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

(11) **EP 4 001 743 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
25.05.2022 Bulletin 2022/21

(21) Application number: **20878582.4**

(22) Date of filing: **20.10.2020**

(51) International Patent Classification (IPC):
F21S 41/30 *(2018.01)* ***F21S 41/40*** *(2018.01)*
F21S 41/24 *(2018.01)* ***F21S 41/25*** *(2018.01)*

(52) Cooperative Patent Classification (CPC):
F21S 41/24; F21S 41/25; F21S 41/30; F21S 41/40

(86) International application number:
PCT/CN2020/122163

(87) International publication number:
WO 2021/078114 (29.04.2021 Gazette 2021/17)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **25.10.2019 CN 201921809909 U**

(71) Applicant: **Hasco Vision Technology Co., Ltd.**
Jiading District
Shanghai 201821 (CN)

(72) Inventors:
- **ZHU, He**
  Shanghai 201821 (CN)
- **QIU, Zhiping**
  Shanghai 201821 (CN)
- **SANG, Wenhui**
  Shanghai 201821 (CN)

(74) Representative: **SSM Sandmair**
Patentanwälte Rechtsanwalt Partnerschaft mbB
Joseph-Wild-Straße 20
81829 München (DE)

(54) VEHICLE LAMP OPTICAL ELEMENT

(57) A vehicle lamp optical element. One end of the vehicle lamp optical element is provided with a plurality of light-condensing structures, and the other end is provided with a light exit surface, and the light exit surface is an arc-shaped surface that protrudes outwards. The vehicle lamp optical element has the following advantages: 1, the primary optical element and the secondary optical element of the prior art are integrated into one piece, and the relative position accuracy of the two no longer needs to be ensured during installation, which may better ensure the stability of the light shape of a vehicle lamp while also reducing the size of a vehicle lamp module; 2, a partition slot is provided to achieve secondary light distribution; 3, a pointed slot is provided to replace existing light-shielding plates, so that the structure of the vehicle lamp module is simplified and the overall size is reduced; and 4, a low beam part and a high beam part are provided, and a partition slot is provided on the bottom surface of the high beam part, or a wedge-shaped gap is provided between the two, so that high beam and low beam functions are simultaneously achieved in the integrated vehicle lamp optical element, which diversifies the functions of the vehicle lamp optical element.

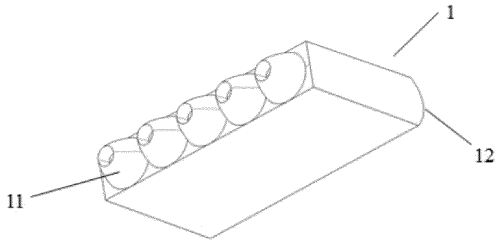

FIG. 1

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Description

Cross Reference to Related Applications

[0001] This application claims the priority of China Patent Application No. 201921809909.6, filed on October 25, 2019, which is hereby incorporated by reference in its entirety.

Field of the Invention

[0002] The present invention relates to the technical field of vehicle lighting, in particular to a vehicle lamp optical element.

Background of the Invention

[0003] In the technical field of vehicle lamps, a vehicle lamp module generally refers to a device that uses a plastic or glass lens or an equivalent structure as a final light exit element and is used for illumination of an automobile headlamp. The vehicle lamp optical element is an important part of the vehicle lamp module. After light emitted by a light source is emitted via the vehicle lamp optical element, a required light shape of a vehicle lamp can be formed.

[0004] The vehicle lamp module in the prior art has a primary optical element and a secondary optical element. The required light shape is obtained by performing light distribution adjustment twice through the primary optical element and the secondary optical element, compared to light distribution adjustment performed once through only one optical element, performing the light distribution adjustments twice is more flexible, this is because the light shape can be adjusted by means of adjusting light distribution parameters of the two optical elements, there are many adjustable light distribution parameters, for example, a light inlet surface and a light exit surface of the primary optical element and a light inlet surface or a light exit surface of the secondary optical element can be adjusted.

[0005] The prior art has the following shortcomings:

1. Generally, a condenser with a plurality of light-concentrating structures is used as the primary optical element, and a lens is provided as the secondary optical element, this arrangement has a first advantage of increasing the number of components in the vehicle lamp module and increasing the overall size, and a second advantage that relative positions of the two optical elements need to be ensured to be accurate, which has a high requirement for assembling accuracy.
2. When the condenser is used as a low beam optical element, it is also necessary to mount a light-shielding plate in front of the condenser to form a low beam cut-off line, which will result in a complicated structure of the vehicle lamp module and an increase in size.

Summary of the Invention

[0006] For the above-mentioned shortcomings, the technical problem to be solved in the present invention is to provide a vehicle lamp optical element integrating a primary optical element and a secondary optical element into one piece, so that the accuracy problem caused by assembling is avoided.

[0007] The present invention provides a vehicle lamp optical element. One end of the vehicle lamp optical element is provided with a plurality of light-condensing structures, and the other end is provided with a light exit surface; and the light exit surface is an arc-shaped surface that protrudes outwards.

[0008] Preferably, a penetrating partition slot is formed on the vehicle lamp optical element, and the partition slot includes a light outlet surface and a light inlet surface which are disposed oppositely.

[0009] Preferably, extending directions of the light outlet surface and the light inlet surface are the same as an extending direction of the light exit surface.

[0010] Preferably, the vehicle lamp optical element is a flat plate type.

[0011] Preferably, the vehicle lamp optical element is bent and includes a light-condensing channel and a light guide channel which are connected with each other; a reflecting surface is arranged at a junction between the light-condensing channel and the light guide channel; a plurality of light-condensing structures are arranged on a bottom end of the light-condensing channel, a front end of the light guide channel is provided with a light exit surface; and the partition slot penetrates through the light guide channel.

[0012] Preferably, a pointed slot with a V-shaped longitudinal section is formed in the vehicle lamp optical element; and the pointed slot includes a pointed slot reflecting surface away from the light exit surface and a pointed slot side surface close to the light exit surface.

[0013] Preferably, extending directions of the pointed slot reflecting surface and the pointed slot side surface are the same as the extending direction of the light exit surface. Preferably, a shape of a junction between the pointed slot reflecting surface and the pointed slot side surface adapts to a shape of the light shape cut-off line.

[0014] Preferably, the vehicle lamp optical element is a flat plate type.

[0015] Preferably, the vehicle lamp optical element is bent and includes a light-condensing channel and a light guide channel which are connected with each other; a reflecting surface is arranged at a junction between the light-condensing channel and the light guide channel; a plurality of light-condensing structures are arranged on a bottom end of the light-condensing channel, a front end of the light guide channel is provided with a light exit surface; and the pointed slot is formed on the light guide channel. Preferably, the light exit surface is a convex lens

surface or an arc-shaped surface that extends in a left-right direction.

[0016] Preferably, the vehicle lamp optical element includes a low beam part located above and a high beam part located below; ends of the low beam part and the high beam part away from the light exit surface are both provided with a plurality of light-condensing structures; and the other ends are connected up and down into one piece to jointly form the light exit surface.

[0017] Preferably, a groove is formed in a bottom surface of the high beam part; the groove includes a front side surface and a rear side surface which are disposed oppositely; and the front side surface and the rear side surface are connected through a connection surface.

[0018] Preferably, a wedge-shaped gap is arranged between the low beam part and the high beam part, and a width of the gap gradually decreases from a rear end to a front end.

[0019] Preferably, each light-condensing structure is of a light-condensing cup structure with a concave cavity; an external contour of the light-condensing structure is of a curved structure that gradually increases from the rear end to the front end; an opening of the concave cavity is opened towards the rear end; a bottom of the concave cavity is provided with a protrusion that protrudes towards the rear end; or, each light-condensing structure is a solid body, the external contour of which is of a curved structure gradually increasing from the rear end to the front end and a light inlet surface of which is a plane or curved surface; or, each light-condensing structure is a protrusion that protrudes towards the rear end.

[0020] The present invention has the following beneficial effects.

1. The primary optical element and the second optical element of the prior art are integrated into one piece, which can effectively reduce the number of parts. During installation, it is not necessary to ensure the relative position accuracy of the primary optical element and the second optical element, so that the stability of the light shape of the vehicle lamp can be better ensured, and the size of the vehicle lamp module is also reduced.

