

United States Patent

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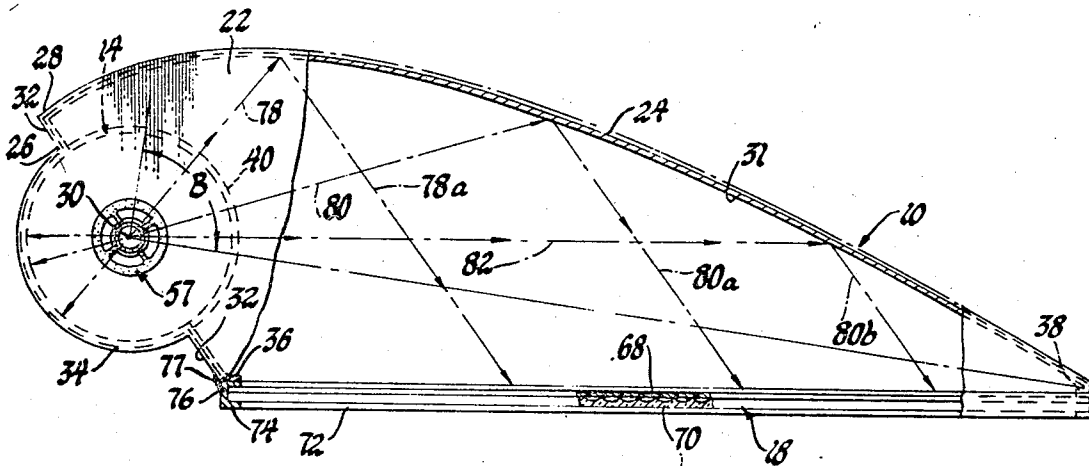
[54] RECTANGULAR VEHICLE HEADLAMP WITH
COLLIMATING DISCS
1 Claim, 5 Drawing Figs.

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ABSTRACT: A motor vehicle headlamp including a housing having a reflecting surface which is a segment of a parabolic cylinder wherein a linear light source is located along the focal axis of the parabolic cylinder and the light emitted therefrom is laterally controlled by a laminae of optical discs that collimate the light such that the rays are directed onto the reflecting surface in planes substantially normal to the focal axis. The reflected light rays are forwardly distributed in a desired illumination pattern by an optical lens located in a rectangular frontal opening of the housing.

See Fig 4
Stack of high index
light directing disks
joined by low index
adhesive layers



