Oct. 25, 1938. E. A. HOWARD ET AL. 2,134,558

VEHICLE HEAD LAMP

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Fig.1.

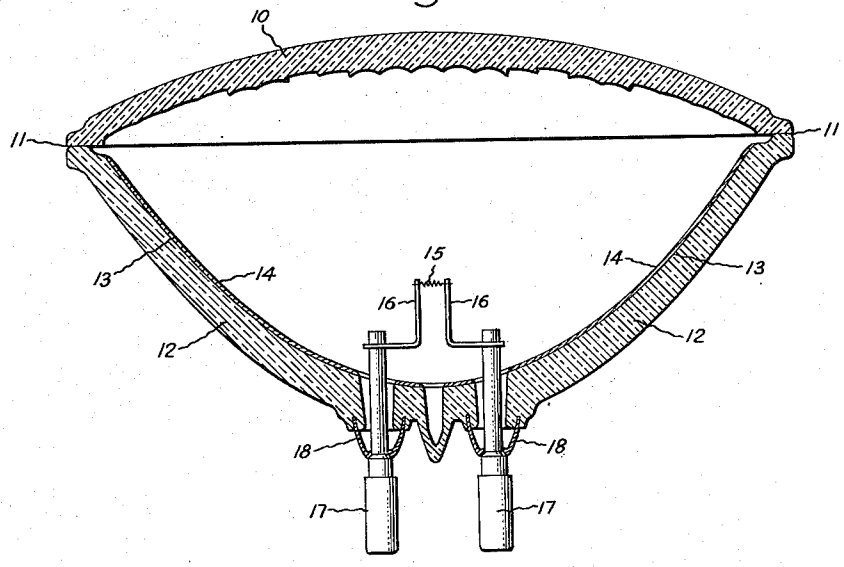

Fig.2.

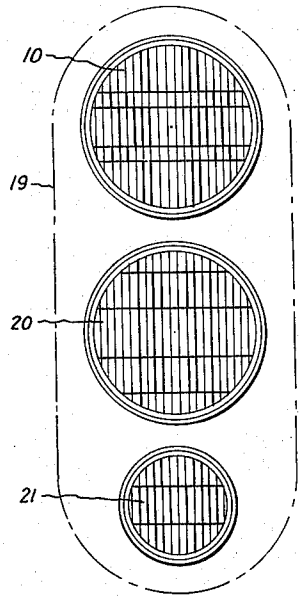

Fig.3.

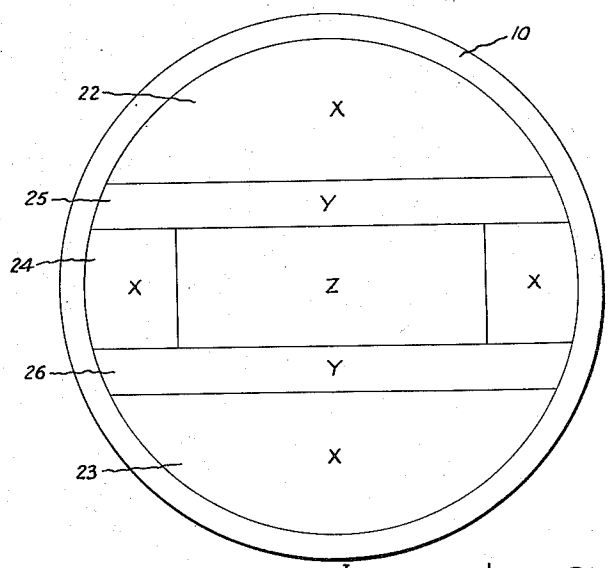

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Fig. 4.

