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(54) VEHICLE LAMP OPTICAL UNIT, VEHICLE LAMP MODULE, AND VEHICLE

(57) Provided are a vehicle lamp optical unit, vehicle lamp module, and vehicle. The vehicle lamp optical unit comprises a first optical element (1), the rear end face and front end face of the first optical element (1) are, in the direction of light emission, a light incident structure reference plane (11) and a first light-emitting surface (12) respectively; the rear end of the first optical element (1) is formed as a light incident part, the light incident part compises at least one first light incident structure arranged along the left-right direction of the light incident structure reference face (11), and a first light passage (13) is formed between the light incident part and the first light-emitting surface (12); the first light incident structure is arranged to extend from the upper side or the lower side of the reference face (11) of the light incident structure to the first light passage (13), each first light incident structures guides the light received by the first light incident structure to exit toward the first light passage (13) and be transmitted to the first light exit face (12) along the first light passage (13). The vehicle lamp optical unit improves the visual effect of vehicle lamp lighting, satisfying the requirements of multiple lighting modes and illumination modes.

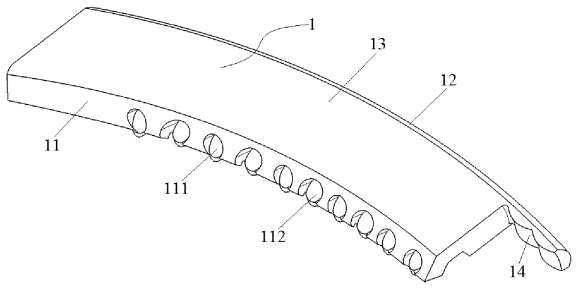

FIG. 1

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Description

Cross-reference to Related Applications

[0001] The present disclosure claims the benefit of Chinese patent application No. 202010634007.4 filed on July 2, 2020, the contents of which are incorporated herein by reference.

Technical Field

[0002] The present disclosure relates to a vehicle illumination device, and particularly to a vehicle lamp optical unit. In addition, it further relates to a vehicle lamp module und a vehicle.

Background Art

[0003] With the rapid development of the automobile industry and the continuous improvement of people's living conditions, automobiles have become one of the indispensable means of transportation for people to travel. The global retain number of automobiles is increasing year by year, and the popularity of automobiles has also driven the rapid development of the manufacture and design of automobile parts. For example, the role of automobile lamps is not only limited to illumination function, and the appearance modeling thereof and specific lighting effect modes for turning on or turning off vehicle lamps have begun to be pursued by consumers.

[0004] With the diversification of vehicle lamp modeling and illumination modes, it is required to provide a vehicle illumination device with a plurality of vehicle illumination units, such as low beam, high beam, and daytime running lamps, and position lamps, respective vehicle illumination units are usually arranged independently from each other and dispersedly, and it is required to provide each vehicle illumination unit separately with corresponding light incident portion and light emergent portion, so as to produce multiple illumination areas or illumination effects. However, the dispersed and independent arrangement of multiple vehicle illumination units not only leads to great space occupation of the entire vehicle illumination device and increases the volume of the vehicle lamp, but also increases positioning and installation errors between respective parts and affects the accuracy of the optical system. In addition, the light source of a vehicle illumination unit is usually arranged in the rear of the light incident portion thereof, and a light spot would be formed when the vehicle lamp is turned on, which affects the appearance effect of the vehicle lamp when it is turned on.

[0005] Therefore, it is required to design a novel vehicle lamp optical unit to overcome or alleviate the above shortcomings of the prior art.

Summary

[0006] A technical problem firstly to be solved by the present disclosure is to provide a vehicle lamp optical unit, which can improve the appearance visual effect obtained by a lightened vehicle lamp and meet requirements for various vehicle lamp illumination modes and lightening modes.

[0007] A technical problem to be solved by a second aspect of the present disclosure is to provide a vehicle lamp module, which can improve the appearance visual effect and meet requirements for various vehicle lamp illumination modes and lightening modes.

[0008] A technical problem to be solved by a third aspect of the present disclosure is to provide a vehicle, of which the vehicle lamp illumination modes and the lightening modes are diversified and have good illumination effects.

[0009] In order to achieve the above-mentioned objects, a first aspect of the present disclosure provides a vehicle lamp optical unit, comprising a first optical element, wherein the rear end face and the front end face of the first optical element along a light emergent direction are respectively a light incident structure reference plane (light incident structure reference face) and a first light emergent surface (first light-emitting face), the rear end of the first optical element is formed as a light incident portion (light incident part), the light incident portion comprises at least one first light incident structure provided along the left-right direction of the light incident structure reference plane, and a first light passageway is formed between the light incident portion and the first light emergent surface; wherein the first light incident structure is configured to extend from the upper side or the lower side of the light incident structure reference plane to the first light passageway, each of the first light incident structures is capable of guiding light received by the first light incident structure to exit towards the first light passageway and be transmitted to the first light emergent surface along the first light passageway.

[0010] As a preferred structural form, each of the first light incident structures respectively comprises a collimator located on the upper side or the lower side of the light incident structure reference plane and a light guide portion in connection with the collimator; the light guide portion extends from the light emergent end of the collimator to the rear end of the first light passage; a reflecting portion is provided on the light guide portion; and the reflecting portion is capable of reflecting the emergent light of the collimator to a direction towards the first light passage for emergence.

[0011] Preferably, a recess structure corresponding to the light guide portion is respectively provided at a connection between the first light passage and each of the light guide portions, and each of the recess structures respectively comprises a light guide portion connection surface in connection with the light guide portion corresponding to the recess structure, an intermediate con-

nection surface in connection with the light guide portion connection surface, and an light passage connection surface in connection with the intermediate connection surface, wherein a first cut-off portion forming a first light shape cut-off line is provided at the connection between the intermediate connection surface and the light passage connection surface.

[0012] More preferably, the first light emergent surface is a curved surface protruding forwards, the first cut-off portion is located on the median surface of the first light emergent surface, and the median surface is a horizontal plane passing through the vertex of a longitudinal transversal of the first light emergent surface.

[0013] Specifically, the first light emergent surface is a curvature continuous curved surface.

[0014] Typically, a light guide is provided in the recess structure, and the light emergent surface of the light guide faces the light passage connection surface, such that light emerging from the light emergent surface of the light guide are transmitted to the first light emergent surface via the first light passage.

[0015] As another preferred structural form, the at least one first light incident structure is configured to have at least one low-beam first light incident structure, or have at least one high-beam first light incident structure, or have at least one of the low-beam first light incident structure and at least one of the high-beam first light incident structure.

[0016] Preferably, the projection plane shapes of the first light emergent surface and the light incident structure reference plane along the light emergent direction are respectively a strip-shape extending left and right; the first light incident structure is configured as a plurality of the low-beam first light incident structures and a plurality of the high-beam first light incident structures; the low-beam first light incident structures and the high-beam first light incident structures are arranged alternately; and each of the collimators is located on the lower side of the light incident structure reference plane.

[0017] More preferably, the distance between the first cut-off portion corresponding to the low-beam first light incident structure and the upper surface of the first light passage is greater than the distance between the first cut-off portion corresponding to the high-beam first light incident structure and the upper surface of the first light passage.

[0018] Further preferably, the intermediate connection surface corresponding to the low-beam first light incident structure is configured to tilt upwards from back to front, and the side of the intermediate connection surface facing the first light passage is a reflecting surface.

[0019] Specifically, the intermediate connection surface corresponding to the high-beam first light incident structure is configured to tilt downwards from back to front, and the side of the intermediate connection surface departing from the first light passage is a reflecting surface.

[0020] As yet another preferred structural form, the vehicle lamp optical unit further comprises a second optical element; a notch for accommodating the second optical element is formed on a side in left-right direction of the first optical element; the rear end face and the front end face of the second optical element along the light emergent direction are respectively a light incident surface and a second light emergent surface; the light incident surface is provided with at least one second light incident structure; and the second optical element is arranged to be capable of guiding light emerging from the second light emergent surface to exit through the first light emergent surface.

[0021] Preferably, the first optical element is provided with a secondary light incident surface, the secondary light incident surface is located in the rear of the first light emergent surface and faces the notch, and the secondary light incident surface comprises at least one curved surface protruding backwards.

[0022] More preferably, the light incident surface is provided with a plurality of the second light incident structures, and the plurality of the second light incident structures is configured to have at least one low-beam second light incident structure and at least one high-beam second light incident structure.

[0023] Further preferably, each of the low-beam second light incident structures and each of the high-beam second light incident structures are respectively a collimating structure.

[0024] Specifically, the low-beam second light incident structure is located above the high-beam second light incident structure; the second light emergent surface comprises a low-beam light emergent surface located in front of the low-beam second light incident structure and a high-beam light emergent surface located at the light emergent end of the high-beam second light incident structure; a second light passage is provided between the light emergent end of the low-beam second light incident structure and the low-beam light emergent surface; and a second cut-off portion for forming a second light shape cut-off line is provided at the connection between the bottom surface of the second light passage and the low-beam light emergent surface.

[0025] More specifically, the lower surface of the second light passage is configured as a reflecting surface.

[0026] Typically, the low-beam light emergent surface is configured as a curved surface protruding forwards.

[0027] The second aspect of the present disclosure provides a vehicle lamp module, comprising a vehicle lamp optical unit as described above, and light sources provided in one-to-one correspondence with the first light incident structures, wherein each of the light sources is capable of being controlled individually to be turned on or turned off.

[0028] The third aspect of the present disclosure provides a vehicle, comprising a vehicle lamp module as described above.

[0029] It can be seen from the above technical solutions of the present disclosure that as for the first optical

element in the vehicle lamp optical unit according to the present disclosure, the first light incident structure is configured to extend from a side in the up-down width direction of the light incident structure reference plane to the first light passage, the first light incident structure can guide light received thereby to be emerged towards the first light passage and be transmitted to the first light emergent surface along the first light passage, that is to say, a light source corresponding to the first light incident structure is provided on the upper side or the lower side of the light incident structure reference plane, wherein it can be effectively avoided that a light spot is produced in a situation where the light source is provided in the rear of the first optical element, and it is accordingly avoided that the vehicle lamp lightening effect shows, when viewing from the front of the vehicle lamp, a row of light spots, hereby improving the appearance visual effect of the vehicle lamp optical unit; moreover, the vehicle lamp optical unit can meet requirements for various vehicle lamp illumination modes and lightening modes.

[0030] Other features and more prominent advantages of the present disclosure will be described in detail in subsequent specific embodiments.