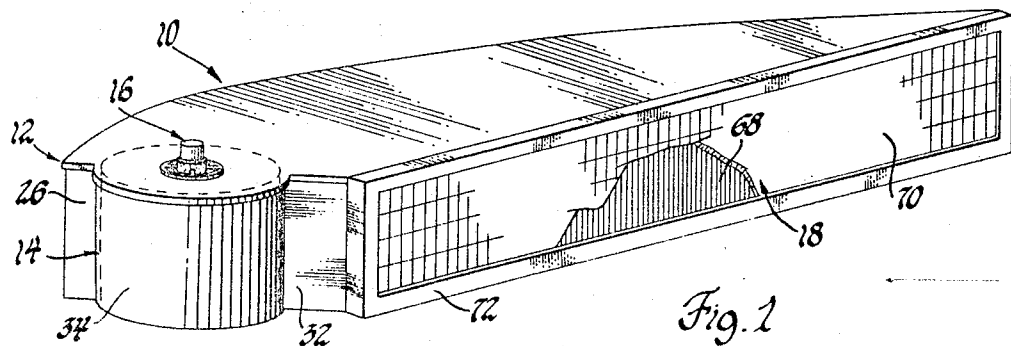


Fig. 1

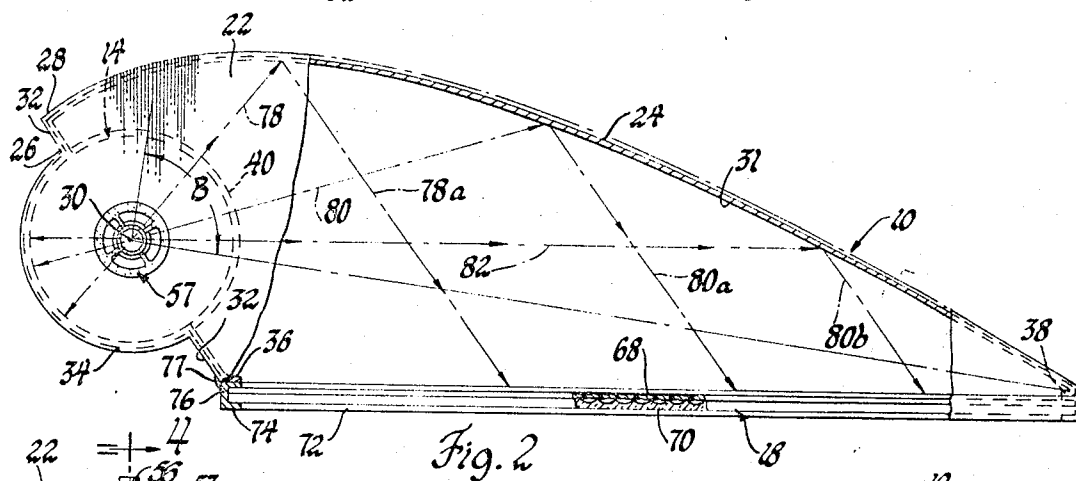


Fig. 2

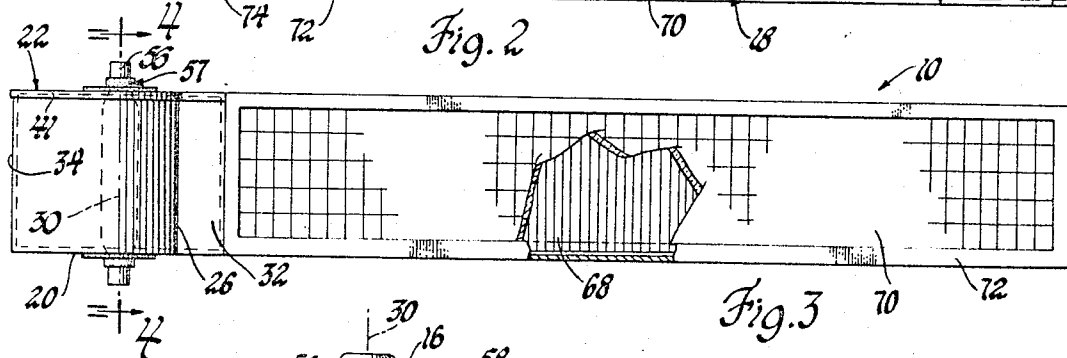


Fig. 3

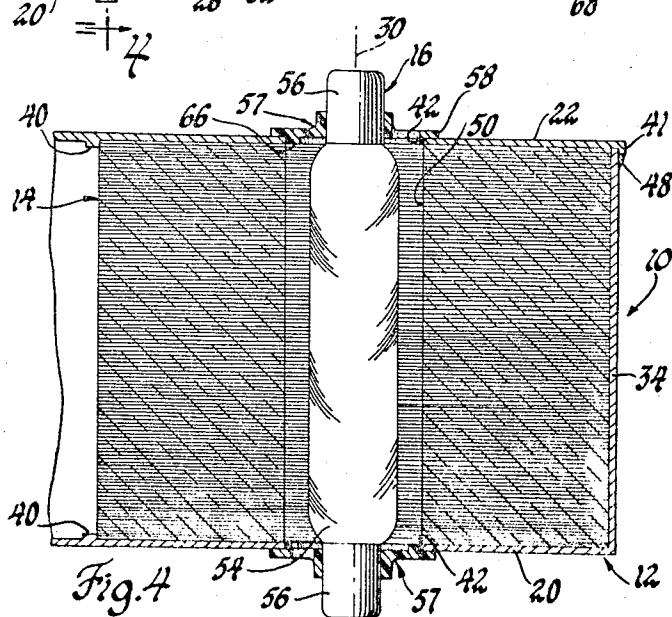


Fig. 4

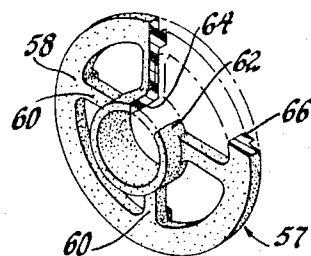


Fig. 5

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RECTANGULAR VEHICLE HEADLAMP WITH COLLIMATING DISCS

It has long been recognized that a rectangular barlike headlamp would give increased flexibility in the frontal styling of motor vehicles. Such a headlamp would produce a novel appearance for the vehicle, contribute to a lower frontal silhouette, and facilitate retracting and concealment of the headlamp. However, present headlamp units using a reflector having a paraboloidal surface are not readily adaptable to noncircular frontal designs. In these units, the rays emitted from a "point" light source located at the focal point of the surface are reflected parallel to the axis of the reflector. Inasmuch as the light-collecting efficiency for such a reflector design is at a maximum when the front edge terminates at a plane normal to the axis of revolution, headlamps of this type are most ideally suited for use with a substantially circular front lens. To provide a rectangular frontal appearance, the end portions of the paraboloid are removed thereby decreasing the light-collecting efficiency of the reflector. Accordingly, previous rectangular headlamp designs have required larger reflectors to compensate for the loss in collecting efficiency. The development in rectangular headlamps has also been impeded by the inability to achieve lateral control of the illumination from the filament. Because the filaments conventionally used in paraboloidal headlamps deviate from an ideal "point" source, the rays are not parallelly reflected off of the reflector. The resulting undisciplined illumination further reduces the collecting efficiency in rectangular headlamp designs.

The present invention contemplates overcoming the above-noted problems by providing a headlamp having a rectangular frontal lens wherein lateral control of light is achieved by columnating the illumination from a linear light source by means of a laminae of total internal reflection optical discs. The light source is located along the focal axis of a reflecting surface forming a segment of a parabolic cylinder and the optical discs serve to restrict the illumination into parallel planes and thereby correct for deviation of the source from an idealized "line" illumination. Therefore, the light rays are directed normally onto the reflecting surface and reflected therefrom parallelly onto the headlamp lens. In this manner, the light emitted from the source reaches the lens as a coherent column in much the same manner as in conventional headlamps using a paraboloidal reflector. A refraction grating and an optical lens are used in the present invention to achieve the desired horizontal and vertical light distribution. Additionally, by providing a headlamp wherein the light source is located remote from the lens, the headlamp will have a relatively low interior temperature thereby permitting the use of a plastic lens which can be formed into more precise and intricate optical patterns than is obtainable with conventional molded glass lenses.