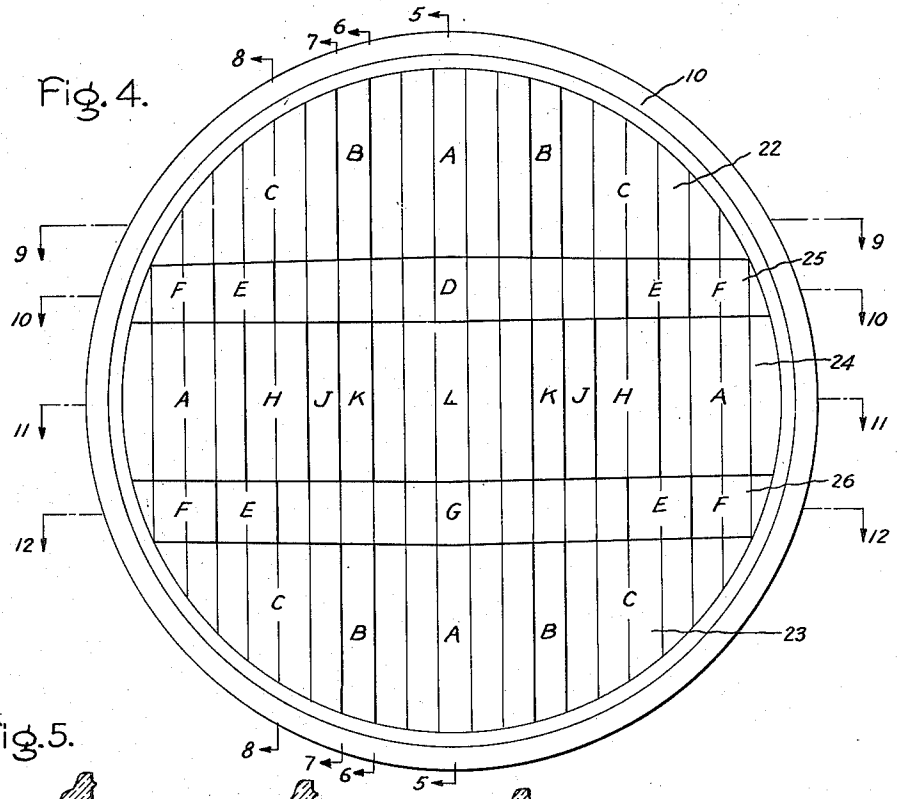


Fig. 5.

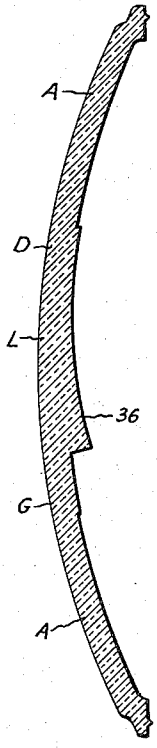


Fig. 6.

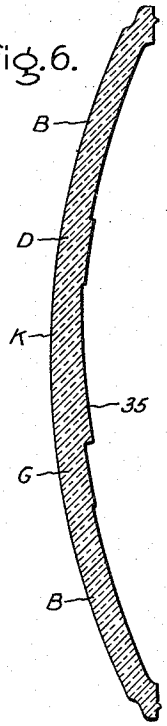


Fig. 7.

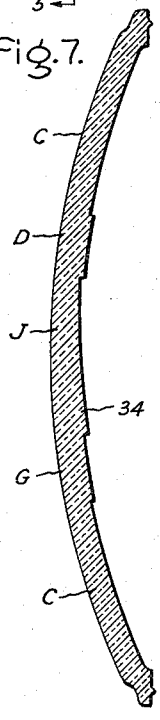
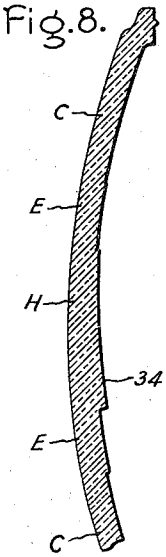


Fig. 8.



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Filed March 23, 1937 3 Sheets-Sheet 3

Fig. 9.

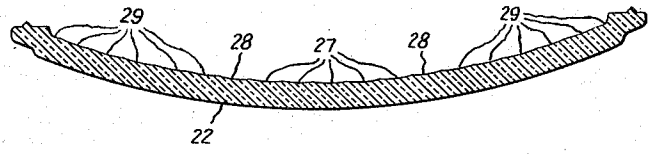


Fig. 10.

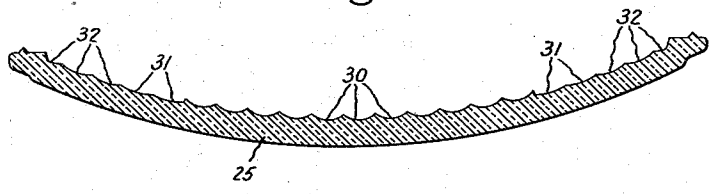


Fig. 11.