2. By means of providing the partition slot, secondary light distribution can be achieved in the one-piece optical element, which improves the flexibility of light distribution.

3. By means of providing the pointed slot to replace existing light-shielding plates, a low beam or high beam cut-off line is achieved, the structure of the vehicle lamp module is also simplified, and the overall size is reduced.

4. By means of disposing the low beam part and the high beam part and providing the partition slot on the bottom surface of the high beam part, or providing the wedge-shaped gap between the low beam part and the high beam part, the high beam and low beam functions are simultaneously achieved in the integrated vehicle lamp optical element, so that the function of the vehicle lamp optical element is diversified.

Brief Description of the Drawings

[0021]

FIG. 1 is a three-dimensional diagram of Embodiment I;
FIG. 2 is an optical path diagram of Embodiment I;
FIG. 3 is a three-dimensional diagram I of Embodiment II;
FIG. 4 is a three-dimensional diagram II of Embodiment II;
FIG. 5 is an optical path diagram of Embodiment II;
FIG. 6 is a three-dimensional diagram I of Embodiment III;
FIG. 7 is a three-dimensional diagram II of Embodiment III;
FIG. 8 is an optical path diagram of Embodiment III;
FIG. 9 is a three-dimensional diagram of Embodiment IV;
FIG. 10 is an optical path diagram of Embodiment IV;
FIG. 11 is a three-dimensional diagram I of Embodiment V;
FIG. 12 is a three-dimensional diagram II of Embodiment V;
FIG. 13 is a sectional diagram and an optical path diagram of Embodiment V;
FIG. 14 is an optical path diagram of Embodiment VI;
FIG. 15 is an optical path diagram of Embodiment VII;
FIG. 16 is an optical path diagram of Embodiment VIII;
FIG. 17 is a three-dimensional diagram of Embodiment IX;
FIG. 18 is an optical path diagram of Embodiment IX;
FIG. 19 is a three-dimensional diagram of Embodiment X;
FIG. 20 is an optical path diagram of Embodiment X;
FIG. 21 is a three-dimensional diagram of Embodiment XI;
FIG. 22 is an optical path diagram of Embodiment XI;
FIG. 23 is a three-dimensional diagram of Embodiment XII; and
FIG. 24 is an optical path diagram of Embodiment XII.

Reference signs of elements:

[0022]

1	Vehicle lamp optical element
11	Light-condensing structure
12	Light exit surface
13	Light-condensing channel
14	Light guide channel

15 Reflecting surface
16 Low beam part
17 High beam part
2 Partition slot
21 Light outlet surface
22 Light inlet surface
3 Pointed slot
31 Pointed slot reflecting surface
32 Pointed slot side surface
33 Junction
4 Groove
41 Rear side surface
42 Front side surface
43 Connection surface
44 Front edge
5 Gap
51 Cut-off part

Detailed Description of the Embodiments

[0023] The specific embodiments of the present invention are further described below in detail in combination with the accompanying drawings. These embodiments are merely illustrative of the present invention, and are not intended to limit the present invention.

[0024] In the description of the present invention, it should be noted that directional or positional relationships indicated by the terms "longitudinal", "transverse", "front", "rear", "left", "right", "vertical", "top", "bottom", "inside", "outside" and the like are directional or positional relationships as shown in the drawings, and are only for the purpose of facilitating and simplifying the description of the present invention instead of indicating or implying that devices or elements indicated must have particular orientations, and be constructed and operated in the particular orientations, so that these terms should not be construed as limiting the present invention.

[0025] In the description of the present invention, it should be further noted that unless otherwise explicitly specified and defined, the terms "mounted", "coupled" and "connected" shall be understood broadly, and may be, for example, fixedly connected, or detachably connected, or integrally connected, or directly connected, or indirectly connected through an intermediate medium, or interconnection between two elements. For those of ordinary skill in the art, the specific meanings of the above terms in the present invention can be understood according to specific situations. In addition, in the description of the present invention, unless otherwise indicated, "plurality" means two or more.

[0026] In the following description, the accompanying drawing in FIG. 2 is a reference basis of directions. The direction to the right side, where a light exit surface 12 is located, of the drawing paper is a front direction, the direction to the left side of the drawing paper is a rear direction, the direction to the upper side of the drawing paper is an upper direction, the direction to the lower side of the drawing paper is a lower direction, the direction perpendicular to the drawing paper and facing inward is the left direction, and the direction perpendicular to the drawing paper and facing outward is the right direction. All single-point lines in the drawings represent optical axes.

[0027] The present invention provides a vehicle lamp optical element, the vehicle lamp optical element 1 is made of a light transmittance material, one end of which is provided with a plurality of light-condensing structures 11 and the other end of which is provided with a light exit surface 12, the light exit surface 12 is an arc-shaped surface that protrudes outwards, the light exit surface 12 may be an arc-shaped surface which extends in a left-right direction of the vehicle lamp optical element 1 as shown in FIGS. 1-16, or a convex lens surface as shown in FIGS. 17-22, the convex lens surface here refers to a revolution surface obtained after a light outlet surface cut-off line of a convex lens revolves. In the present invention, the primary optical element and the second optical element of the prior art are made into a whole. During installation, it is not necessary to ensure the relative position accuracy of the primary optical element and the second optical element, so that the stability of a light shape can be better ensured, and the number of parts is also reduced, which is conductive to reducing the size of the vehicle lamp module. Specifically, it can be understood with reference to Embodiments I and II of the present invention.

Embodiment I

[0028] Referring to FIG. 1 and FIG. 2, the vehicle lamp optical element 1 is a flat plate type. Incident light enters the vehicle lamp optical element 1 via light-condensing structures 11, then exits via a light exit surface 12, and is projected in front of a vehicle.

Embodiment II

[0029] Referring to FIGS. 3-5, the vehicle lamp optical element 1 is bent and includes a light-condensing channel 13 and a light guide channel 14 which are connected with each other; and a reflecting surface 15 is arranged at a junction between the light-condensing channel 13 and the light guide channel 14. The light-condensing channel 13 approximately extends in an up-down direction and is provided with a plurality of light-condensing structures 11 at a bottom end, the light guide channel 14 approximately extends in a front-rear direction and is provided with a light exit surface 12 at a front end. The light-condensing structures 11 can receive an incident light and condense the light. The condensed light enters the light-condensing channel 13, is reflected via the reflecting surface 15, then is emitted via the light exit surface 12 at an end part of the light guide channel 14, and is projected in front of a vehicle. Most of the light that is transmitted to the reflecting surface 15 is totally reflected.

[0030] In the vehicle lamp optical element of this em-

bodiment, the light exit surface 12 is set to be an arc-shaped surface that protrudes outwards, that is, the primary optical element and the second optical element of the prior art are made into a whole, it is not necessary to ensure the relative position accuracy of the primary optical element and the second optical element, so that the stability of a light shape can be better ensured; and meanwhile, the bent vehicle lamp optical element is conductive to reducing the size of the vehicle lamp optical element 1 in the front-rear direction, which can further reduce the size of the vehicle lamp module.

[0031] In order to better adjust a light exit shape on the basis of the integrated vehicle lamp optical element, in the present invention, a penetrating partition slot 2 is formed in the vehicle lamp optical element 1, the partition slot 2 includes a light outlet surface 21 and a light inlet surface 22 which are disposed oppositely. Preferably, extending directions of the light outlet surface 21 and the light inlet surface 22 are the same as an extending direction of the light exit surface 12, of course, the extending directions may also be different according to an actual need. The integrated vehicle lamp optical element 1 is divided into two optical parts: a front optical part and a rear optical part by the partition slot 2, the optical part located on the front side corresponds the existing secondary optical element, and the optical part located on the rear side corresponds to the existing primary optical element, so that the vehicle lamp optical element 1 can also achieve secondary light distribution while having the advantages of one piece. The partition slot 2 may be vertically penetrating and/or laterally penetrating, the light outlet surface 21 and the light inlet surface 22 of the partition slot 2 may have various forms, such as a plane, a concave surface, or a convex surface. Specifically, it can be understood with reference to Embodiments III and IV of the present invention.