Brief Description of Drawings

[0031]

Fig. 1 is a first structural schematic diagram of a first specific embodiment of a vehicle lamp optical unit of the present disclosure;

Fig. 2 is a second structural schematic diagram of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 3 is a third structural schematic diagram of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 4 is a fourth structural schematic diagram of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 5 is a fifth structural schematic diagram of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 6 is a partial enlarged view of the part A in Fig. 5;

Fig. 7 is a sixth structural schematic diagram of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 8 is a partial enlarged view of the part B in Fig. 7;

Fig. 9 is a first top view of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 10 is a sectional view in C-C of Fig. 9;

Fig. 11 is a beam path diagram of emergent light from a low-beam first light incident structure in Fig. 9;

Fig. 12 is a second top view of the first specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 13 is a sectional view in G-G of Fig. 12;

Fig. 14 is a beam path diagram of emergent light from a high-beam first light incident structure in Fig. 12;

Fig. 15 is a first structural schematic diagram of a second specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 16 is a partial enlarged view of the part D in Fig. 15;

Fig. 17 is a top view of the second specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 18 is a sectional view in E-E of Fig. 17;

Fig. 19 is a second structural schematic diagram of the second specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 20 is a first structural schematic diagram of a specific embodiment of a second optical unit of the present disclosure;

Fig. 21 is another structural schematic diagram of the second optical element of the Fig. 20;

Fig. 22 is a beam path diagram of emergent light from a low-beam second light incident structure in Fig. 20;

Fig. 23 is a beam path diagram of emergent light from a high-beam second light incident structure in Fig. 20;

Fig. 24 is a first structural schematic diagram of a third specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 25 is a second structural schematic diagram of the third specific embodiment of the vehicle lamp optical unit of the present disclosure;

Fig. 26 is a top view of the third specific embodiment

of the vehicle lamp optical unit of the present disclosure;

Fig. 27 is a sectional view in F-F of Fig. 26;

Fig. 28 is a light shape diagram formed correspondingly by the low-beam first light incident structure and the low-beam second light incident structure in Fig. 20;

Fig. 29 is a light shape diagram formed correspondingly by the high-beam first light incident structure and the high-beam second light incident structure in Fig. 20;

Fig. 30 is a structural schematic diagram of the vehicle lamp optical unit shown in Fig. 20 in a state of being mounted in a vehicle lamp module;

Fig. 31 is a roadway light shape diagram when the vehicle lamp module shown in Fig. 30 is applied to a vehicle lamp; and

Fig. 32 is a roadway light shape line pattern when the vehicle lamp module shown in Fig. 30 is applied to a vehicle lamp.

Description of Reference Signs:

[0032]

1	first optical element
11	light incident structure reference plane
111	low-beam first light incident structure
112	high-beam first light incident structure
113	collimator
114	light guide portion
115	reflecting portion
12	first light emergent surface
13	first light passage
131	recess structure
132	light guide portion connection surface
133	intermediate connection surface
134	light passage connection surface
135	first cut-off portion
14	secondary light incident surface
2	second optical element
21	light incident surface
211	low-beam second light incident structure
212	high-beam second light incident structure
22	second light emergent surface
221	low-beam light emergent surface
222	high-beam light emergent surface
23	second light passage
24	second cut-off portion
3	light guide
4	light source
a	main low-beam light shape
b	auxiliary low-beam light shape
c	auxiliary high-beam light shape
a	main high-beam light shape

Detailed Description of Embodiments

[0033] The specific embodiments of the present disclosure will be illustrated in detail below with reference to the accompanying drawings. It should be understood that specific embodiments described here are merely used to illustrate and explain the present disclosure, instead of being intended to limit the present disclosure.

[0034] In the description of the present disclosure, it shall be clarified that, unless otherwise expressly specified and defined, terms such as "connect", "provide", and "mount" shall be construed in a broad sense. For example, connection may refer to fixed connection, or detachable connection, or integrated connection; it may refer to direct connection, or indirect connection via an intermediate, or inner communication between two elements or interactive relationship between two elements. For a person ordinarily skilled in the art, the specific meanings of the above-mentioned terms in the present disclosure could be construed in accordance with specific circumstances. It shall further be clarified that a longitudinal transversal is a transversal obtained through interception of a first light emergent plane 12 by a vertical plane perpendicular to a vertical tangent plane of the first light emergent plane 12.

[0035] In addition, terms such as "first" and "second"

are used merely for purpose of description, and cannot be construed as indicating or implying to have importance in relativity, or implicitly suggesting the number of the indicated technical feature. Therefore, a feature defined with a term "first" or "second" can explicitly or implicitly comprise one or more said feature.

[0036] It should be understood that in order to facilitate the description of the present disclosure and simplify the description, terms "front" and "rear" refer to the forward and backward directions of a vehicle lamp optical unit along a light emergent direction, that is to say, the first light emergent surface 12 is located in the front, and a light incident structure reference plane 11 is located in the rear; terms "left" and "right" refer to the left and right direction of the vehicle lamp optical unit along the light emergent direction; and terms "upper" and "lower" refer to the upward and downward directions of the vehicle lamp optical unit along the light emergent direction. The terms indicate orientation or position relationships shown based on the accompanying drawings, rather than indicating or implying that a specified device or element must have a certain orientation and be constructed and operated in a certain orientation, and therefore cannot be construed as limiting the present disclosure.

[0037] Referring to Figs. 1 to 15, Fig. 17, Fig. 19, and Figs. 24 to 26, a vehicle lamp optical unit provided in a first aspect of the present disclosure comprises a first optical element 1, wherein the rear end face and the front end face of the first optical element 1 along a light emergent direction are respectively a light incident structure reference plane 11 and a first light emergent surface 12, the rear end of the first optical element 1 is formed as a light incident portion, the light incident portion comprises at least one first light incident structure provided along the left and right direction of the light incident structure reference plane 11, and a first light passage 13 is formed between the light incident portion and the first light emergent surface 12, wherein the first light incident structure is configured to extend from the upper side or the lower side of the light incident structure reference plane 11 to the first light passage 13, each of the first light incident structures is capable of guiding light rays received by the first light incident structure to be emitted towards the first light passage 13 and be transmitted to the first light emergent surface 12 along the first light passage 13.

[0038] Through the vehicle lamp optical unit according to the above-mentioned basic technical solutions of the present disclosure, light rays received by the first light incident structure emerge towards the first light passage 13 after direction change from the upper side or the lower side of the light incident structure reference plane 11, and are transmitted to the first light emergent surface 12 along the first light passage 13, and in turn emerge from the first light emergent surface 12 and form a desired illumination light shape, wherein it can be effectively avoided that a light spot is produced when a light source (namely the light source 4 described below) corresponding to the first light incident structure is provided in the rear of the first optical element 1, and it is avoided that the vehicle lamp lightening effect shows, when viewing from the front of the vehicle lamp, a row of light spots, hereby improving the appearance visual effect of the vehicle lamp optical unit; moreover, the vehicle lamp optical unit can meet requirements for various vehicle lamp illumination modes and lightening modes.

[0039] As a preferred embodiment of the present disclosure, referring to Figs. 1 to 15, Fig. 17, Fig. 19, and Figs. 24 to 26, each of the first light incident structures respectively comprises a collimator 113 located on the upper side or the lower side of the light incident structure reference plane 11, and a light guide portion 114 in connection with the collimator 113; the light guide portion 114 extends from the light emergent end of the collimator 113 to the rear end of the first light passage 13; the light guide portion 114 is provided with a reflecting portion 115; and the reflecting portion 115 is capable of reflecting the emergent light of the collimator 113 to a direction towards the first light passage 13 for emergence. Various collimating elements may be adopted for the structure of the collimator 113. For example, it may be specifically configured as a collimating cup, which is provided with an inwardly recessed light source connection portion, and correspondingly, the opening of the light source connection portion faces up or faces down. The reflecting portion 115 may be specifically configured as a reflecting plane or a reflecting curved surface, which is opposite to the light emergent end of the collimator 113 and has a certain inclined angle, that is to say, light rays received by the collimator 113 are emitted to the reflecting portion 115, reflected by the reflecting portion 115 and then emitted towards the first light passage 13, and transmitted to the first light emergent surface 12 through the first light passage 13.

[0040] In the present disclosure, in order to enable the vehicle lamp optical unit to be better applied for forming various vehicle lamp light shapes, preferably, a recess structure 131 corresponding to the light guide portion 114 is respectively provided at the connection between the first light passage 13 and each of the light guide portions 114, and referring to Figs. 10 and 11 and Figs. 13 and 14, each of the recess structures 131 respectively comprises a light guide portion connection surface 132 in connection with the light guide portion 114 corresponding to the recess structure 131, an intermediate connection surface 133 in connection with the light guide portion connection surface 132, and an light passage connection surface 134 in connection with the intermediate connection surface 133, wherein a first cut-off portion 135 forming a first light shape cut-off line is provided at the connection between the intermediate connection surface 133 and the light passage connection surface 134. At this moment, the first light shape cut-off line formed by the first cut-off portion 135 can be designed according to specific application situations of the first optical element 1, e.g., it may be an auxiliary low-beam cut-off line, or an auxiliary high-beam cut-off line.

[0041] In the present disclosure, the first light emergent surface 12 is preferably a curved surface protruding forwards, and may be configured as a single and smooth curved light emergent surface, hereby improving the aesthetics of the appearance of the vehicle lamp. Correspondingly preferably, referring to Fig. 4, the first cut-off portion 135 is located on the median surface of the first light emergent surface 12, and the median surface is a horizontal plane passing through the vertex of a longitudinal transversal of the first light emergent surface 12, such that the first light shape cut-off line correspondingly formed by the first cut-off portion 135 is clearer and realizes a better light shape.

[0042] Further preferably, the first light emergent surface 12 is a curvature continuous curved surface, which improves the appearance and the light emerging effect of the first optical element 1.

[0043] The at least one first light incident structure according to the present disclosure may be specifically configured to have at least one low-beam first light incident structure 111, or have at least one high-beam first light incident structure 112, or have at least one low-beam first light incident structure 111 and at least one high-beam first light incident structure 112. There may be one, two, three or more low-beam first light incident structures 111 and/or high-beam first light incident structures 112, and the number may be configured according to actual application requirements of the vehicle lamp optical unit.