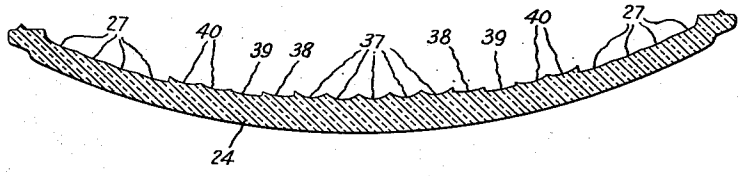


Fig. 12.

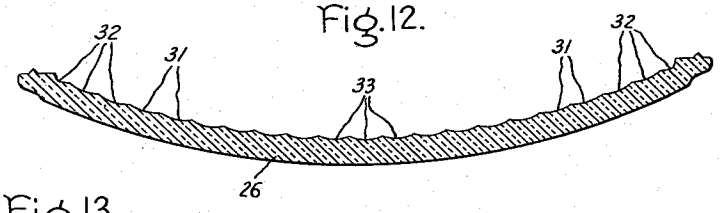
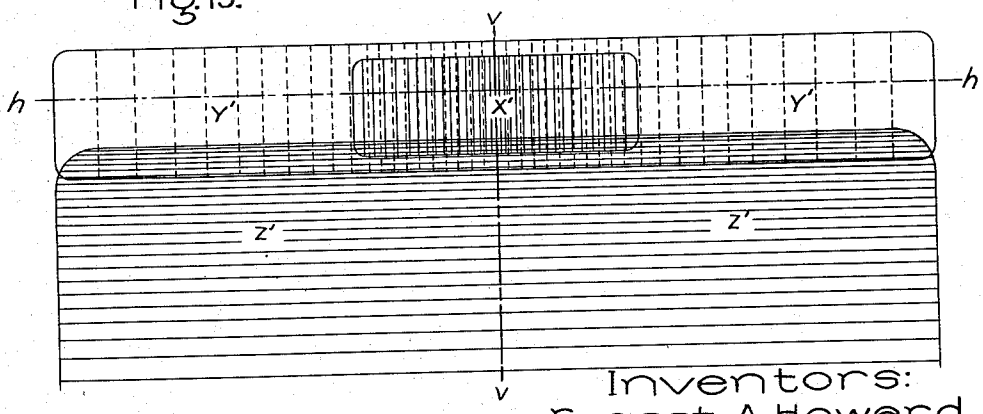


Fig. 13.



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UNITED STATES PATENT OFFICE

2,134,558

VEHICLE HEAD LAMP

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Application March 23, 1937, Serial No. 132,530

7 Claims. (Cl. 240—41.4)

Our invention relates to vehicle headlights, and more particularly to light directing elements or lenses therefor. Still more particularly, our invention pertains to a design of lens adapted to produce a country driving beam, e. g., one that will project the rays of light a maximum distance forwardly of the vehicle while at the same time maintaining a uniform and symmetrical distribution of light across the entire width of the highway to reveal curves therein and objects at the sides thereof.

Our design of lens has been developed in conjunction with, and is particularly applicable to vehicle headlights of the reflector lamp type such as is described and claimed in co-pending application Serial No. 68,713, Daniel K. Wright, filed March 13, 1936. In lamps of this type a single filament or concentrated light source is accurately positioned at the focal point of the parabolic reflector portion of the lamp, thereby resulting in the projection of a powerful and efficient beam of light. When such a lamp is used to project only one type of beam, such as a country driving, country meeting or city driving beam, the lens with which such lamp is equipped can be so designed as to produce the most efficient beam of the single type desired.

A country driving beam should comprise a high intensity central portion together with gradually tapering side portions wide enough to sufficiently illuminate curves in the highway and objects at the side thereof, and downwardly and sidewardly tapering portions to illuminate the foreground. The high intensity central portion should extend a few degrees above the horizontal to take care of minor loading variations, to illuminate the highway the maximum distance in front of the vehicle while the latter is undergoing longitudinal rocking motions, such as are caused by bumps or depressions in the roadway, and also to illuminate inclines when approaching the same.