Embodiment III

[0032] As shown in FIGS. 6-8, the optical lamp optical element 1 is a flat plate type, and the partition slot 2 is a cubic slot. Both of the partition slot and the light exit surface 12 extend in the left-right direction of the vehicle lamp optical element 1. An incident light enters the vehicle lamp optical element 1 via the light-condensing structures 11, then is emitted via the light outlet surface 21, the light inlet surface 22, and the light exit surface 12 in sequence, and is projected in front of the vehicle.

Embodiment IV

[0033] The vehicle lamp optical element of this embodiment is further improved on the basis of Embodiment II. Referring to FIG. 9 and FIG. 10, the partition slot 2 penetrates through the light guide channel 14 from top to bottom and has the same extending direction as that of the light exit surface 12. An incident light enters the light-condensing channel 13 via the light-condensing structures 11, enters the light guide channel 14 after being reflected by the reflecting surface 15, then is emitted via the light outlet surface 21, the light inlet surface 22, and the light exit surface 12 in sequence, and is projected in front of the vehicle.

[0034] In Embodiment III and Embodiment IV, in addition to the advantages of one piece of Embodiment I/II, secondary light distribution can be achieved through the partition slot 2, so as to obtain a desired light shape.

[0035] In order to form a low beam or high beam cut-off line while removing a light-shielding plate, preferably, a pointed slot 3 with a V-shaped longitudinal section is formed in the vehicle lamp optical element 1 of the present invention. The pointed slot 3 includes a pointed slot reflecting surface 31 away from the light exit surface 12 and a pointed slot side surface 32 close to the light exit surface 12. Extending directions of the pointed slot reflecting surface 31 and the pointed slot side surface 32 are the same as or may be different from the extending direction of the light exit surface 12. A shape of a junction 33 between the pointed slot reflecting surface 31 and the pointed slot side surface 32 adapts to a shape of a low beam or high beam cut-off line, so as to form the low beam or high beam cut-off line, the shape is different as the shape of a light shape cut-off line is different, part of the incident light is cut off at the junction 33 and then is emitted from the light exit surface 12 to form the low beam or high beam cut-off line, thereby achieving the purpose of removing the light-shielding plate and reducing the size of the vehicle lamp module. Those skilled in the art can adjust inclination angles of the pointed slot reflecting surface 31 and the pointed slot side surface 32 according to a need. Specifically, it can be understood with reference to Embodiments V to VIII of the present invention.

Embodiment V

[0036] As shown in FIGs. 11-13, the vehicle lamp optical element 1 of this embodiment is a flat plate type, which is further improved on the basis of Embodiment I and is used for realizing a low beam function or an auxiliary low beam function. An upwards sunken pointed slot 3 is formed in a bottom surface of the vehicle lamp optical element. The pointed slot 3 includes a slantways disposed pointed slot reflecting surface 31 and a vertically disposed pointed slot side surface 32, most of the light that is emitted to the pointed slot reflecting surface 31 can be totally reflected. Part of incident light A is emitted to the pointed slot reflecting surface 31 and then is emitted from a top surface of the vehicle lamp optical element 1 after being reflected, and part of incident light B is emitted to the pointed slot reflecting surface 31 and then is emitted from the light exit surface 12 after being reflected. A shape of a junction 33 (namely a top of the pointed slot 3) between the pointed slot reflecting surface 31 and the pointed slot side surface 32 adapts to a shape of a low beam cut-off line, so as to form the low beam cut-off line, the shape is different as the shape of the low beam cut-

off line is different, part of incident light C is cut off at the junction 33 and then is emitted from the light exit surface 12 to form the low beam cut-off line.

Embodiment VI

[0037] As shown in FIG. 14, the vehicle lamp optical element 1 of this embodiment is further improved on the basis of Embodiment I and is used for realizing a high beam function or an auxiliary high beam function. A downwards sunken pointed slot 3 is formed in a top surface of the vehicle lamp optical element 1, part of incident light A is emitted to the pointed slot reflecting surface 31 and then is emitted from a bottom surface of the vehicle lamp optical element 1 after being reflected, part of incident light B is directly emitted from the light exit surface 12. A shape of a junction 33 (namely a bottom of the pointed slot 3) between the pointed slot reflecting surface 31 and the pointed slot side surface 32 adapts to a shape of a high beam cut-off line, so as to form the high beam cut-off line, the shape is different as the shape of the high beam cut-off line is different, part of incident light C is cut off at the junction 33 and then is emitted from the light exit surface 12 to form the high beam cut-off line.

Embodiment VII

[0038] The vehicle lamp optical element of this embodiment is further improved on the basis of Embodiment II and is used for realizing a low beam function or an auxiliary low beam function. As shown in FIG. 15, an upwards sunken pointed slot 3 is formed in a bottom surface of the light guide channel 14. The pointed slot 3 includes a slantways disposed pointed slot reflecting surface 31 and a pointed slot side surface 32, most of the light that is emitted to the pointed slot reflecting surface 31 can be totally reflected. Part of incident light A is reflected by the reflecting surface 15, is then reflected by the pointed slot reflecting surface 31 to a top surface of the vehicle lamp optical element 1, and is emitted, part of incident light B is reflected by the reflecting surface 15 and then is directly emitted from the light exit surface 12. A shape of a junction 33 (namely a top of the pointed slot 3) between the pointed slot reflecting surface 31 and the pointed slot side surface 32 adapts to a shape of a low beam cut-off line, so as to form the low beam cut-off line, the shape is different as the shape of the low beam cut-off line is different, part of incident light C is reflected by the reflecting surface 15, is then cut off at the junction 33, and is emitted from the light exit surface 12 to form the low beam cut-off line.

Embodiment VIII

[0039] The vehicle lamp optical element of this embodiment is further improved on the basis of Embodiment II and is used for realizing a high beam function or an auxiliary high beam function. As shown in FIG. 16, a downwards sunken pointed slot 3 is formed in a top surface of the light guide channel 14, and most of the light that is emitted to the pointed slot reflecting surface 31 can be totally reflected. The light may be cut off at a junction 33 (namely a bottom of the pointed slot 3) between the pointed slot reflecting surface 31 and the pointed slot side surface 32 to form a high beam cut-off line.

[0040] In order to achieve a low beam and high beam integration mode, preferably, the vehicle lamp optical element 1 of the present invention includes a low beam part 16 located above and a high beam part 17 located below, the two parts are in a flat plate type. Ends of the low beam part and the high beam part away from the light exit surface 12 are both provided with a plurality of light-condensing structures 11; and the other ends are connected up and down into one piece to jointly form the light exit surface 12. As shown in FIGS. 17-22, the light exit surface 12 may be a convex lens surface, of course, it may also be an arc-shaped surface that extends in a left-right direction of the vehicle lamp optical element 1. Specifically, it can be understood with reference to Embodiments IX to XII of the present invention.

Embodiment IX

[0041] As shown in FIG. 17 and FIG. 18, a bottom surface of the low beam part 16 and a top surface of the high beam part 17 are connected, a groove 4 is formed in a bottom surface of the high beam part 17, the groove 4 includes a front side surface 42 and a rear side surface 41 which are disposed oppositely and are connected through a connection surface 43. The front side surface 42 and the rear side surface 41 extend in a left-right direction, preferably, the front side surface 42 is closer to the light exit surface 12 with respect to the rear side surface 41. A junction between the connection surface 43 and the front side surface 42 is a front edge 44, the shape of the front edge 44 adapts to a shape of a low beam cut-off line to form the low beam cut-off line, the shape is different as the shape of the low beam cut-off line is different. In the incident light entering from the light-condensing structures 11 of the low beam part 16, one part of incident light A is directly emitted from the light exit surface 12, and the other part of incident light B is cut off by the front edge 44 and is emitted from the light exit surface 12. The two parts of light A and B are used for generating a light shape of a low beam. Incident light C entering via the light-condensing structures 11 of the high beam part 17 can be emitted to the rear side surface 41, refracted to the front side surface 42, refracted to the light exit surface 12, and emitted, so as to generate a light shape of a high beam which is connected to the light shape of the low beam.