[0044] In order to simplify the structural design of the vehicle lamp optical unit, reduce positioning and installation errors between various vehicle lamp illumination units and between parts, and improve the installation accuracy, the projection plane shapes of the first light emergent surface 12 and the light incident structure reference plane 11 along the light emergent direction are respectively a strip-shape extending left and right; the first light incident structure is configured to be multiple low-beam first light incident structures 111 and multiple high-beam first light incident structures 112; the low-beam first light incident structures 111 and the high-beam first light incident structures 112 are arranged alternately; and each of the collimators 113 is located on the lower side of the light incident structure reference plane 11. At this moment, the first optical element 1 can be simultaneously used for forming partial light shape or complete light shape of the low beam or the high beam, and integrate multiple functions as a whole, thus making the structural design simple and compact. The alternate arrangement of the low-beam first light incident structures 111 and the high-beam first light incident structures 112 can meet the requirement that under the two modes, i.e., the low-beam mode and the high-beam mode, the first light emergent surface 12 has consistent lightening effect, and it is avoided that the first light emergent surface 12 is only partially lightened in a single low-beam mode, which affects the lightening effect of the vehicle lamp.

[0045] Based on the alternate arrangement of the low-beam first light incident structures 111 and the high-beam first light incident structures 112, the distance between the first cut-off portion 135 corresponding to the low-beam first light incident structure 111 and the upper surface of the first light passage 13 is greater than the distance between the first cut-off portion 135 corresponding to the high-beam first light incident structure 112 and the upper surface of the first light passage 13, that is to say, the first cut-off portion 135 corresponding to the high-beam first light incident structure 112 is higher than the first cut-off portion 135 corresponding to the low-beam first light incident structure 111, such that there is a segment difference the first cut-off portion 135 corresponding to the low-beam first light incident structure 111 and the first cut-off portion 135 corresponding to the high-beam first light incident structure 112. By providing the segment difference between the first cut-off portion 135 corresponding to the low-beam first light incident structure 111 and the first cut-off portion 135 corresponding to the high-beam first light incident structure 112, the high-beam light shape and the low-beam light shape have a certain superposition, that is to say, the cut-off line of the high-beam light shape is located below the cut-off line of the low-beam light shape, and accordingly, the adjoining effect between the low beam and the high beam is better.

[0046] Further specifically, the intermediate connection surface 133 corresponding to the low-beam first light incident structure 111 is configured to tilt upwards from back to front, and the side of the intermediate connection surface 133 facing the first light passage 13 is configured as a reflecting surface; and the intermediate connection surface 133 corresponding to the high-beam first light incident structure 112 is configured to tilt downwards from back to front, and the side of the intermediate connection surface 133 departing from the first light passage 13 is also configured as a reflecting surface. Referring to Fig. 11, light rays received by the low-beam first light incident structure 111 are subjected to a direction change by the light guide portion 114 and are emitted towards the first light passage 13, then most light rays are directly transmitted to the first light emergent surface 12 after passing through the first light passage 13 and being cut off by the corresponding first cut-off portion 135 thereof, while other minor light rays are directed to the corresponding intermediate connection surface 133 thereof and reflected by the intermediate connection surface 133 to the inside of the first light passage 13 for further transmission, so as to improve the luminous efficiency. Those two parts of light rays commonly form a light shape having an auxiliary low-beam cut-off line after emerging from the first light emergent surface 12. Referring to Fig. 12, the high-beam first light incident structure 112 takes the corresponding light guide portion connection surface 132 as a primary high-beam light emergent surface and takes the light passage connection surface 134 as a secondary high-beam light incident surface. Light rays received by the high-beam first light incident structure 112 emerge from the corresponding light guide portion connection surface 132 after direction change by the light guide portion 114. Most

light rays directly enter the first light passage 13 through the corresponding light passage connection surface 134 after being cut off by the corresponding first cut-off portion 135, and are transmitted to the first light emergent surface 12, while other minor light rays are directed to the corresponding intermediate connection surface 133 thereof and reflected by the intermediate connection surface 133 to the corresponding light passage connection surface 134 and are further transmitted in the first light passage 13, so as to improve the luminous efficiency. Those two parts of light rays commonly form a light shape having an auxiliary high-beam cut-off line after emerging from the first light emergent surface 12.

[0047] Based on the above-mentioned first optical element according to the present disclosure, referring to Figs. 15 to 26, this vehicle lamp optical unit further comprises a second optical element 2; a notch for accommodating the second optical element 2 is formed on one side in the left and right direction of the first optical element 1; the rear end face and the front end face of the second optical element 2 along the light emergent direction are respectively a light incident surface 21 and a second light emergent surface 22; the light incident surface 21 is provided with at least one second light incident structure; and the second optical element 2 is configured to be capable of guiding light rays emerging from the second light emergent surface 22 to exit through the first light emergent surface 12. The first optical element 1 and the second optical element 2 share the first light emergent surface 12, which is more conducive to the combination of the light shapes of the two, such that the vehicle lamp optical unit forms a desired vehicle lamp light shape.

[0048] In order that the part of the first optical element 1 corresponding to the second optical element 2 and located in front thereof can form a single focus for forming a main low-beam cut-off line having an inflection point, the first optical element 1 is preferably provided with a secondary light incident surface 14, the secondary light incident surface 14 is located in the rear of the first light emergent surface 12 and faces the notch, and the secondary light incident surface 14 comprises at least one curved surface protruding backwards.

[0049] As a preferred embodiment of the second optical element 2, the light incident surface 21 is provided with multiple second light incident structures, and the multiple second light incident structures are configured to have at least one low-beam second light incident structure 211 and at least one high-beam second light incident structure 212. The specific numbers of the low-beam second light incident structures 211 and the high-beam second light incident structures 212 may be configured according to requirements for the light shape formed by the second optical element 2; moreover, it is preferred that those two are molded as a whole, hereby improving the installation accuracy of the vehicle lamp optical unit.

[0050] Preferably, each of the low-beam second light incident structures 211 and each of the high-beam second light incident structures 212 are respectively a collimating structure. The collimating structure may be a collimating element, such as a collimating cup, so as to improve the light efficiency.

[0051] Specifically, referring to Figs. 20 and 21, the low-beam second light incident structure 211 is located above the high-beam second light incident structure 212; the second light emergent surface 22 comprises a low-beam light emergent surface 221 located in front of the low-beam second light incident structure 211 and a high-beam light emergent surface 222 located at the light emergent end of the high-beam second light incident structure 212; a second light passage 23 is provided between the light emergent end of the low-beam second light incident structure 211 and the low-beam light emergent surface 221; and a second cut-off portion 24 for forming a second light shape cut-off line is provided at the connection between the bottom surface of the second light passage 23 and the low-beam light emergent surface 221. The second light shape cut-off line may be a main low-beam cut-off line, or a main high-beam cut-off line. At this moment, referring to Fig. 22, light rays received by the low-beam second light incident structure 211 are emitted to the second light passage 23 to be transmitted to the low-beam light emergent surface 211 through the second light passage 23, and form a light shape having a main low-beam cut-off line via the second cut-off portion 24; and light rays received by the high-beam second light incident structure 212 directly emerge from the high-beam light emergent surface 222 and form a light shape having a main high-beam cut-off line via the second cut-off portion 24.

[0052] Further preferably, the lower surface of the second light passage 23 is configured as a reflecting surface. When partial light rays emitted by the low-beam second light incident structure 211 to the second light passage 23 are emitted to the lower surface of the second light passage 23, they are reflected by the reflecting surface to the inside of the second light passage 23 to be further transmitted; when partial light rays directed by the high-beam light emergent surface 222 are emitted to the lower surface of the second light passage 23, they are reflected by the reflecting surface to be further transmitted forwards, and the luminous efficiency can be improved by configuring the lower surface of the second light passage 23 as a reflecting surface. Typically, the low-beam light emergent surface 221 is configured as a curved surface protruding forwards, and specifically may be a curved surface protruding in up-down direction, or may also be a curved surface protruding in left-right direction, or may also be a curved surface protruding simultaneously in up-down direction and in left-right direction. This structure makes light rays emerging from the low-beam light emergent surface 221 more concentrated, and more light rays would enter the secondary light incident surface 14, hereby further improving the luminous efficiency.

[0053] Based on the various specific embodiments of the vehicle lamp optical unit as described above, referring to Figs. 24 to 27, a light guide 3 is further provided in the

recess structure 131, and the light emergent surface of the light guide 3 faces towards the light passage connection surface 134, such that light rays emerging from the light emergent surface of the light guide 3 are transmitted to the first light emergent surface 12 through the first light passage 13. The light guide 3 shares the first light emergent surface 12 with the first optical element 1 and the second optical element 2, such that the vehicle lamp optical unit not only has the low-beam illumination function and/or the high-beam illumination function, but also has various illumination functions such as a low-beam III zone, a daytime running lamp or a position lamp, while occupied space is small. It shall be clarified that when the first optical element 1 is provided with a high-beam first light incident structure 112, there is a certain distance between the light guide 3 and the intermediate connection surface 133 of the recess structure 131, such that emergent light rays of the light guide portion connection surface 132 corresponding to the high-beam first light incident structure 112 can pass through and be emitted to the corresponding light passage connection surface 134 thereof, the minimum distance L between the two is set to $\leq$ 10 mm, preferably, 1 mm $\leq$ L $\leq$ 5 mm; and when the first optical element 1 is only provided with a low-beam first light incident structure 111, the distance L may be set to 0.