One object of our invention is the provision of a headlight lens which will produce an efficient country driving beam fulfilling the above-mentioned requirements. Another object is the design of a country driving lens which utilizes the rays of light passing through only the top, bottom and side sections thereof for the production of the high intensity central portion of the beam, these sections being less sensitive to filament placement variations. A further object is the provision of downwardly bending prisms at the center section of such a lens for the purpose of depressing the rays of light passing therethrough to thereby illuminate that portion of the highway immediately in front of the vehicle. A still further object is the provision of divers vertically extending, horizontal light spreading flutes so situated within the lens and so graded in degree of spread as to provide the necessary width of beam to adequately illuminate curves in the highway and objects at the side thereof. Other objects and advantages of our invention will be apparent from the following description of an embodiment thereof and from the accompanying drawings, in which:

Fig. 1 is a horizontal sectional view of a reflector lamp of the type disclosed in the previously mentioned co-pending application Serial No. 68,713, equipped with our novel design of country driving lens; Fig. 2 is a diagrammatic view showing the manner in which a reflector lamp equipped with our country driving lens may be mounted in a holder together with other similar lamps for projecting country driving, country meeting, city driving or other types of beams; Fig. 3 is a diagrammatic front elevational view of our lens showing the manner in which the area thereof is divided into sections for the production of certain portions of the composite country driving beam; Fig. 4 is a front elevation of a country driving lens comprising our invention; Figs. 5, 6, 7 and 8 are vertical sectional views taken on the lines 5—5, 6—6, 7—7, and 8—8 respectively of Fig. 4; Figs. 9, 10, 11 and 12 are horizontal sectional views taken on the lines 9—9, 10—10, 11—11, and 12—12 respectively of Fig. 4; and Fig. 13 is a view showing the beam pattern produced by one of our country driving lenses when mounted on a reflector lamp of the type shown in Fig. 1.

Referring to the drawings, there is shown in Fig. 1 a reflector lamp comprising a lens 10, made in accordance with our invention, sealed at 11 to a preformed reflector portion 12 in the manner described in the previously referred to co-pending application. The said reflector portion 12 is made of pressed glass, the interior surface 13 of which is preferably of paraboloidal shape and is covered with a coating 14 constituting a reflecting surface. A concentrated light source comprising a horizontally disposed bar filament 15, similar to that disclosed in U. S. Patent No. 2,012,806, Brown et al., is mounted within the lamp by lead wires 16, terminal members 17, and metal cups 18, and is accurately positioned at the focal point of the reflector surface 14. The greater accuracy with which the pressed glass paraboloidal interior surface 13 can be formed over the conventional stamped metal reflectors,

together with the accurate disposition of the concentrated light source 15 at the focal point of the reflector surface 14, results in the projection of a powerful and efficient beam of light.

When such a lamp is utilized for the projection of a single type of beam only, such as a country driving beam, the lens can be so designed as to produce the proper distribution of the light rays for such beam alone. Fig. 2 illustrates diagrammatically one manner in which a plurality of reflector lamps of the type described above, each equipped with a different lens designed to produce a different type of beam, may be mounted in a holder 19. Lens 10 is a country driving lens made in accordance with our invention, while lens 20 is adapted to produce a country meeting beam, and lens 21 a city driving beam. The lenses 20 and 21 may be of the type shown and claimed in our co-pending applications Serial Nos. 132,531 and 132,532, respectively, of even date. Although we have shown all three lamps mounted in a single holder, they may, if desired, be separately mounted, or grouped in a variety of ways. Thus, the country meeting lamps may be mounted on or in the front fenders of an automobile to better indicate the width of the car to approaching drivers, while the country and city driving lamps may be grouped together nearer the center of the car.

Referring to Figs. 3 and 4, the lens 10 constituting our invention comprises a plurality of substantially horizontal sections, consisting of a top section or segment 22, a bottom section or segment 23, a center section 24, and upper and lower intermediate sections 25 and 26 respectively. Each of said sections consists of a plurality of vertically extending light spreading flutes formed on the rear surface of the lens, certain of which are of different degrees of spread. In addition, the central portion of the center section 24 is formed with a series of downwardly bending prisms for the purpose of depressing the rays of light projected therethrough.

In a country driving beam, the most important constituent thereof is the high intensity portion, which should be relatively narrow both in vertical and horizontal extent. To obtain a beam of narrow vertical spread the images making up the same must, of necessity, be taken from those portions of the reflector projecting the smallest images of the filament or light source, which images are more easily controlled than the larger ones. The smallest images of the light source will be projected by those portions of the reflector the farthest distance from the light source. It is for this reason that the images projected through the top and bottom sections 22 and 23 respectively of the lens 10 and through the extreme outer or side areas of the center section 24, as indicated at X in Fig. 3, are utilized to make up the high intensity portion of the composite country driving beam.