Embodiment X

[0042] A difference between Embodiment X and Embodiment IX is that as shown in FIG. 17 and FIG. 18, the

light-condensing structure of Embodiment IX is a light-condensing cup structure with a concave cavity; an external contour of the light-condensing structure is of a curved structure that gradually increases from the rear end to the front end; an opening of the concave cavity towards the rear end; and a bottom of the concave cavity is provided with a protrusion that protrudes towards the rear end. It can be known with reference to FIG. 19 and FIG. 20 that the light-condensing structure 11 of Embodiment X is a protrusion that protrudes towards the rear end. The specific working principle of Embodiment X is the same as that of Embodiment IX, and repeated descriptions are not made here.

Embodiment XI

[0043] As shown in FIG. 21 and FIG. 22, rear ends of the low beam part 16 and the high beam part 17 of Embodiment XI are separated, and front ends are connected into a whole, a wedge-shaped gap 5 is reserved between a bottom surface of the low beam part 16 and a top surface of the high beam part 17, a width of the gap 5 gradually decreases from the rear end to the front end, the frontmost end of the gap 5 is a cut-off part 51, the shape of which adapts to a shape of a low beam cut-off line to form the low beam cut-off line, the shape is different according to different shapes of the low beam cut-off line. In the incident light entering from the light-condensing structures 11 of the low beam part 16, one part of incident light is directly emitted from the light exit surface 12, and the other part of incident light is cut off by the cut-off part 51 and is emitted from the light exit surface 12. The two parts of light are used for generating a light shape of a low beam. The incident light entering via the light-condensing structures 11 of the high beam part 17 can be directly emitted from the light exit surface 12 to generate a light shape of a high beam which is connected to the light shape of the low beam.

Embodiment XII

[0044] As shown in FIG. 23 and FIG. 24, a bottom surface of the low beam part 16 and a top surface of the high beam part 17 of Embodiment XII are connected, and a wedge-shaped gap 5 is formed in a junction therebetween, a width of the gap 5 gradually decreases from the rear end to the front end, the frontmost end of the gap 5 is a cut-off part 51, the shape of which adapts to a shape of a low beam cut-off line to form the low beam cut-off line the shape is different according to different shapes of the low beam cut-off line. The specific working principle of Embodiment XII is the same as that of Embodiment XI, and repeated descriptions are not made here. In the above-mentioned Embodiments I to XII, the light-condensing structures 11 have various representation forms. For example, each light-condensing structure may be of the light-condensing cup structure with the concave cavity as shown in FIG. 1 in Embodiment I, the external contour is of the curved structure that gradually increases from the rear end to the front end; the opening of the concave cavity faces a side away from the light exit surface 12; the bottom of the concave cavity is provided with the protrusion that protrudes towards the side away from the light exit surface 12; or, no concave cavity is formed inside, and the light-condensing structure is only the solid body, the external contour of which is of the curved structure gradually increasing from the rear end to the front end and the light inlet surface of which is a plane or curved surface; or, the light-condensing structure may also be the protrusion arranged at an end part of the vehicle lamp optical element 1 as shown in FIG. 20 in Embodiment X. There may be one row or multiple rows of light-condensing structures 11 which can well collect and collimate the light emitted by a light source, thereby increasing the utilization rate of the light.

[0045] In conclusion, the present invention has the following beneficial effects.

1. The primary optical element and the second optical element of the prior art are made into a one piece, which can effectively reduce the number of parts, during installation, it is not necessary to ensure the relative position accuracy of the primary optical element and the second optical element, so that the stability of the light shape of the vehicle lamp can be better ensured, and the size of the vehicle lamp module is also reduced.

2. By means of providing the partition slot, secondary light distribution can be achieved in the one-piece optical element, which improves the flexibility of light distribution.

3. By means of providing the pointed slot to replace existing light-shielding plates, a low beam or high beam cut-off line is achieved, the structure of the vehicle lamp module is also simplified, and the overall size is reduced.

4. By means of disposing the low beam part and the high beam part and the providing the partition slot on the bottom surface of the high beam part, or reserving the wedge-shaped gap between the low beam part and the high beam part, the high beam and low beam functions are simultaneously achieved in the one-piece vehicle lamp optical element, so that the function of the vehicle lamp optical element is diversified.

[0046] The above is only the preferred embodiments of the present invention. It should be noted that those of ordinary skill in the art can further make several improvements and substitutions without departing from the technical principles of the present invention. These improvements and substitutions shall also all fall within the protection scope of the present invention.

Claims

1. A vehicle lamp optical element, **characterized in that** one end of the vehicle lamp optical element (1) is provided with a plurality of light-condensing structures (11), and the other end is provided with a light exit surface (12); and the light exit surface (12) is an arc-shaped surface that protrudes outwards; the vehicle lamp optical element (1) comprises a low beam part (16) located above and a high beam part (17) located below; ends of the low beam part and the high beam part away from the light exit surface (12) are both provided with a plurality of light-condensing structures (11); and the other ends are connected up and down into one piece to jointly form the light exit surface (12); a groove (4) is formed in a bottom surface of the high beam part (17); the groove (4) comprises a front side surface (42) and a rear side surface (41) which are disposed oppositely; and the front side surface and the rear side surface are connected through a connection surface (43).

2. The vehicle lamp optical element according to claim 1, **characterized in that** the light exit surface (12) is a convex lens surface or an arc-shaped surface that extends in a left-right direction.

3. The vehicle lamp optical element according to claim 1, **characterized in that** each light-condensing structure (11) is of a light-condensing cup structure with a concave cavity; an external contour of the light-condensing structure is of a curved structure that gradually increases from the rear end to the front end; an opening of the concave cavity is opened towards the rear end; a bottom of the concave cavity is provided with a protrusion that protrudes towards the rear end; or, each light-condensing structure (11) is a solid body, the external contour of which is of a curved structure gradually increasing from the rear end to the front end and a light inlet surface of which is a plane or curved surface; or, each light-condensing structure (11) is a protrusion that protrudes towards the rear end.

4. The vehicle lamp optical element according to claim 1, **characterized in that** a bottom surface of the low beam part (16) and a top surface of the high beam part (17) are connected.

5. The vehicle lamp optical element according to claim 1, **characterized in that** the front side surface (42) and the rear side surface (41) extend in the left-right direction.

6. The vehicle lamp optical element according to claim 1, **characterized in that** a junction between the connection surface (43) and the front side surface (42) is a front edge (44); and the shape of the front edge (44) adapts to a shape of a low beam cut-off line.

7. The vehicle lamp optical element according to claim 1, **characterized in that** both of the low beam part (16) and the high beam part (17) are in a flat plate type.