[0054] In a preferred specific embodiment of the vehicle lamp optical unit according to the present disclosure, referring to Figs. 24 to 27 and in combination with Figs. 1 to 23, the vehicle lamp optical unit comprises a first optical element 1 and a second optical element 2. The rear end face and the front end face of the first optical element 1 along a light emergent direction are respectively a light incident structure reference plane 11 and a first light emergent surface 12. The projection plane shapes of the first light emergent surface 12 and the light incident structure reference plane 11 along the light emergent direction are respectively a strip-shape extending left and right. The rear end of the first optical element 11 is formed as a light incident portion, the light incident portion comprises a first light incident structure provided along the left and right direction of the light incident structure reference plane 11. A first light passage 13 is formed between the light incident portion and the first light emergent surface 12. The first light emergent surface 12 is a curvature continuous curved surface protruding forwards. The first light incident structure is configured to have six low-beam first light incident structures 111 and four high-beam first light incident structures 112. The low-beam first light incident structures 111 and the high-beam first light incident structures 112 are arranged alternately. Each of the low-beam first light incident structures 111 and each of the high-beam first light incident structures 112 respectively comprises a collimator 113 located on the lower side of the light incident structure reference plane 11 and a light guide portion 114. The light guide portion 114 extends from the light emergent end of the collimator 113 to the rear end of the first light passage 13. The light guide portion 114 is provided with a reflecting portion 115, and the reflecting portion 115 can reflect the emergent light of the collimator 113 to a direction towards the first light passage 13 for emergence. A recess structure 131 corresponding to the light guide portion 114 is respectively provided at the connection between the first light passage 13 and each of the light guide portions 114. Each of the recess structures 131 respectively comprises a light guide portion connection surface 132 in connection with the light guide portion 114 corresponding to the recess structure 131, an intermediate connection surface 133 in connection with the light guide portion connection surface 132, and an light passage connection surface 134 in connection with the intermediate connection surface 133. A first cut-off portion 135 forming a first light shape cut-off line is provided at the connection between the intermediate connection surface 133 and the light passage connection surface 134, and the first cut-off portion 135 is located on the median surface of the first light emergent surface 12. The distance between the first cut-off portion 135 corresponding to the low-beam first light incident structure 111 and the upper surface of the first light passage 13 is greater than the distance between the first cut-off portion 135 corresponding to the high-beam first light incident structure 112 and the upper surface of the first light passage 13. The intermediate connection surface 133 corresponding to the low-beam first light incident structure 111 is configured to tilt upwards from back to front, and the side of the intermediate connection surface 133 facing the first light passage 13 is a reflecting surface. The intermediate connection surface 133 corresponding to the high-beam first light incident structure 112 is configured to tilt downwards from back to front, and the side of the intermediate connection surface 133 departing from the first light passage 13 is a reflecting surface. A notch for accommodating the second optical element 2 is formed on the right side in the left and right direction of the first optical element 1, a secondary light incident surface 14 is located in the rear of the first light emergent surface 12 and faces the notch, and the secondary light incident surface 14 comprises two curved surface protruding backwards, which are arranged in the left and right direction. The rear end face and the front end face of the second optical element 2 along the light emergent direction are respectively a light incident surface 21 and a second light emergent surface 22. The second light emergent surface 22 is arranged to face the secondary light incident surface 14. The light incident surface 21 is provided with two low-beam second light incident structures 211 and two high-beam second light incident structures 212. The low-beam second light incident structure 211 is located above the high-beam second light incident structure 212. The light emergent end of the high-beam second light incident structure 212 is configured as a high-beam light emergent surface 222. The front end of the low-beam second light incident structure 211 is successively provided with a second light passage 23 and a low-beam light emergent surface 221. A

second cut-off portion 24 for forming a second light shape cut-off line is provided at the connection between the bottom surface of the second light passage 23 and the low-beam light emergent surface 221. The upper and lower sides of the lower surface of the second light passage 23 are both configured as reflecting surfaces. The low-beam light emergent surface 221 is configured as a curved surface protruding forwards. A light guide 3 for forming the light shape of a daytime running lamp may further be provided in the recess structure 131. The light emergent surface of the light guide 3 faces the light passage connection surface 134, and the minimum distance L between the light guide 3 and the intermediate connection surface 133 is set to 3 mm.

[0055] In the above embodiment of the vehicle lamp optical unit, referring to Figs. 28 and 29 and in combination with Figs. 1 to 27, turning on the light source 4 corresponding to the low-beam first light incident structure 111, the collimator 113 corresponding to the low-beam first light incident structure 111 receives light rays and emits the same to the light guide portion 114, the light rays are reflected by the reflecting portion 115 on the light guide portion 114 to the direction towards the first light passage 13 for emergence, and the light rays are transmitted to the first light emergent surface 12 through the first light passage 13 and form an auxiliary low-beam light shape b having an auxiliary low-beam cut-off line via the corresponding first cut-off portion 135 thereof; when turning on the light source 4 corresponding to the high-beam first light incident structure 112, the collimator 113 corresponding to the high-beam first light incident structure 112 receives light rays and emits the same to the light guide portion 114, the light rays emerge from the corresponding light guide portion connection surface 132 after direction change through the reflection by the reflecting portion 115 on the light guide portion 114, and enter the first light passage 13 through the corresponding light passage connection surface 134 and are transmitted to the first light emergent surface 12, while forming an auxiliary high-beam light shape c having an auxiliary high-beam cut-off line via the corresponding first cut-off portion 135 thereof; turning on the light source corresponding to the low-beam second light incident structure 211, light rays received by the low-beam second light incident structure 211 are emitted to the second light passage 23 and transmitted to the low-beam light emergent surface 211 through the second light passage 23, then emerge via the first light emergent surface 12 after incident from the secondary light incident surface 14, and form a main low-beam light shape a having a main low-beam cut-off line via the second cut-off portion 24; turning on the light source corresponding to the high-beam second light incident structure 212, light rays received by the high-beam second light incident structure 212 directly emerge from the high-beam light emergent surface 222, and emerge from the first light emergent surface 12 after entering from the secondary light incident surface 14, and form a main high-beam light shape d having a main high-beam cut-off line via the second cut-off portion 24; and turning on the light source corresponding to the light guide 3 (the light source is provided at one end of the light guide 3), the light rays thereof emerge from the light emergent surface of the light guide 3 and enter the first light passage 13 through the light passage connection surface 134, then are transmitted to the first light emergent surface 12 through the first light passage 13 and form a low-beam III-zone light shape or a daytime running lamp light shape or a position lamp light shape.

[0056] When being applied in a vehicle lamp module, the vehicle lamp optical unit as described above can realize various illumination functions such as low beam, high beam, and daytime running lamp. When light sources corresponding to the low-beam first light incident structure 111 and the low-beam second light incident structure 211 are turned on, it is the low-beam illumination mode for the vehicle lamp, and when the light sources corresponding to the high-beam first light incident structure 112 and the high-beam second light incident structure 212 are turned on, it is switched to the high beam illumination mode. After all the light sources corresponding to the low-beam illumination mode and the high beam illumination mode are turned off, the function of the daytime running lamp can be realized just by turning on the light source corresponding to the light guide 3. As a way for forming a vehicle lamp light shape, after that light sources 4 corresponding to each first light incident structure and each second light incident structure have been lit up, partial light shapes of the low beam or the high beam of the vehicle lamp are formed through projection by the first light emergent surface 12 of the first optical element 1. The respective partial light shapes form a complete low beam or high beam light shape by splicing. At this moment, in cooperation with the on-off controller of the respective light sources 4, specific welcome or shutting-down mode of the vehicle lamp can be realized by lighting up the light sources 4 in a certain order when the vehicle lamp is lit up or shut down. For example, as shown in Figs. 31 and 32, the low-beam light shape of the vehicle lamp is divided into nine areas. When the low beam of the vehicle lamp is turned on, light sources 4 corresponding to the nine areas are lit up one by one from left to right, so as to form light shapes of the nine areas in order, which are shown as ①, ②, ③, ④, OO , ⑥, ⑦, ⑧ and ⑨, hereby realizing the welcome mode of the vehicle lamp and ultimately forming a complete low-beam light shape.

[0057] Based on the above-mentioned vehicle lamp optical unit according to the present disclosure, referring to Fig. 30, a second aspect of the present disclosure provides a vehicle lamp module, comprising a vehicle lamp optical unit according to any one of the above-mentioned embodiments, and light sources 4 provided in one-to-one correspondence with the first light incident structures, wherein each of the light sources 4 is capable of being controlled individually to be turned on or turned off. Therefore, it at least has all the beneficial effects brought by

the technical solutions of the above-mentioned embodiments of the vehicle lamp optical unit.

[0058] A third aspect of the present disclosure provides a vehicle, comprising a vehicle lamp module as described above. Therefore, it at least has all the beneficial effects brought by the technical solutions of the above-mentioned embodiments of the vehicle lamp optical unit and the vehicle lamp module.

[0059] It can be seen from the above technical solutions of the present disclosure that as for the first optical element 1 in the vehicle lamp optical unit according to the present disclosure, the first light incident structure is configured to extend from one side in the upper-lower width direction of the light incident structure reference plane 11 to the first light passage 13, the first light incident structure can guide light rays received thereby to be emitted towards the first light passage 13 and be transmitted to the first light emergent surface 12 along the first light passage 13, that is to say, a light source corresponding to the first light incident structure is provided on the upper side or the lower side of the light incident structure reference plane 11, wherein it can be effectively avoided that a light spot is produced in a situation where the light source 4 is provided in the rear of the first optical element 1, hereby improving the illumination visual effect of the vehicle lamp optical unit; moreover, the vehicle lamp optical unit can meet requirements for various vehicle lamp illumination modes and lightening modes.

[0060] Preferred embodiments of the present disclosure are illustrated in detail above with reference to the accompanying drawings; however, the present disclosure is not limited thereto. Various simple modifications may be made to the technical solutions of the present disclosure within the scope of the technical concept of the present disclosure, inclusive combinations of respective specific technical features in any proper manner. In order to avoid unnecessary repetition, various possible combination manners will not be described expressly here in the present disclosure. But these simple modifications and combinations should also be deemed as contents disclosed in the present disclosure and all fall within the scope of protection of the present disclosure.

Claims

1. A vehicle lamp optical unit, **characterized in that** the vehicle lamp optical unit comprises a first optical element (1), a rear end face and a front end face of the first optical element (1) along a light emergent direction are respectively a light incident structure reference plane (11) and a first light emergent surface (12), a rear end of the first optical element (1) is formed as a light incident portion, the light incident portion comprises at least one first light incident structure provided along the left and right direction of the light incident structure reference plane (11), and a first light passage (13) is formed between the light incident portion and the first light emergent surface (12),
wherein the first light incident structure is configured to extend from an upper side or a lower side of the light incident structure reference plane (11) to the first light passage (13), each of the first light incident structures is capable of guiding light rays received by the first light incident structure to be emitted towards the first light passage (13) and be transmitted to the first light emergent surface (12) along the first light passage (13).

2. The vehicle lamp optical unit according to claim 1, wherein each of the first light incident structures respectively comprises a collimator (113) located on the upper side or the lower side of the light incident structure reference plane (11) and a light guide portion (114) in connection with the collimator (113); the light guide portion (114) extends from a light emergent end of the collimator (113) to a rear end of the first light passage (13); the light guide portion (114) is provided with a reflecting portion (115); and the reflecting portion (115) is capable of reflecting a emergent light of the collimator (113) to a direction towards the first light passage (13) for emergence.