Inasmuch as the horizontal extent of the intense portion of the composite country driving beam should be relatively small, the degree of spread of the flutes in the top and bottom sections 22, 23 and the side areas of the center section 24 should be very little. Accordingly the top and bottom sections 22, 23 are each composed of a central portion or area A consisting of a plurality of flutes 27 (Fig. 9) having a spread of preferably 6°, intermediate areas B each consisting of a single flute 28 having a spread preferably of 8°, and side areas C each consisting of a plurality of flutes 29 having a spread of preferably 4°. The extreme side portions of the center section 24 likewise comprise the areas A each consisting of a plurality of flutes 27 (Fig. 11) preferably of 6° spread. The above described areas A, B and C, together with their corresponding degree of flute spread, are tabulated below in Table I. The concentrated beam of light or high intensity portion produced by the areas A, B, and C (indicated by X in Fig. 3) and shown in cross section at X' in the beam pattern (Fig. 13), is disposed symmetrically about a vertical line *v—v* which intersects the axis of the associated reflector. By aiming the reflector axis downward a half degree or so, the center of the high intensity portion will be located a like amount below a horizontal line *h—h* passing through the focal point of the reflector, so that the top surface of such high intensity portion extends a degree or two above said horizontal line. In this manner illumination of the highway a maximum distance in front of a fast moving vehicle is assured under all conditions of loading and longitudinal rocking motion, or when approaching an incline.

The widespread graduated-intensity portion of the composite country driving beam, indicated at Y' in Fig. 13, should be of slightly greater vertical extent than the high intensity portion, and of considerably greater width or horizontal spread. Of the lens area remaining available, the area represented at Y in Fig. 3, comprising the intermediate sections 25, 26, is best suited for the production of the widespread graduated intensity portion Y' of the beam, for the reason that the filament images projected therethrough are the next smallest in size to those projected through the area X. To give the desired amount of horizontal width to the wide spreading beam portion Y', the flutes formed in the intermediate sections 25, 26 should have a considerable degree of spread. Referring to Figs. 4 and 10, the upper intermediate section 25 is composed of a central area D consisting of a plurality of flutes 30 having a spread of preferably 32°, intermediate areas E each consisting of two flutes 31 having a spread of preferably 12°, and side areas F each consisting of a plurality of flutes 32 having a spread preferably of 18°. The lower intermediate section 26 of our lens is similar in horizontal section (Fig. 12) to the upper intermediate section 25 except for the central area G, the flutes 33 of which differ from flutes 30 of area D in degree of spread, flutes 33 having a spread of 18° as compared to the 32° spread of flutes 30. The various degrees of spread of flutes 30, 31, 32 and 33 included in areas D, E, F and G are listed in Table I below. The particular construction and arrangement we have shown of these flutes 30, 31, 32 and 33 results in the production of a relatively thin plate or beam of light Y' which smoothly tapers off in intensity towards the sides thereof, and is of sufficient width and height to reveal curves in the highway and objects at the sides thereof. Like the high intensity portion X', the plate of light Y' is also disposed symmetrically about the vertical line *v—v* (Fig. 13) while the top surface thereof preferably extends a slight distance above the top surface of the high intensity portion X'.

Areas A, B, C, D, E, F and G having been utilized to produce either the high intensity portion X' or the widespread graduated intensity portion Y' of the composite country driving beam, the remaining areas H, J, K and L, designated as the middle section Z in Fig. 3, are used to furnish the illumination immediately in front of the vehicle, which illumination is graduated in

intensity both sideward and downward. These areas H, J, K and L are in the zone of large images, i. e., where the rays of light project the largest filament images of any projected through the lens. These large images, as previously stated, are difficult to control, and for this reason the areas H, J, K and L are all formed with downwardly bending prisms on the rear surface of the lens for the purpose of depressing or bending down the light rays projected therethrough. These prisms further serve to direct the light rays passing through the same immediately in front of the vehicle to thereby illuminate the foreground. Referring to Figs. 5 to 8 inclusive, it will be seen that areas H and J are each formed with downwardly bending prisms **34** of preferably 3°; areas K each with a downwardly bending prism **35** of preferably 4°; and area L with a downwardly bending prism **36** preferably graded from 3° at the top thereof to 10° at the bottom. Thus the maximum amount of downward bending of the light rays passing through areas H, J, K and L occurs at the central area L, where the images are largest and most difficult to control.