Accordingly, the objects of the present invention are: to provide a lighting unit wherein a reflector forming a segment of a parabolic cylinder reflects columnized light from a source through a rectangular-shaped optical lens; to provide a lighting unit wherein light from a substantially "line" source filament is directed onto a parabolic cylindrical reflecting surface in discreet columns by means of a total reflection optical laminae; and to provide a headlamp wherein a headlamp housing has a reflecting surface in the form of a segment of a parabolic cylinder which reflects illumination from a "line" source filament through a rectangular optical lens, the light from the source being directed onto the reflecting surface in parallel planes by means of a laminae of total reflection optical discs positioned parallel to the light source and the reflecting surface.

These and other objects will be apparent to one skilled in the art upon reading the following detailed description, reference being made to the accompanying drawings in which:

FIG. 1 is a perspective view of a headlamp made in accordance with the present invention;

FIG. 2 is a partially sectioned plan view of the headlamp shown in FIG. 1;

FIG. 3 is a front view of the headlamp shown in FIG. 1;

FIG. 4 is an enlarged sectional view taken along line 4-4 of FIG. 3; and

FIG. 5 is a perspective view of the retaining cap for the headlamp light source.

Referring to FIG. 1, a headlamp 10 made in accordance with the present invention generally comprises a housing 12, an optical column 14, a light source 16, and illumination distribution means 18.

As shown in FIGS. 2 and 3, the housing 12 is a two-piece metallic die casting and comprises a baseplate 20 having an integral upwardly extending marginal rim, and a coverplate 22. The rim includes a rear wall 24 and an integrally formed sidewall 26. As shown in FIG. 2, the rear wall 24 is in the form of a segment of a parabolic cylinder having an origin at 28 and a focal axis at 30. In this connection, it will be appreciated that an elliptical reflecting surface can easily be incorporated in the present invention. The front surface of the rear wall is provided with a silverized or aluminized reflecting surface 31 and the opposed interior surfaces of the baseplate 20 and the cover plate 22 are provided with a light-absorbing coating. The sidewall 26 includes a pair of straight walls 32, coplanar with the origin 28 and the focal axis 30, and a centrally disposed semicylindrical section 34 having an origin at the focal axis 30. The forward straight wall 32 frontally terminates with an inwardly turned flange 36 and the rear wall 24 frontally terminates with an inwardly turned flange 38. Annular locating rims 40 that define continuations of the semicylindrical section 34 are formed on the opposed interior surfaces of the cover plate 22 and the baseplate 20. A marginal flange 41 is formed at the edge of the cover plate 22 for locating the latter on the lower portion of the housing. Additionally, apertures 42 are formed in the aforementioned plates coaxial with the focal axis 30.

