primary optical elements 3, different from the first-type primary optical elements 2.

5 [0029] This lighting device 1 further comprises low beam light sources 21 and side beam light sources 31. Each low beam light source 21 is adapted for emitting a low beam, and is oriented so that at least part of the low beam is directed to one of the first-type primary optical elements 2, so that the first-type primary optical elements 2 are intended to project a primary low beam. Each side beam light source 31 is adapted for emitting a side beam, and is oriented so that at least part of the side beam is directed to one of the second-type primary optical elements 3, so that the second-type primary optical elements 3 are intended to project a primary side beam.

10 [0030] This lighting device 1 also comprises a diaphragm element 4 with a front edge 41. The diaphragm element 4 is arranged for receiving the primary low beams, in such a way that when the primary low beams are projected by the first-type primary optical element 2, part of the primary low beams are reflected by the diaphragm element 4.

15 [0031] The lighting device 1 also comprises a main optical element 5, suitable for receiving the primary side beam and projecting a side beam pattern, and suitable for receiving a part of the primary low beam which has not been reflected by the diaphragm element 4 and projecting a low beam pattern, wherein primary low beam rays corresponding to the front edge 41 are projected as a cut-off line of the low beam pattern.

20 [0032] As a consequence, in the output of the main optical element 5, a combined beam is projected, some of this combined beam coming from the low beam light sources 21 and the rest of the combined beam coming from the side beam light sources 31.

25 [0033] The first-type primary optical element 2, the second-type primary optical element 3, the diaphragm element 4 and the main optical element 5 are integral to each other. This means that these elements are portions of a single part, which is manufactured taking into account the relative distances between each element, and the tolerances that must be fulfilled in order to obtain a valid product.

30 [0034] In this particular embodiment, the main optical element 5 comprises a first portion 51 suitable for receiving the primary side beam and projecting a side beam pattern, and a second portion 52 suitable for receiving the part of the primary low beam which has not been reflected by the diaphragm element 4 and projecting a low beam pattern.

35 [0035] As the legal regulations governing the light output of side beams and low beams is different, the main optical element 5, which is common for both beams, comprises two different portions in order to adapt to the particular shapes of said final beams.

40 [0036] In the particular embodiment shown in this figure, the main optical element 5 is an outer lens.

[0037] The second-type primary optical element 3 is suitable for providing cornering light functions, all-weather light or fixed bending light functions. In this case, the position laterally beyond the first-type primary optical elements 2, at their both sides, is more suitable for cornering light functions, but different positions would be relative for different functionalities, all of them within the scope of the present invention.

[0038] A main heat sink 6 is in charge of the dissipation of heat coming from the low beam and side beam light sources. This heat sink 6 contains a radiator to evacuate the heat which is dissipated from the light sources into the ambient air.

[0039] Regarding the first-type primary optical element 2 and the second-type primary optical element 3, a group of collimators may perform this function in a suitable manner. However, other optical elements, which may be more adapted to different types of light sources or to different lighting functionalities, should also be considered as within the scope of this invention.

[0040] Figure 2 shows an automotive headlamp 10 comprising the lighting module 1 described in the previous figure.

[0041] Such an automotive headlamp 10 may be installed in an automotive vehicle and perform the required functionalities in a usually smaller size than the automotive headlamps 10 which comprises separate modules for low beam and side beam. Further, the final light beam projected by the outer lens 5 and limited by the diaphragm element 4 is more accurately defined, since the relative positions between the different light sources are defined by the shape of the module, without being influenced by any assembly process.

Claims

1. A lighting module (1) for an automotive headlamp, the lighting module comprising
 a first-type primary optical element (2);
 at least a low beam light source (21), adapted for emitting a low beam, the low beam light source (21) being oriented so that at least part of the low beam is directed to the first-type primary optical element (2), so that the first-type primary optical element (2) is intended to project a primary low beam;
 a second-type primary optical element (3), different from the first-type primary optical element (2);
 at least a side beam light source (31), adapted for emitting a side beam, the side beam light source (31) being oriented so that at least part of the side beam is directed to the second-type primary optical element (3), so that the second-type primary optical element (3) is intended to project a primary side beam laterally beyond the primary low beam;
 a diaphragm element (4) with a front edge (41), the diaphragm element (4) being arranged for receiving at least part of the primary low beam, in such a way

that when the primary low beam is projected by the first-type primary optical element (2), part of the primary low beam is reflected by the diaphragm element (4);

a main optical element (5), suitable for receiving the primary side beam and projecting a side beam pattern, and suitable for receiving a part of the primary low beam which has not been reflected by the diaphragm element (4) and projecting a low beam pattern, wherein primary low beam rays corresponding to the front edge (41) are projected as a cut-off line of the low beam pattern,
 wherein the first-type primary optical element (2), the low beam light source (21), the second-type primary optical element (3), the side beam light source (31), the diaphragm element (4) and the main optical element (5) are integral to each other, thereby forming the lighting module (1).