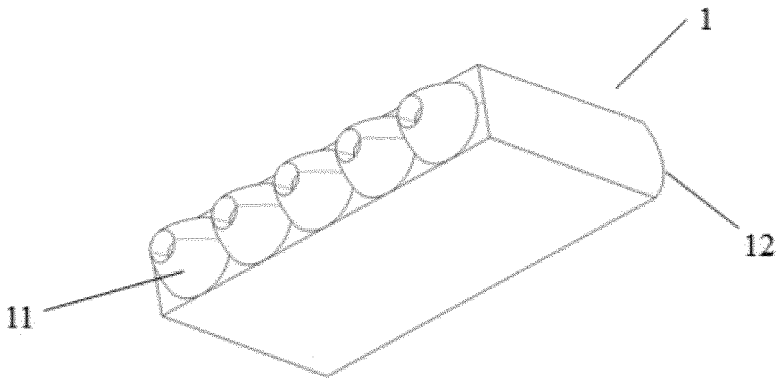


FIG. 1

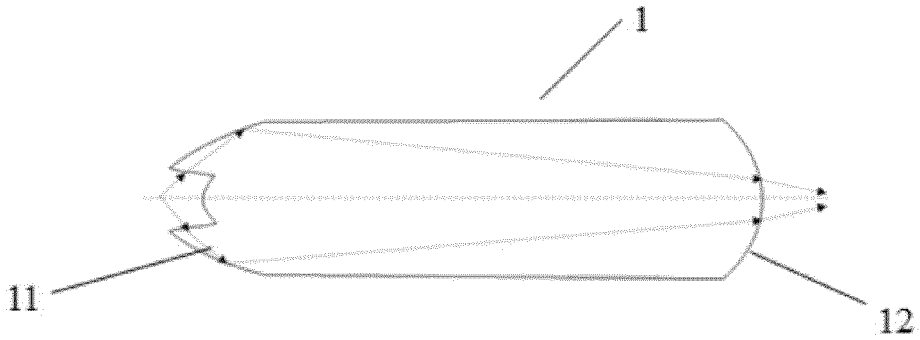


FIG. 2

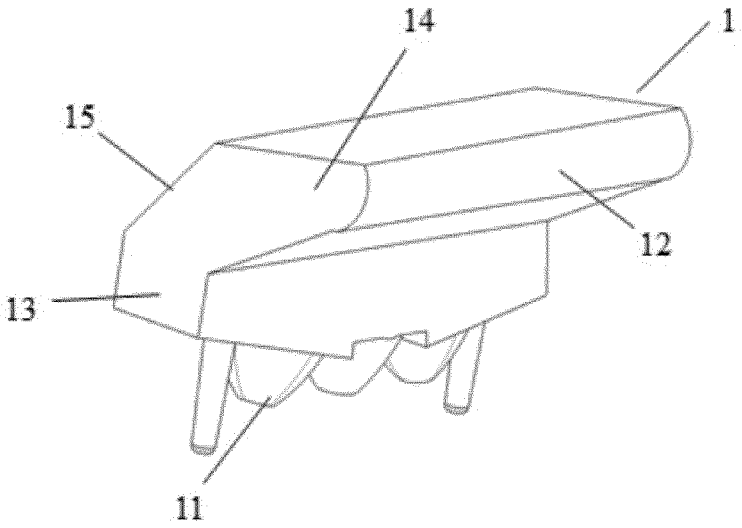
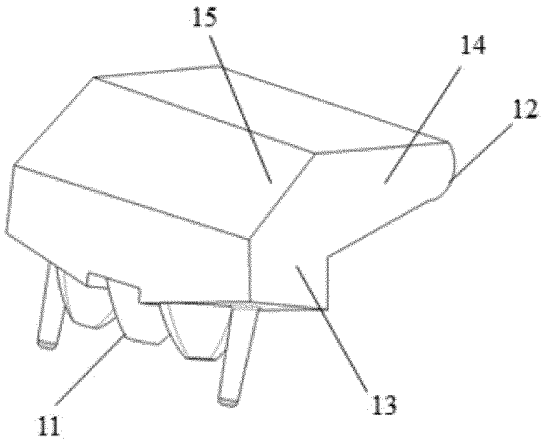


FIG. 3



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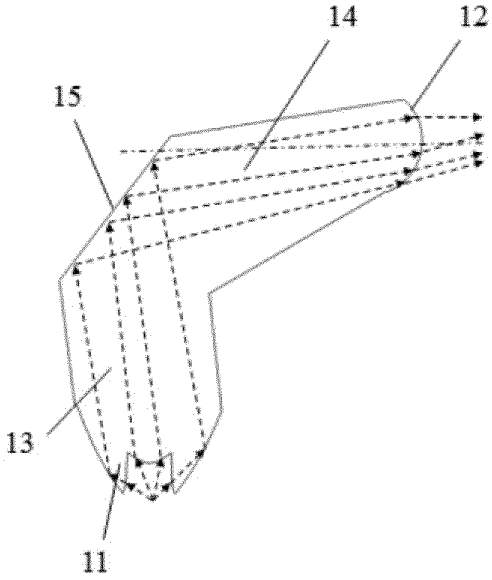
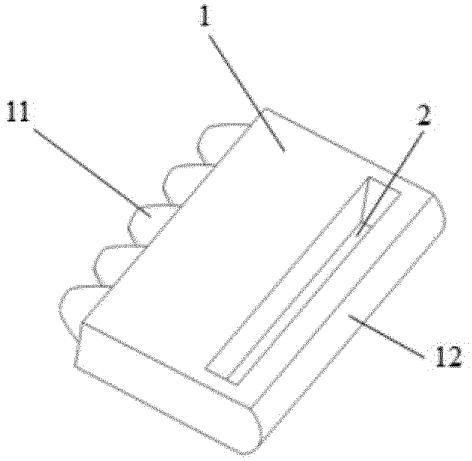


FIG. 5



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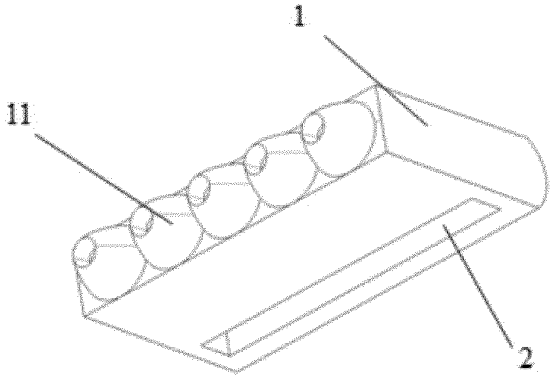

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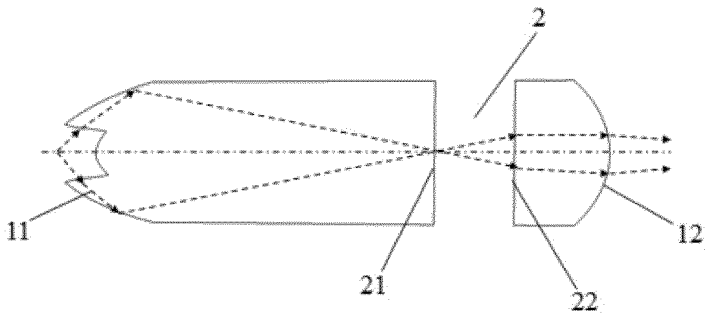


FIG. 8

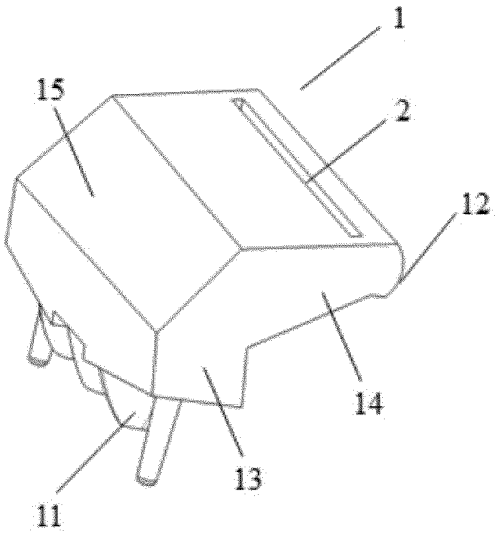


FIG. 9

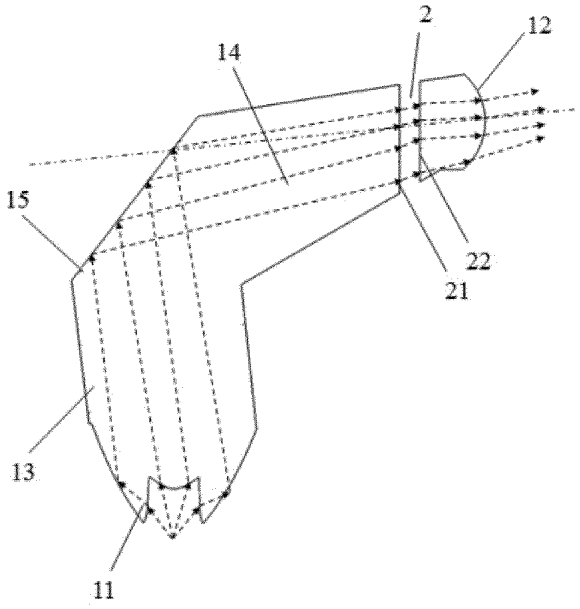


FIG. 10

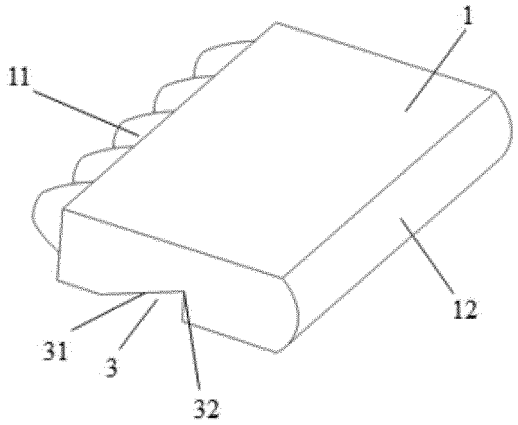
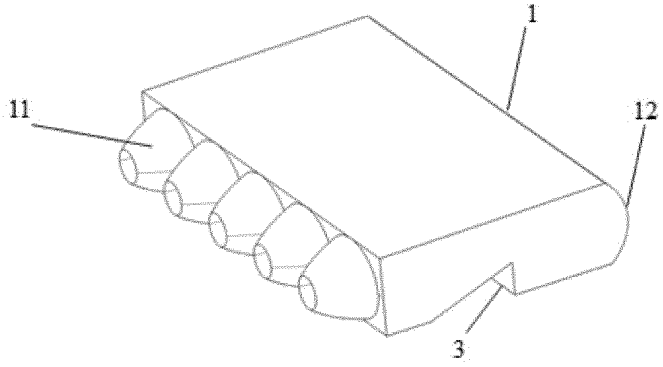