The areas H, J, K and L are also formed with light spreading flutes on the rear surface of the lens, as shown in Fig. 11. These flutes distribute the downwardly bent rays of light across the width of the highway to entirely illuminate the same. Area L comprises a plurality of flutes **37** having a spread of preferably 32°; areas K each comprise a single flute **38** having a spread of preferably 10°; areas J each comprise a single flute **39** having a spread of preferably 6°; and areas H each comprise a pair of flutes **40** having a spread of preferably 18°. The following table lists the various areas of the lens together with the corresponding degree of both the downward prism and flute spread:

Table I

Area	Prism	Spread
	Degrees	*Degrees*
A	0	6
B	0	8
C	0	4
D	0	32
E	0	12
F	0	18
G	0	18
H	3	18
J	3	6
K	4	10
L	Graded 3 to 10	32

As is true with the portions X' and Y' of the country driving beam, the portion Z' produced by the areas H, J, K and L of the lens, is likewise disposed symmetrically about the vertical line *v—v* (Fig. 13) while the top surface thereof is located a few degrees below the horizontal line *h—h*, but slightly overlapping both the high intensity portion X' and the wide spreading portion Y'. In addition, the specific construction and arrangement we have made of the prisms and flutes included within the area Z of the lens causes the portion Z' of the beam pattern to be graduated in intensity both sideward and downward.

The headlight lens described above is adapted to produce a highly efficient country driving beam. Our lens is simple in construction and positive in operation, and when mounted in a headlight, and especially in one of the type described herein, a strong and powerful beam of light is projected therefrom which beam clearly illuminates the highway a maximum distance in front of the vehicle at all times, thus reducing the dangers connected with fast driving. Said beam is also graduated both sideward and downward so as to eliminate any sudden changes in intensity which might tend to cause eye strain on the driver of the automobile.

It will be apparent to those skilled in the art that various changes may be made in the design of the lens as shown without departing from the spirit of the invention, such as altering the shapes of the sections and placing the flutes on the exterior or outer surface. Also, the light directing effect may be derived from a configurated reflector instead of from a lens.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper and lower intermediate sections containing vertically extending flutes of wider light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread and horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

2. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper and lower intermediate sections containing vertically extending flutes of wider light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread with vertically extending flutes of narrow light spread adjacent each side thereof, the whole of said middle section also containing horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

3. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper and lower intermediate sections containing vertically extending flutes of wider light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread with vertically extending flutes of narrow light spread adjacent each side thereof and vertically extending flutes of intermediate light spread adjacent each side of said narrow spreading flutes, the whole of said middle section also containing horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

4. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper intermediate section containing at its middle vertically disposed flutes of wide light spread and at its sides vertically disposed flutes of intermediate light spread and said lower intermediate section consisting of vertically disposed flutes of intermediate light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread and horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

5. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper intermediate section containing at its middle vertically disposed flutes of wide light spread and at its sides vertically disposed flutes of intermediate light spread and said lower intermediate section consisting of vertically disposed flutes of intermediate light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread with vertically extending flutes of narrow light spread adjacent each side thereof, the whole of said middle section also containing horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

6. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread, the flutes at the extreme sides of said segments being of narrower spread than the flutes at the middle thereof, to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper and lower intermediate sections containing vertically extending flutes of wider light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread and horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

7. A lens for a vehicle headlamp divided into upper and lower segments, comparatively narrow upper and lower intermediate sections adjacent said segments extending horizontally across the width of said lens, and a center section between said intermediate sections extending horizontally across the width of said lens, the said upper and lower segments containing vertically extending flutes of narrow light spread, the flutes at the extreme sides of said segments being of narrower spread than the flutes at the middle thereof, to produce a portion at the top of the beam projected by said lens which is of higher intensity than the remainder of the beam and of comparatively narrow horizontal and vertical spread, said upper intermediate section containing at its middle vertically disposed flutes of wide light spread and at its side vertically disposed flutes of intermediate light spread and said lower intermediate section consisting of vertically disposed

flutes of intermediate light spread to produce a portion of wide lateral spread at the top of the beam, said center section containing at its middle vertically extending flutes of wide light spread with vertically extending flutes of narrow light spread adjacent each side thereof and vertically extending flutes of intermediate light spread adjacent each side of said narrow spreading flutes, the whole of said middle section also containing horizontally extending prisms having their bases lowermost to produce in the light beam a portion of wide lateral and vertical spread extending downward from the portions produced by said upper and lower segments and said intermediate sections, the extreme side portions of said center section containing vertically extending flutes of narrow light spread for adding intensity to the portion of the beam projected by said upper and lower segments.

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