3. The vehicle lamp optical unit according to claim 2, wherein a recess structure (131) corresponding to the light guide portion (114) is provided at a connection between the first light passage (13) and each of the light guide portions (114) respectively, and each of the recess structures (131) respectively comprises a light guide portion connection surface (132) in connection with the light guide portion (114) corresponding to the recess structure (131), an intermediate connection surface (133) in connection with the light guide portion connection surface (132), and a light passage connection surface (134) in connection with the intermediate connection surface (133),
wherein a first cut-off portion (135) forming a first light shape cut-off line is provided at a connection between the intermediate connection surface (133) and the light passage connection surface (134).

4. The vehicle lamp optical unit according to claim 3, wherein the first light emergent surface (12) is a curved surface protruding forwards, the first cut-off portion (135) is located on a median surface of the first light emergent surface (12), and the median surface is a horizontal plane passing through a vertex of a longitudinal transversal of the first light emergent surface (12).

5. The vehicle lamp optical unit according to claim 4, wherein the first light emergent surface (12) is a curvature continuous curved surface.

6. The vehicle lamp optical unit according to claim 3,

wherein a light guide (3) is provided in the recess structure (131), and a light emergent surface of the light guide (3) faces the light passage connection surface (134), such that light rays emerging from the light emergent surface of the light guide (3) are transmitted to the first light emergent surface (12) through the first light passage (13).

7. The vehicle lamp optical unit according to claim 3, wherein the at least one first light incident structure is configured to have at least one low-beam first light incident structure (111), or have at least one high-beam first light incident structure (112), or have at least one low-beam first light incident structure (111) and at least one high-beam first light incident structure (112).

8. The vehicle lamp optical unit according to claim 7, wherein projection plane shapes of the first light emergent surface (12) and the light incident structure reference plane (11) along the light emergent direction are respectively a strip-shape extending left and right; the first light incident structure is provided as a plurality of the low-beam first light incident structures (111) and a plurality of the high-beam first light incident structures (112); the low-beam first light incident structures (111) and the high-beam first light incident structures (112) are arranged alternately; and each of the collimators (113) is located on the lower side of the light incident structure reference plane (11).

9. The vehicle lamp optical unit according to claim 8, wherein a distance between the first cut-off portion (135) corresponding to the low-beam first light incident structure (111) and an upper surface of the first light passage (13) is greater than a distance between the first cut-off portion (135) corresponding to the high-beam first light incident structure (112) and the upper surface of the first light passage (13).

10. The vehicle lamp optical unit according to claim 7, wherein the intermediate connection surface (133) corresponding to the low-beam first light incident structure (111) is configured to tilt upwards from back to front, and a side of the intermediate connection surface (133) facing the first light passage (13) is a reflecting surface.

11. The vehicle lamp optical unit according to claim 7, wherein the intermediate connection surface (133) corresponding to the high-beam first light incident structure (112) is configured to tilt downwards from back to front, and a side of the intermediate connection surface (133) departing from the first light passage (13) is a reflecting surface.

12. The vehicle lamp optical unit according to any one of claims 1 to 11, wherein the vehicle lamp optical unit further comprises a second optical element (2); a notch for accommodating the second optical element (2) is formed on a side in the left and right direction of the first optical element (1); the rear end face and the front end face of the second optical element (2) along the light emergent direction are respectively a light incident surface (21) and a second light emergent surface (22); the light incident surface (21) is provided with at least one second light incident structure; and the second optical element (2) is configured to be capable of guiding light rays emerging from the second light emergent surface (22) to exit through the first light emergent surface (12).

13. The vehicle lamp optical unit according to claim 12, wherein the first optical element (1) is provided with a secondary light incident surface (14), the secondary light incident surface (14) is located in a rear of the first light emergent surface (12) and faces the notch, and the secondary light incident surface (14) comprises at least one curved surface protruding backwards.

14. The vehicle lamp optical unit according to claim 12, wherein the light incident surface (21) is provided with a plurality of the second light incident structures, and the plurality of the second light incident structures are configured to have at least one low-beam second light incident structure (211) and at least one high-beam second light incident structure (212).

15. The vehicle lamp optical unit according to claim 14, wherein each of the low-beam second light incident structures (211) and each of the high-beam second light incident structures (212) are respectively a collimating structure.

16. The vehicle lamp optical unit according to claim 14, wherein the low-beam second light incident structure (211) is located above the high-beam second light incident structure (212); the second light emergent surface (22) comprises a low-beam light emergent surface (221) located in front of the low-beam second light incident structure (211) and a high-beam light emergent surface (222) located at a light emergent end of the high-beam second light incident structure (212); a second light passage (23) is provided between the light emergent end of the low-beam second light incident structure (211) and the low-beam light emergent surface (221); and a second cut-off portion (24) for forming a second light shape cut-off line is provided at a connection between a bottom surface of the second light passage (23) and the low-beam light emergent surface (221).

17. The vehicle lamp optical unit according to claim 16,

wherein a lower surface of the second light passage (23) is provided as a reflecting surface.

18. The vehicle lamp optical unit according to claim 16, wherein the low-beam light emergent surface (211) is provided as a curved surface protruding forwards.

19. A vehicle lamp module, **characterized in that** the vehicle lamp module comprises the vehicle lamp optical unit according to any one of claims 1 to 18 and light sources (4) provided in one-to-one correspondence with the first light incident structures, wherein each of the light sources (4) is capable of being controlled individually to be turned on or turned off.