FIG. 11



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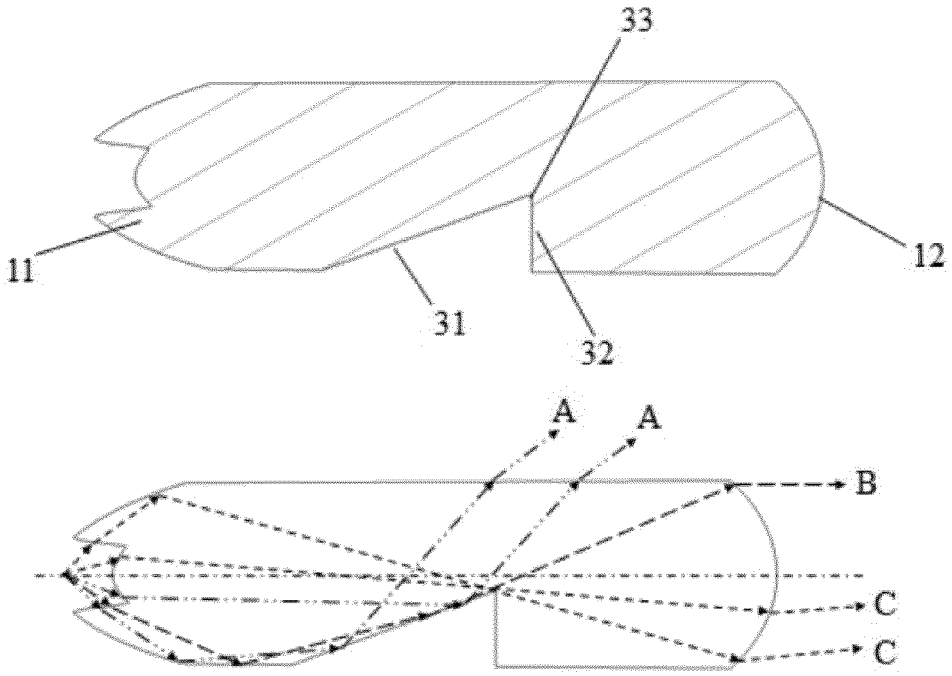