2. A lighting module according to claim 1, wherein the main optical element comprises a first portion suitable for receiving the primary side beam and projecting the side beam pattern, and a second portion suitable for receiving the part of the primary low beam which has not been reflected by the diaphragm element (4) and projecting the low beam pattern.
3. A lighting module according to any of the preceding claims, wherein the main optical element (5) is an outer lens.
4. A lighting module according to any of the preceding claims, wherein the second-type primary optical element (3) is suitable for providing cornering light functions, all-weather light or fixed bending light functions.
5. A lighting module according to any of the preceding claims, wherein the second-type primary optical element (3) are located at both sides of the first-type primary optical element (2).
6. A lighting module according to any of the preceding claims, further comprising a main heat sink (6), intended to dissipate heat from the low beam and side beam light sources.
7. A lighting module according to any of the preceding claims, wherein at least one of the first-type primary optical element (2) and second-type primary optical element (3) is a collimator.
8. A lighting module according to any of the preceding claims, wherein the diaphragm element (4) is an opaque folder or an optical element having a transparent surface.
9. An automotive headlamp (10) comprising a lighting

module (1) according to any of the preceding claims.

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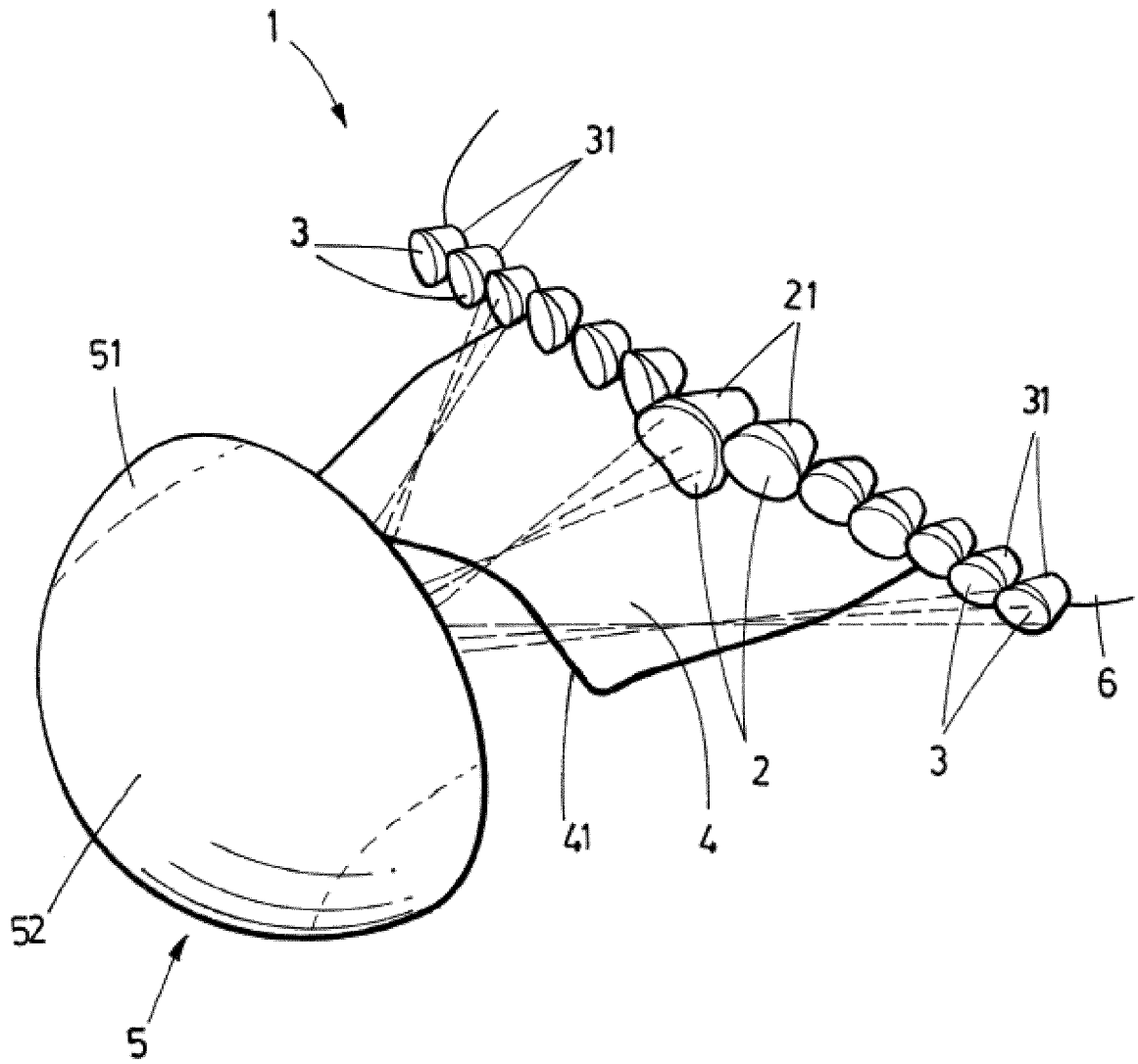