20. A vehicle, **characterized in that** the vehicle comprises the vehicle lamp module according to claim 19.

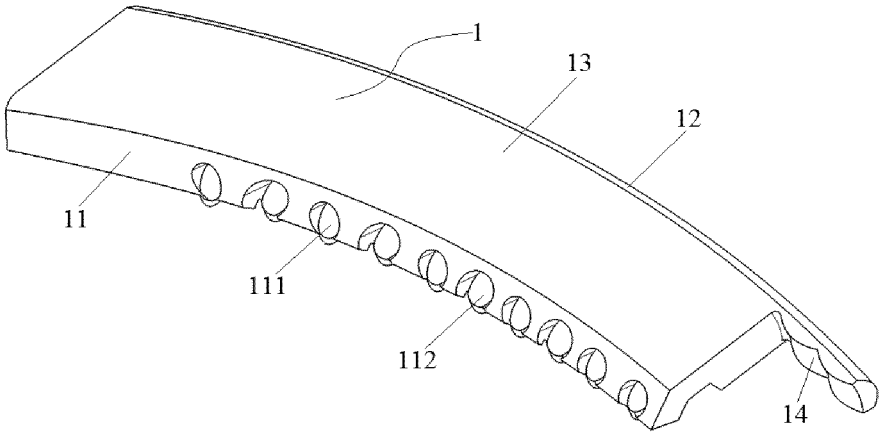

FIG. 1

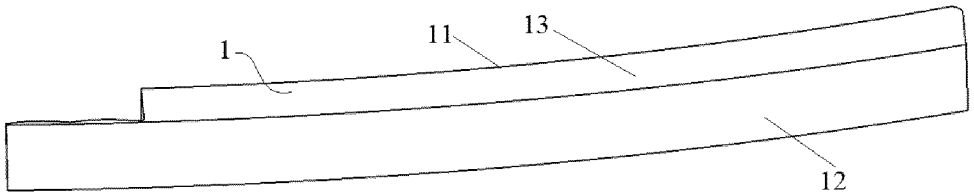

FIG. 2

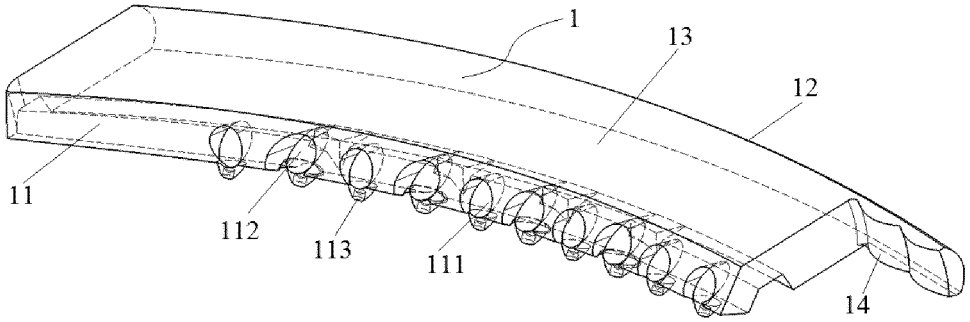

FIG. 3

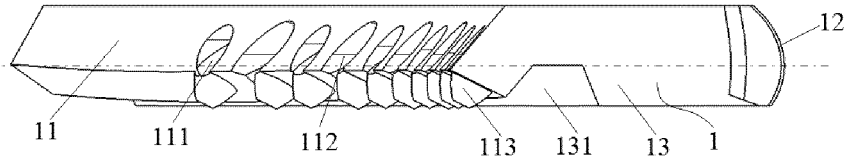

FIG. 4

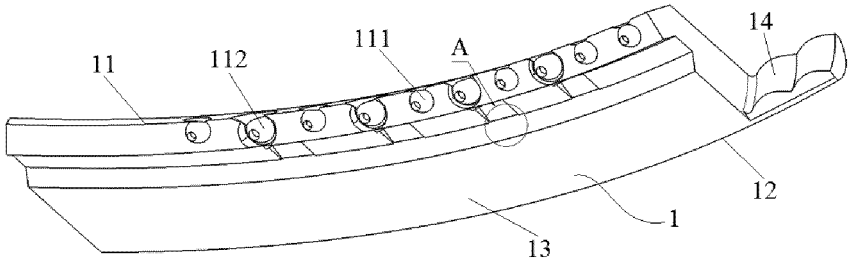

FIG. 5

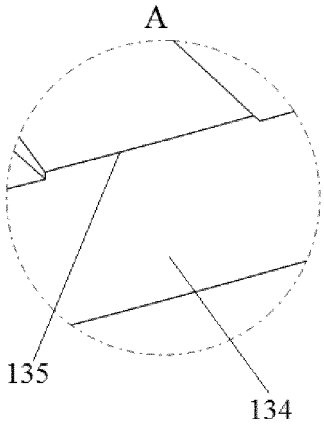

FIG. 6

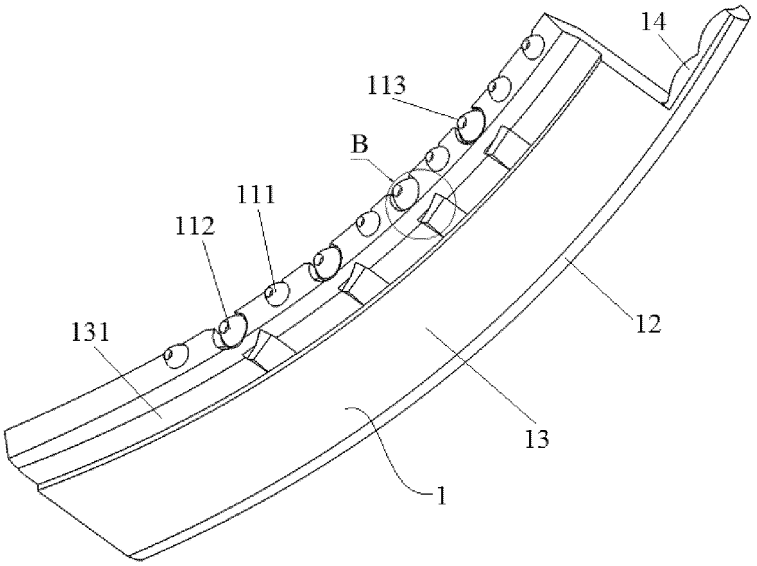

FIG. 7

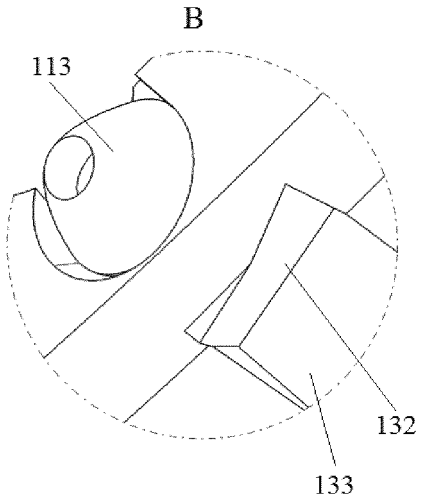

FIG. 8

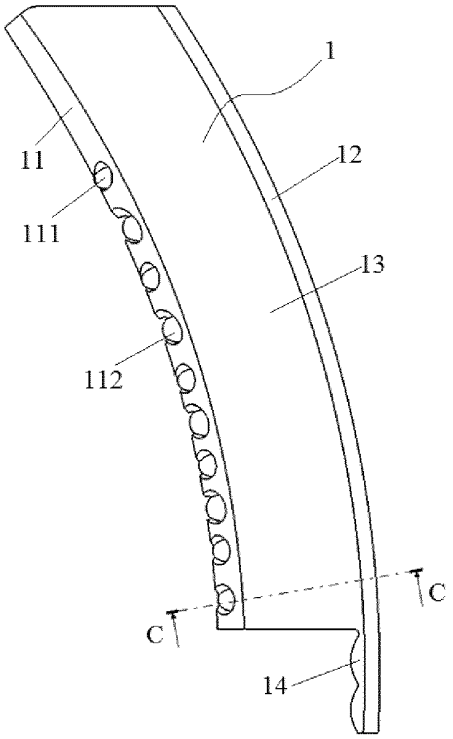

FIG. 9

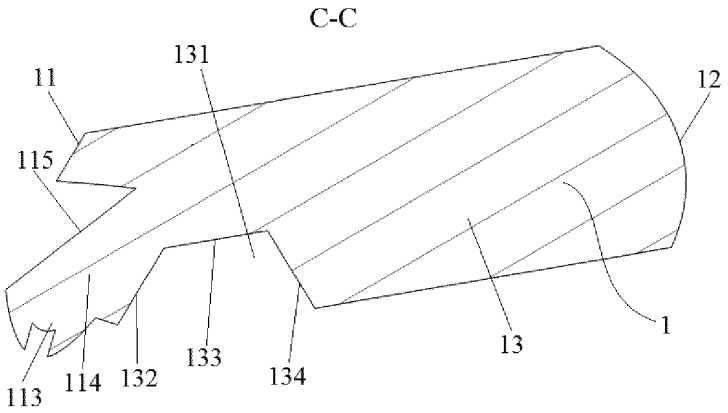

FIG. 10

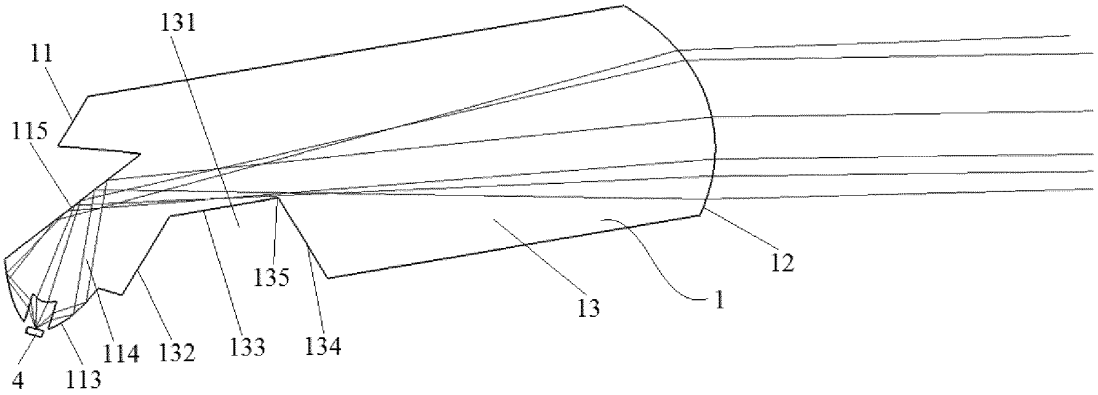

FIG. 11

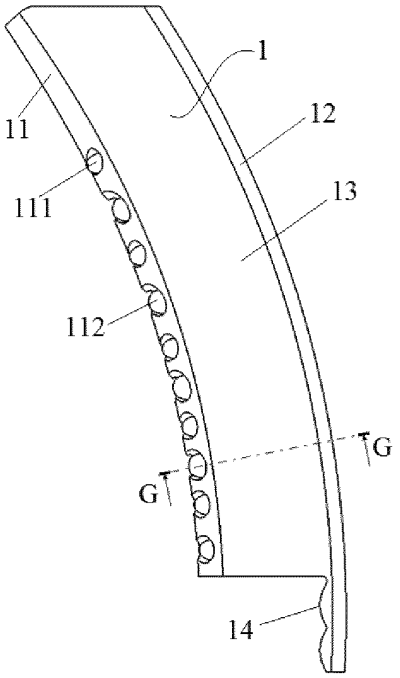

FIG. 12

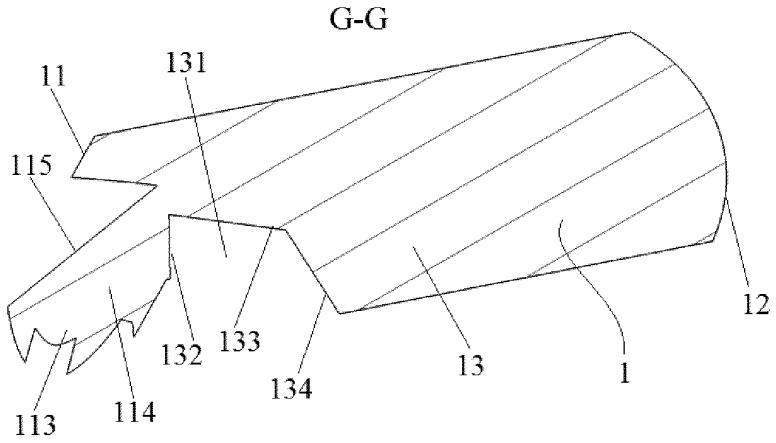

FIG. 13

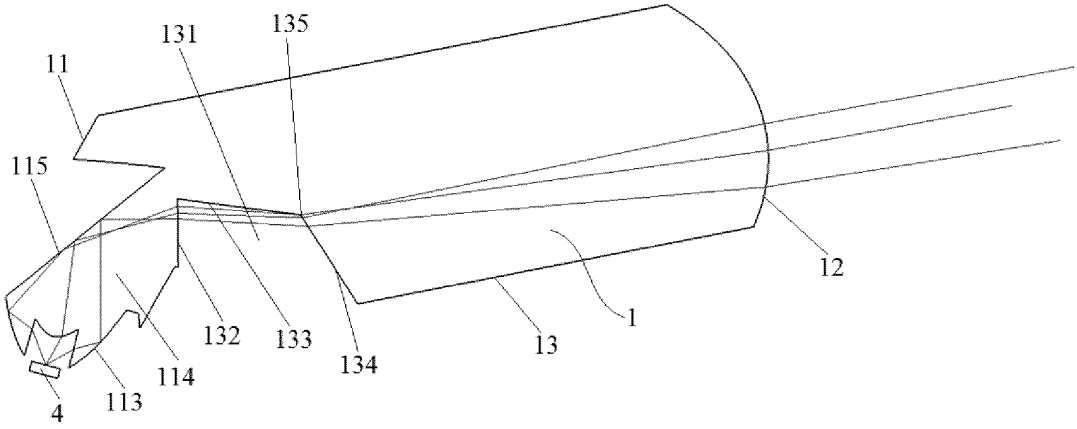

FIG. 14

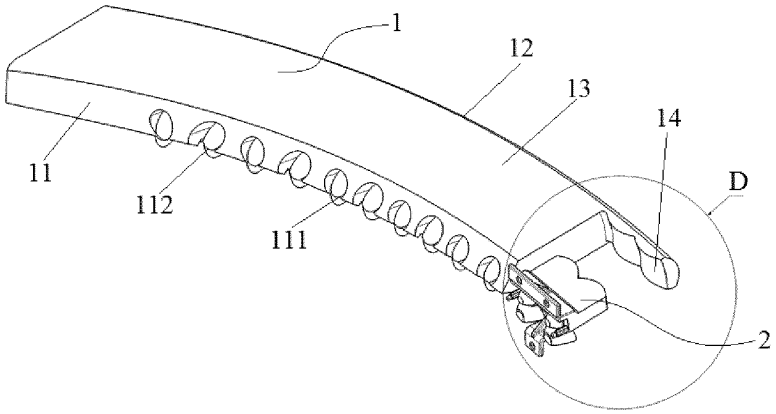

FIG. 15

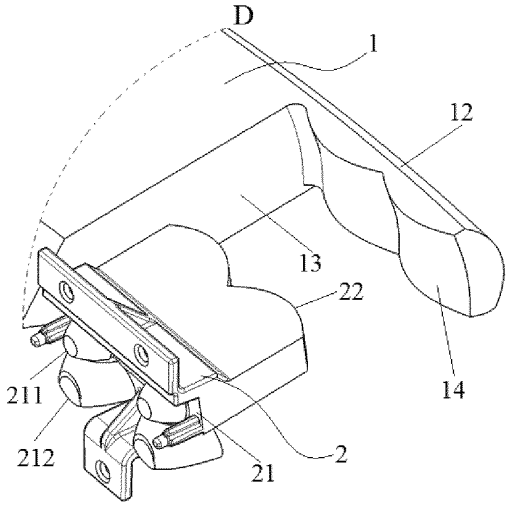

FIG. 16

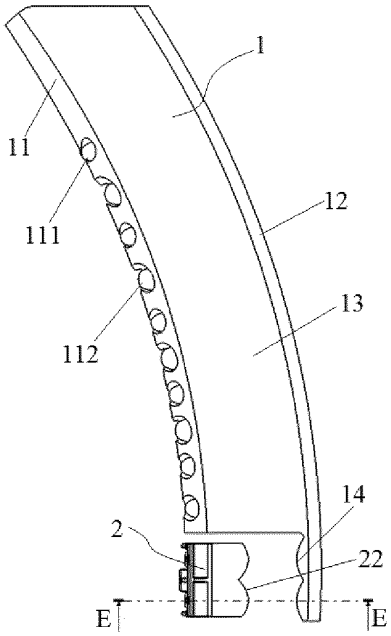

FIG. 17

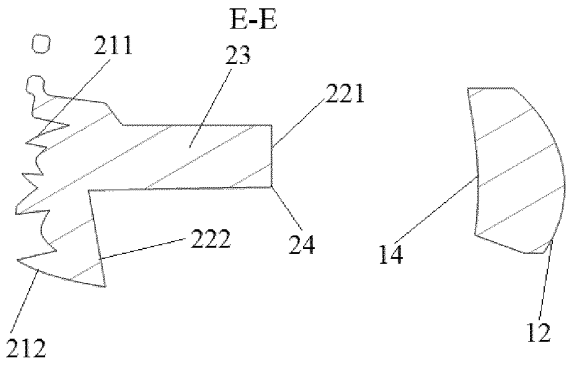

FIG. 18

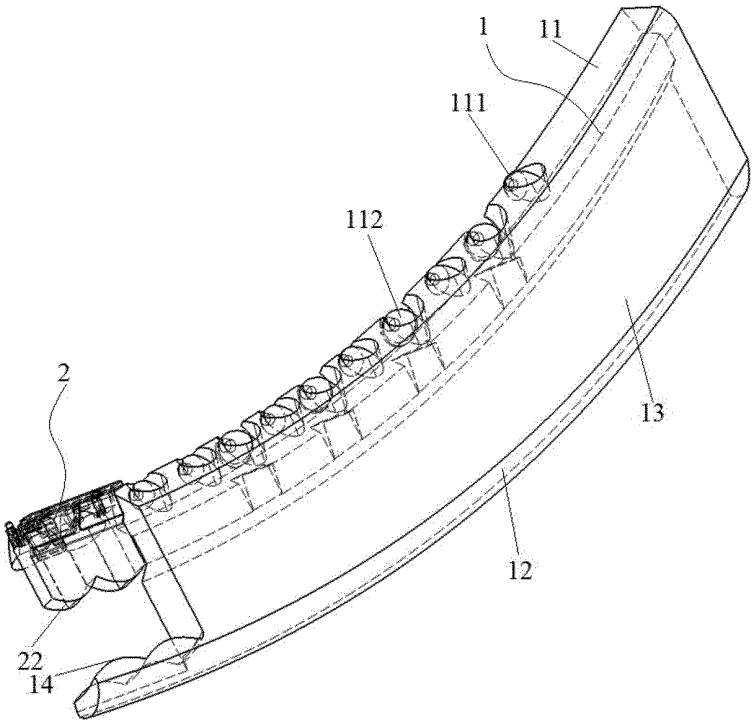

FIG. 19

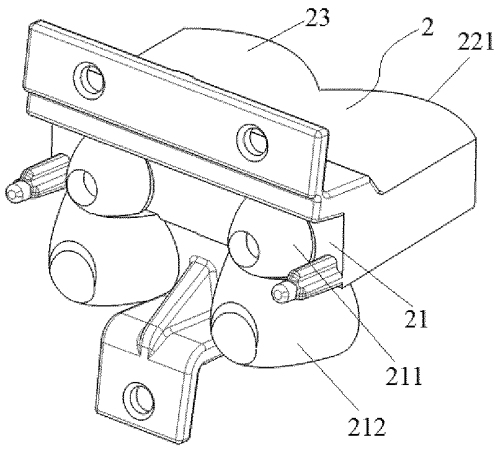

FIG. 20

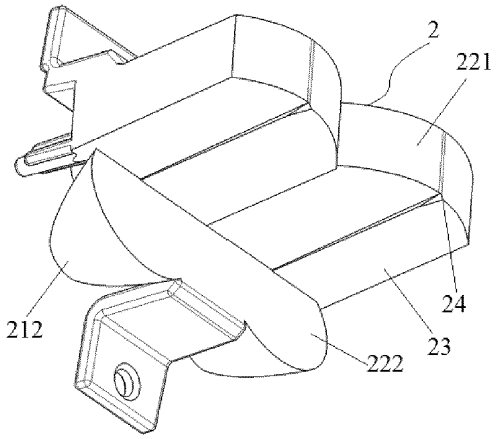

FIG. 21

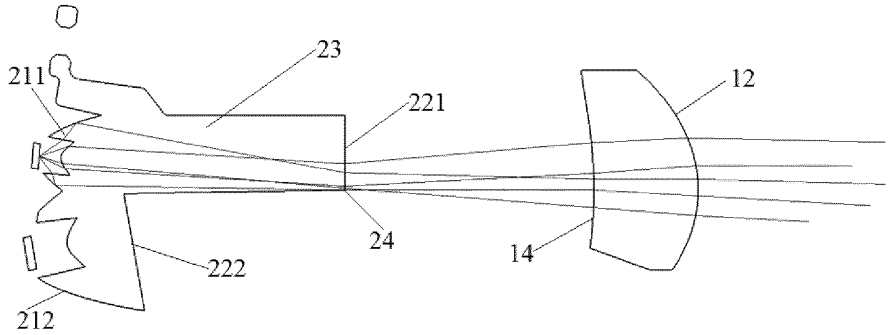

FIG. 22

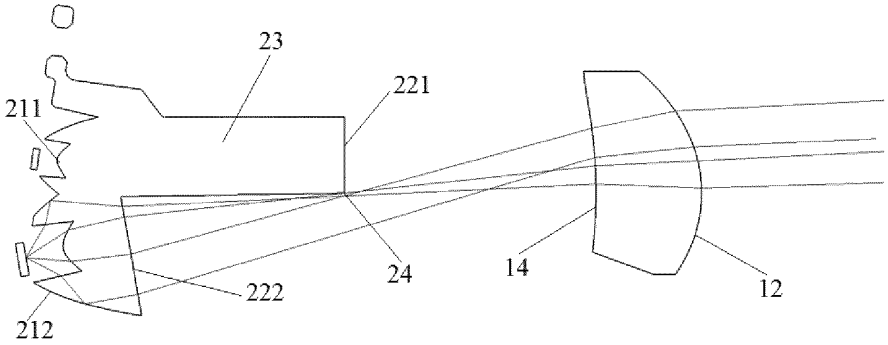

FIG. 23

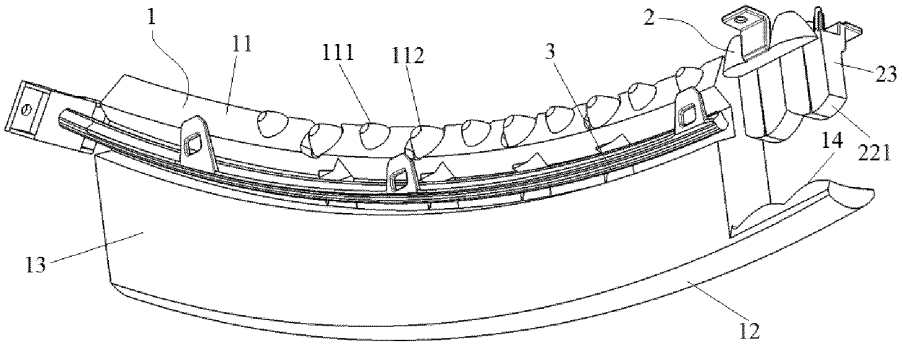

FIG. 24

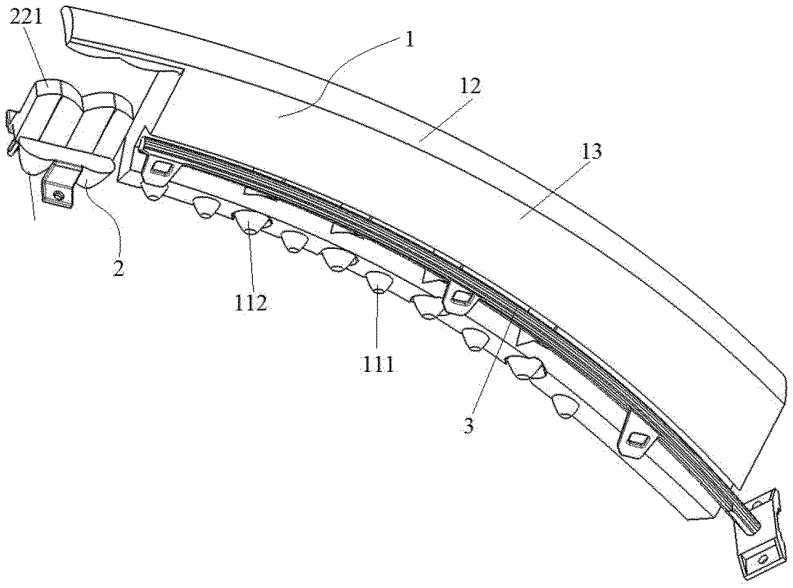

FIG. 25

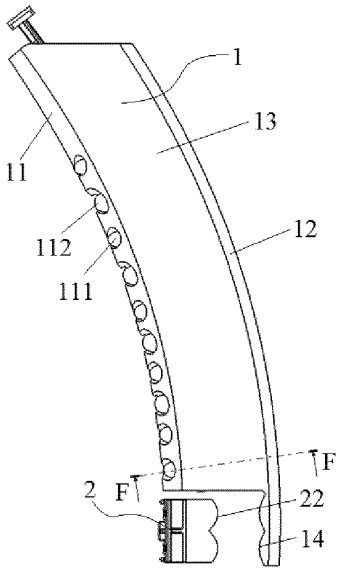

FIG. 26

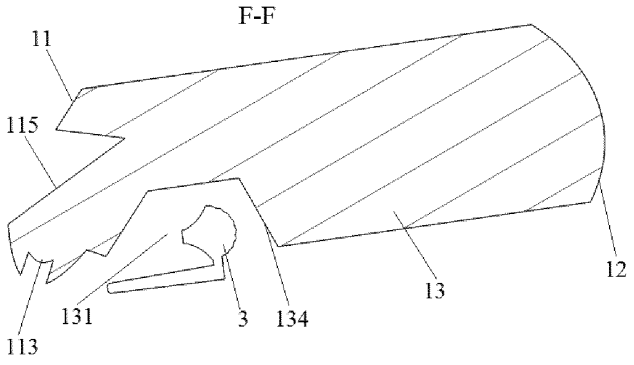

FIG. 27

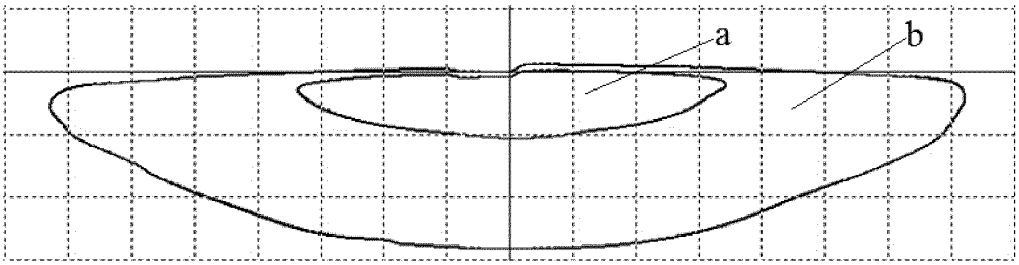

FIG. 28

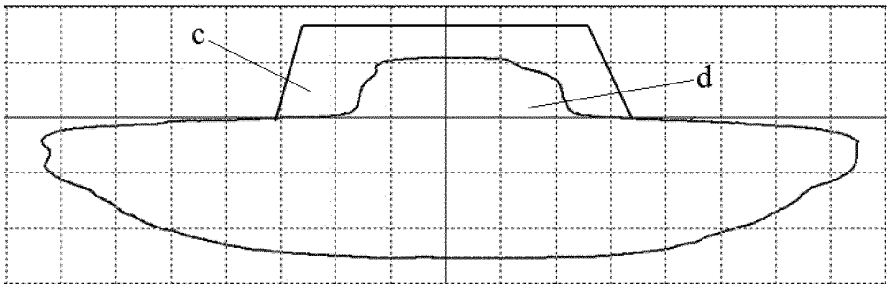

FIG. 29

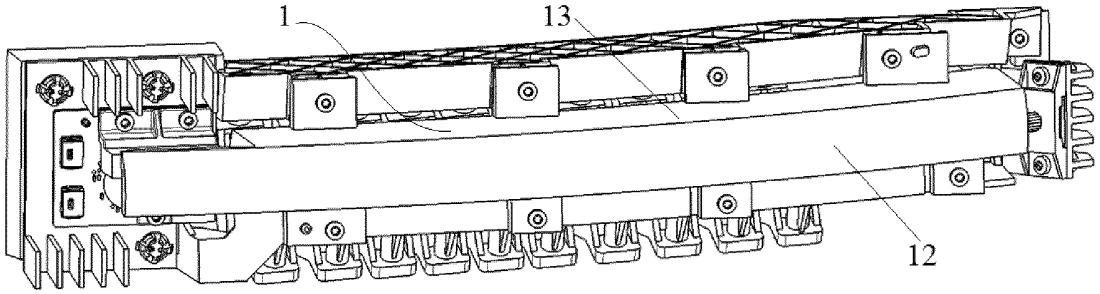