FIG. 13

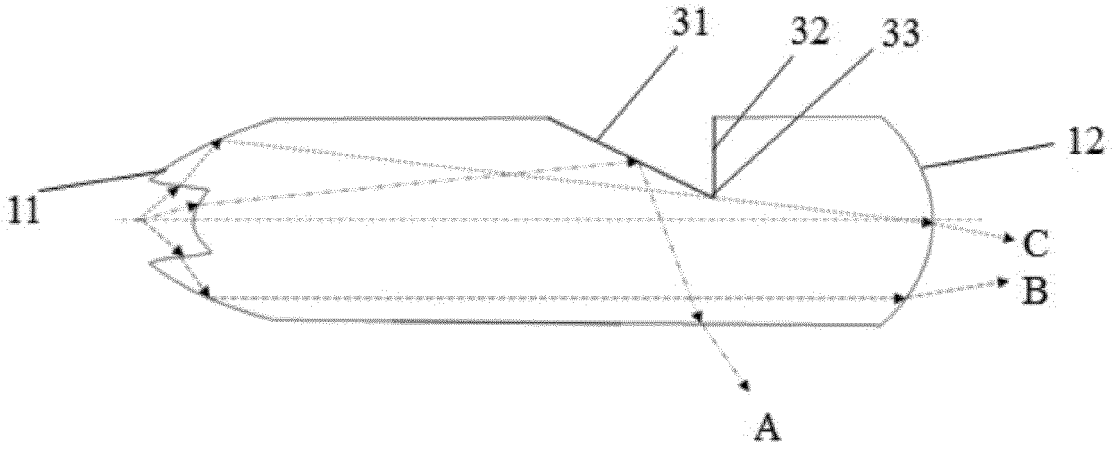


FIG. 14

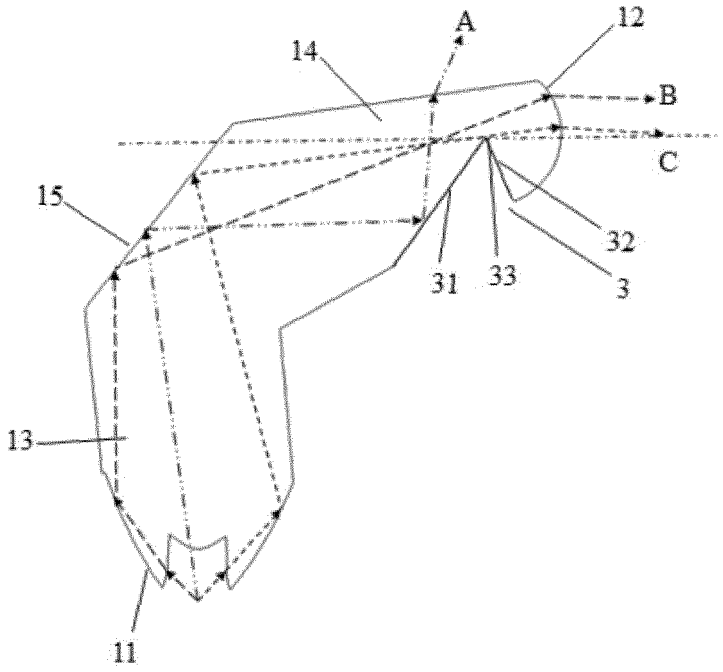


FIG. 15

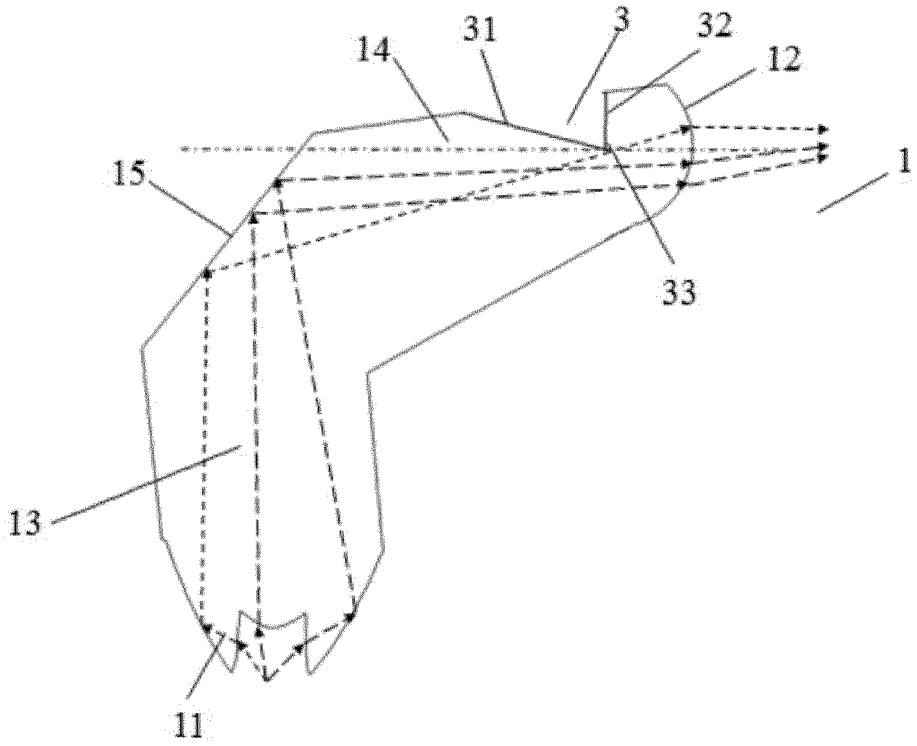


FIG. 16

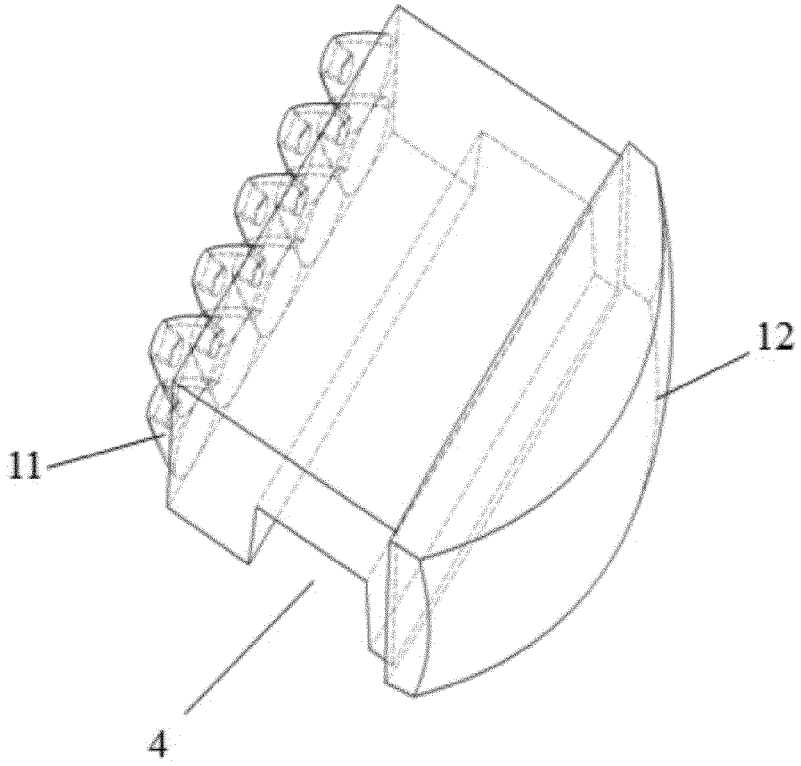


FIG. 17

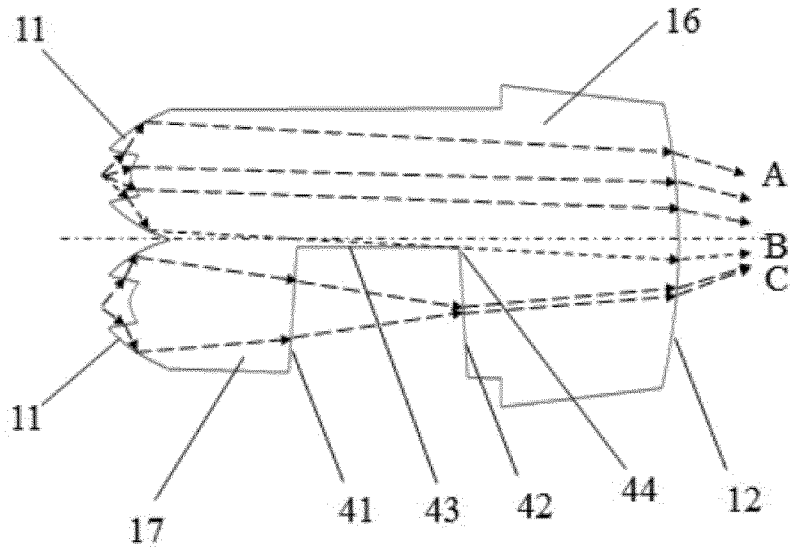


FIG. 18

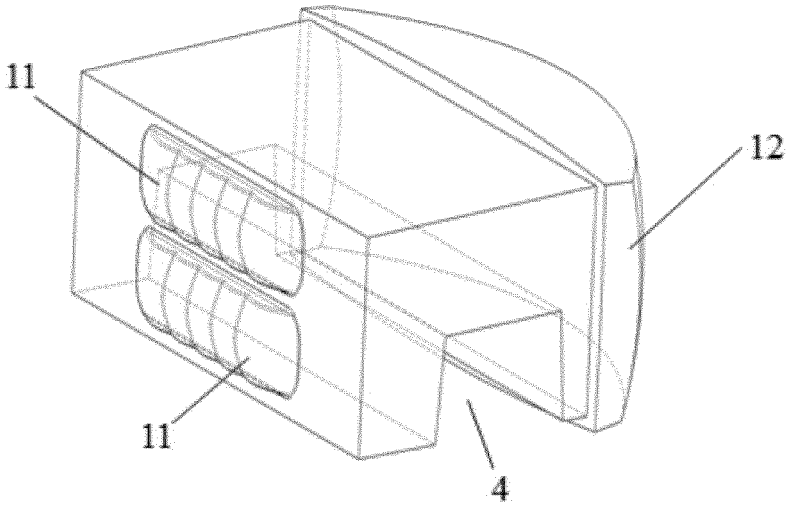


FIG. 19

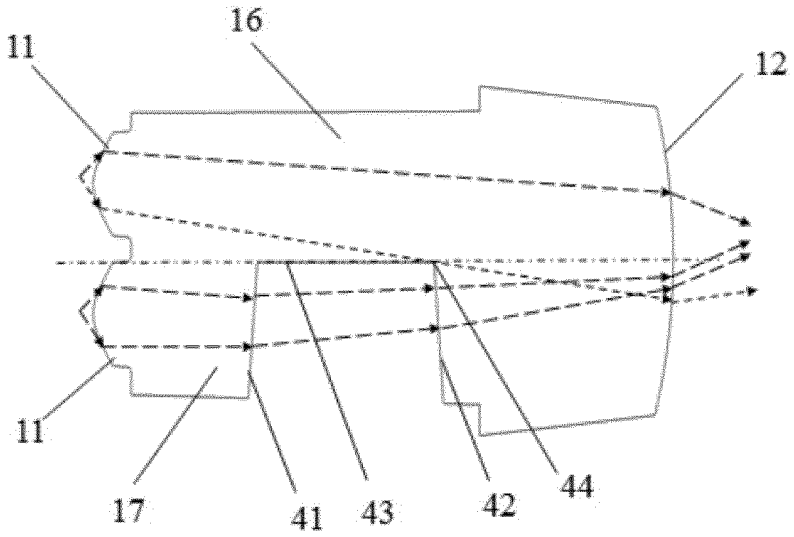
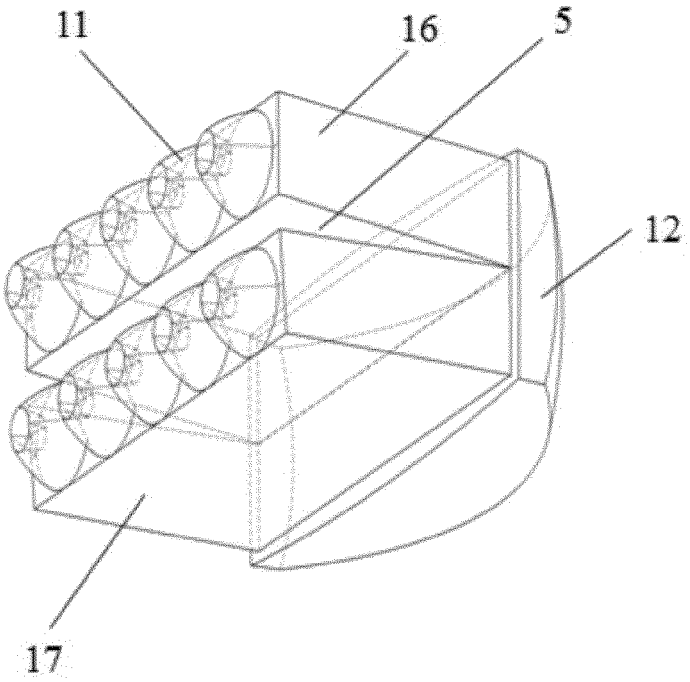