FIG.1

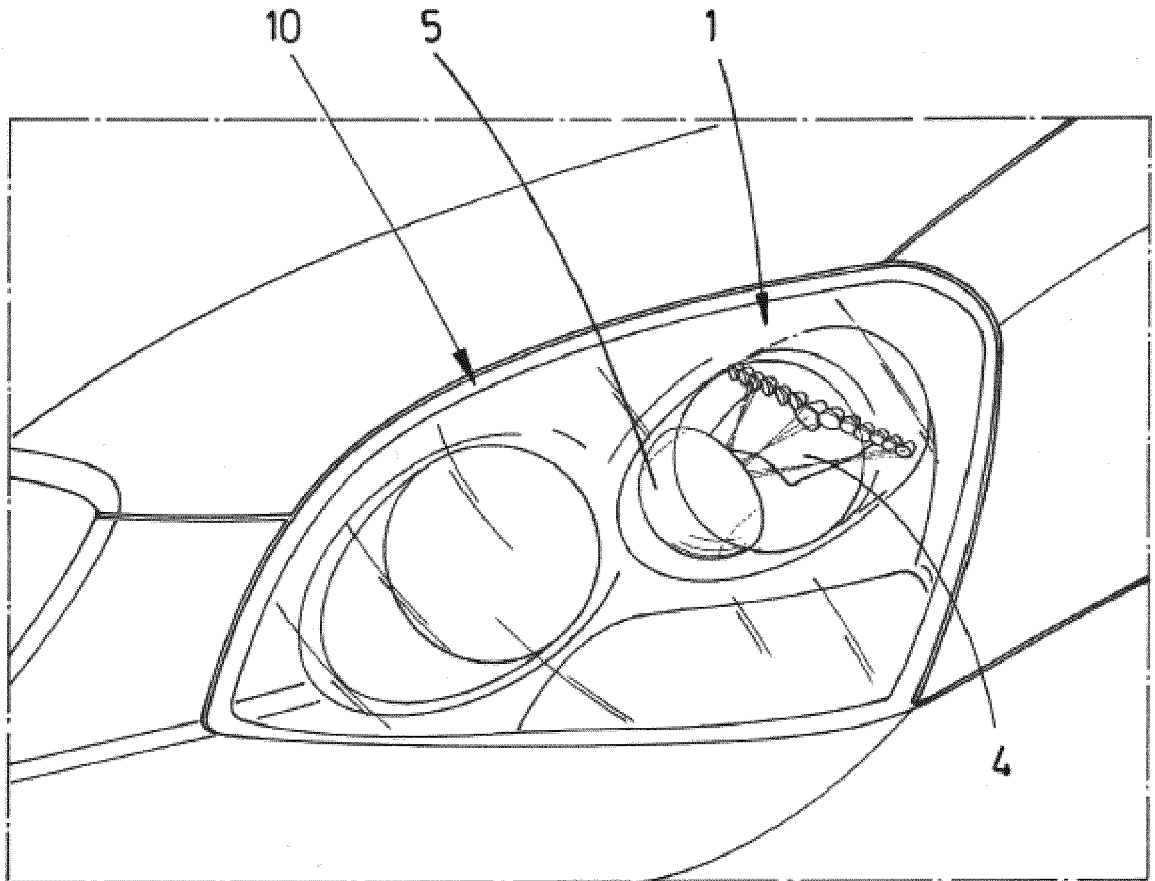


FIG. 2



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Application Number
EP 17 38 2347

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