FIG. 30

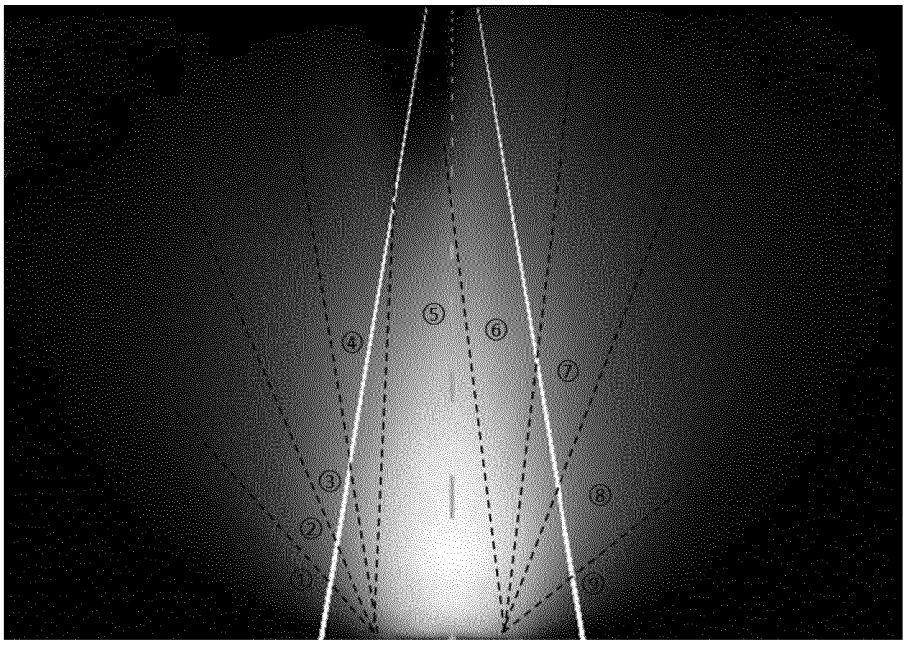

FIG. 31

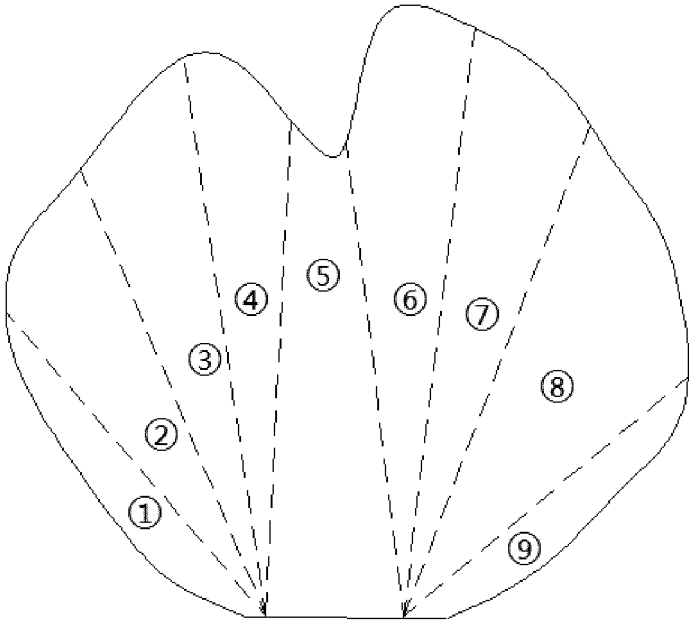

FIG. 32

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/071523

A. CLASSIFICATION OF SUBJECT MATTER

F21S 41/24(2018.01)i; F21W 102/00(2018.01)i

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)

F21S; F21W

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

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

CNPAT, WPI, EPODOC, CNKI: 车, 灯, 光导, 导光, 光源, 均匀, 光斑, 入光, 出光, 近光, 远光, 入射, 出射, 聚光, 截止, vehicle?, light+, lamp?, headlight+, light d guid+, source?, LED, focus+, incident+, upper, lower, up, low, optic?? w path?, light w path?, road+, low w beam?, high w beam

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 212618081 U (HUAYU VISION TECHNOLOGY (SHANGHAI) CO., LTD.) 26 February 2021 (2021-02-26) description, paragraphs [0082]-[0104], and figures 1-2	1-20
Y	CN 210662681 U (SAIC GM WULING AUTOMOBILE CO., LTD.) 02 June 2020 (2020-06-02) description, paragraphs [0020]-[0025], and figures 1-2	1-20
Y	CN 210398742 U (HUAYU VISION TECHNOLOGY (SHANGHAI) CO., LTD.) 24 April 2020 (2020-04-24) description, paragraphs [0043]-[0064], and figures 1-16	1-20
A	CN 210141552 U (HUAYU VISION TECHNOLOGY (SHANGHAI) CO., LTD.) 13 March 2020 (2020-03-13) entire document	1-20
A	CN 210568140 U (ZHEJIANG BAIKANG OPTICAL CO., LTD.) 19 May 2020 (2020-05-19) entire document	1-20

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

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"P" document published prior to the international filing date but later than the priority date claimed