FIG. 20



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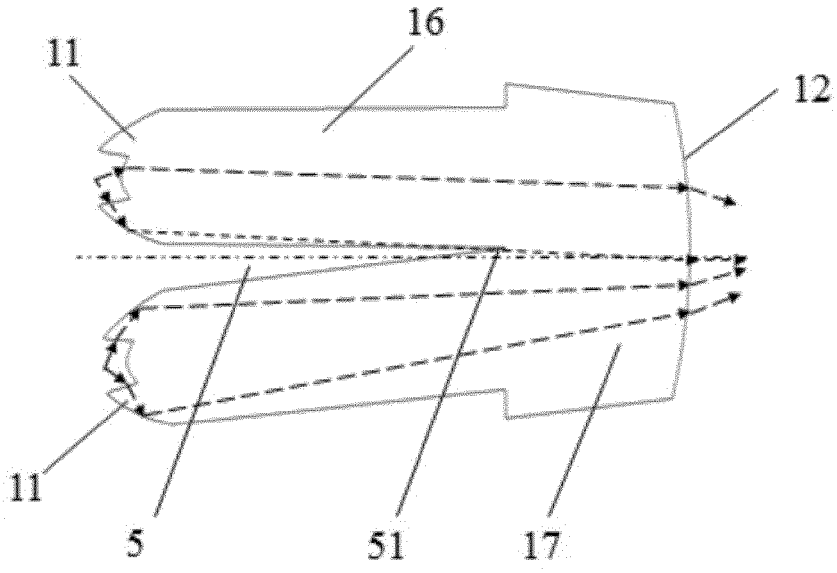

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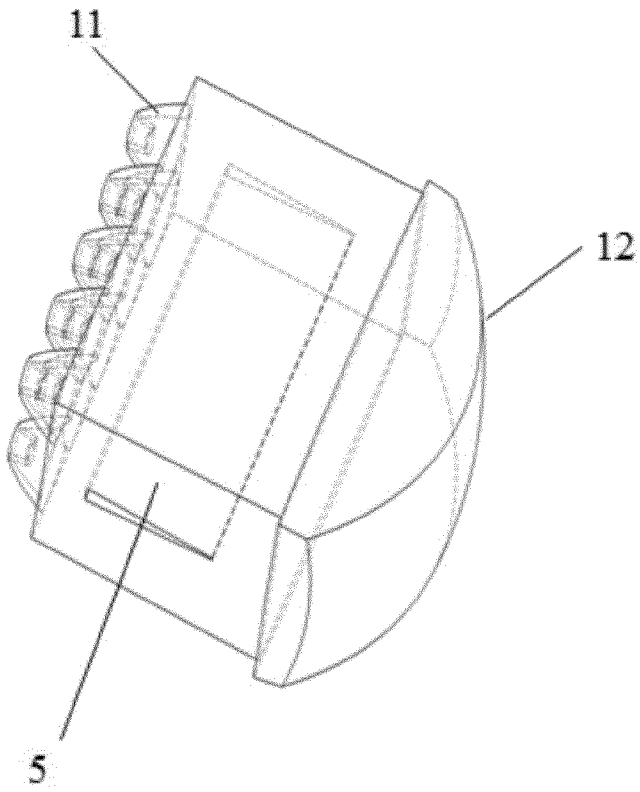

FIG. 23

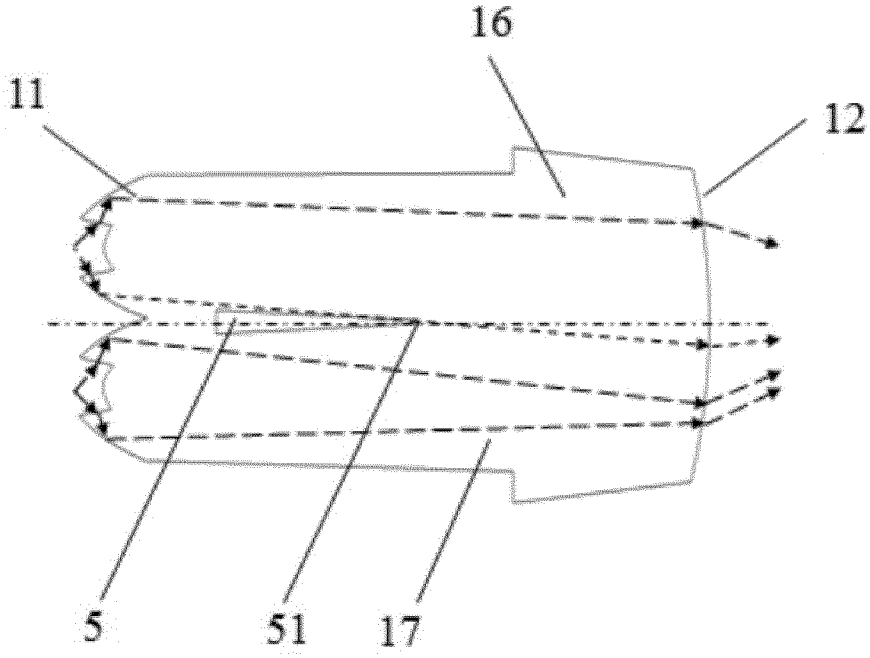

FIG. 24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/122163

A. CLASSIFICATION OF SUBJECT MATTER

F21S 41/30(2018.01)i; F21S 41/40(2018.01)i; F21S 41/24(2018.01)i; F21S 41/25(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; F21V

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; EPODOC; WPI; CNKI: 车, 灯, 照明, 远光, 近光, 截止, 一体, 聚光, 准直, 入射, 出射, 透镜, automobile, car, lamp, light, high, low, beam, far, cut-off, integrate, focus, collimate, incidence, emergence, lens

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 210601445 U (HUAYU VISION TECHNOLOGY (SHANGHAI) CO., LTD.) 22 May 2020 (2020-05-22) description, paragraphs [0080], [0103]-[0105], figures 17-20	1-7
X	CN 108302473 A (VALEO VISION) 20 July 2018 (2018-07-20) description, paragraphs [0004]-[0042], and figures 1-5	1-7
A	CN 205991417 U (SHANGHAI KOITO AUTOMOTIVE LAMP CO., LTD.) 01 March 2017 (2017-03-01) entire document	1-7
A	WO 2015178155 A1 (STANLEY ELECTRIC CO., LTD.) 26 November 2015 (2015-11-26) entire document	1-7
A	CN 107366870 A (SHANGHAI KOITO AUTOMOTIVE LAMP CO., LTD.) 21 November 2017 (2017-11-21) entire document	1-7
A	CN 208919987 U (GREAT WALL MOTOR CO., LTD.) 31 May 2019 (2019-05-31) entire document	1-7

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

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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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
28 December 2020	**21 January 2021**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/122163

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 109140377 A (CHANGSHU INSTITUTE OF TECHNOLOGY) 04 January 2019 (2019-01-04) entire document	1-7
A	CN 205749972 U (JIAXING HELLA LIGHTING CO., LTD.) 30 November 2016 (2016-11-30) entire document	1-7
A	US 2017205044 A1 (STANLEY ELECTRIC CO., LTD.) 20 July 2017 (2017-07-20) entire document	1-7

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2020/122163

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	210601445	U	22 May 2020	None			
CN	108302473	A	20 July 2018	US	10344949	B2	09 July 2019
				EP	3299703	A1	28 March 2018
				US	10082272	B2	25 September 2018
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				FR	3056688	A1	30 March 2018
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				EP	3299703	B1	19 June 2019
				FR	3056688	B1	02 November 2018
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				EP	3333477	A1	13 June 2018
				EP	3150905	A1	05 April 2017
				US	2019301697	A1	03 October 2019
				US	2017211771	A1	27 July 2017
				US	10352523	B2	16 July 2019
CN	107366870	A	21 November 2017	None			
CN	208919987	U	31 May 2019	None			
CN	109140377	A	04 January 2019	CN	208871529	U	17 May 2019
CN	205749972	U	30 November 2016	None			
US	2017205044	A1	20 July 2017	US	10414330	B2	17 September 2019
				JP	2017130322	A	27 July 2017

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 201921809909 **[0001]**