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"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
25 March 2021	**16 April 2021**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/071523

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 210345321 U (HUAYU VISION TECHNOLOGY (SHANGHAI) CO., LTD.) 17 April 2020 (2020-04-17) entire document	1-20
A	CN 209944214 U (NANJING BENZE PHOTOELECTRIC TECHNOLOGY CO., LTD.) 14 January 2020 (2020-01-14) entire document	1-20
A	CN 210601445 U (HUAYU VISION TECHNOLOGY (SHANGHAI) CO., LTD.) 22 May 2020 (2020-05-22) entire document	1-20
A	WO 2008101330 A1 (MAGNA INTERNATIONAL INC.) 28 August 2008 (2008-08-28) entire document	1-20
A	WO 2020074327 A1 (HELLA G.M.B.H. & CO., K.G.A.A.) 16 April 2020 (2020-04-16) entire document	1-20

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/071523

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	212618081	U	26 February 2021	None			
CN	210662681	U	02 June 2020	None			
CN	210398742	U	24 April 2020	None			
CN	210141552	U	13 March 2020	None			
CN	210568140	U	19 May 2020	WO	2021004532	A1	14 January 2021
CN	210345321	U	17 April 2020	None			
CN	209944214	U	14 January 2020	None			
CN	210601445	U	22 May 2020	None			
WO	2008101330	A1	28 August 2008	EP	2122239	B1	20 April 2016
				CA	2673704	C	03 November 2015
				JP	2010519696	A	03 June 2010
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				CA	2673704	A1	28 August 2008
WO	2020074327	A1	16 April 2020	DE	102018125157	A1	16 April 2020

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202010634007 **[0001]**