Referring to FIG. 4, the optical column 14 comprises a laminae of stacked optical discs that are formed of an optical material such as glass or plastic having a relatively high refraction index. Each disc preferably has a thickness in the order of 0.002 to 0.005 inch and is centrally apertured for receiving the light source 16. The top and lower surfaces of the individual discs are joined together by an adhesive coating having a relatively low refraction index. Similarly, the edges of the discs adjacent the semicylindrical section 34 are finished with a coating having a relatively low refraction index.

According to the total reflection principle, when light travels through an optical medium, such as the optical discs, having a high refractive index and strikes an interface having a low refractive index at shallow impingement angles, total refraction will occur therewithin. Thus, light emanating from the source in substantially the same plane as the discs will strike the low refractive surface at a shallow angle and pass through the column 14 in substantially parallel planes whereas light in other planes will have a steep impingement angle and will be absorbed within the disc. In other words, the light passing through the discs will be disciplined into minute coherent columns by virtue of the thinness of the discs and optical properties of the optical column 14.

Referring to FIG. 4, the optical column 14 is located within the semicylindrical section 34 by the rims 40 and is adhesively secured to the cover plate 22 and the baseplate 20. The cover plate 22 is secured to the lower portion at a solder joint 48 such that the optical column 14 forms a permanent part of the housing 12. In assembly, the apertures 42 and the optical column 14 form a bore 50 that is coaxial with the focal axis 30 and normal to the reflecting surface 31.

The light source 16 may be of any commercially available bulb, such as an iodine quartz lamp, producing a substantially linear illumination throughout its axial length. According to the preferred embodiment, the light source 16 generally comprises a cylindrical glass envelope 54 and electrically conductive end caps 56. The bulb filament is located within the envelope 54 and electrically connected to the end caps 56. To illuminate the light source 16, the end caps 56 are connected to a source of electrical power by means of a suitable connector assembly.

As shown in FIG. 4, the light source 16 is located within the bore 50 and is secured to the housing by means of nonconductive retaining caps 57. Referring to FIG. 5, the retaining caps 57 generally comprise an annular outer rim 58, a plurality of radially inwardly extending spokes 60, and an annular hub 62 having a centrally disposed bore 64. The rim 58 includes a downwardly extending locating shoulder 66 which is received within the bore 50 and serves to locate the retaining cap 57 on the housing 12. As shown in FIG. 4, the light source 16 is positioned within the bore 50 by pressing the hubs 62 over end caps 56 and the shoulders 66 into the apertures 42. In assembly, the spokes 60 define ventilation passageways for admitting air to cool the light source 16.

Referring to FIGS. 2 and 3, the illumination distribution means 18 includes a grooved refraction grating 68 and an optical lens 70 which are secured to the housing 12 at a rectangular frontal opening by means of a rectangular bezel 72. Because the lens 70 and the grating 68 are remotely located from the light source 16, the interior operating temperature will be lower than in conventional headlamps. Accordingly, these parts may be formed of an acrylic plastic which is adaptable for molding into precise and intricate optical patterns.

The bezel 72 includes an inwardly turned rim 74 that engages the front surface of the lens 70 and a rearwardly extending leg 76 that is secured to the housing 12 at a solder joint 77 to secure the lens 70 and the refraction grating 68 against the flanges 36 and 38. As is conventional in sealed-beam headlamps, the headlamp cavity is hermetically sealed after being filled with an inert gas.

Referring to FIG. 2, when the source 16 is illuminated, the light rays are directed radially outward therefrom as is representatively shown by rays 78, 80 and 82. By the process of total internal reflection as described above, the rays are laterally controlled in discreet planes or coherent columns of light. As the individual rays impinge upon the reflective surface 31, they are reflected according to conventional optical laws as generally parallel rays 78a-80a-80b. The refraction grating 68 is provided for selectively refracting the light rays onto the optical lens 70. The amount of refraction will be dependent on the location of the grating 68 with respect to the light source 16 and the reflecting surface 26, as well as the location of the housing 12 with respect to the motor vehicle.

The lens 70 is provided with suitable optical faceting for projecting the illumination in a desired horizontal and vertical intensity pattern.

The headlamp 10, thus formed, is attached to a vehicle by means of a headlamp mounting comparable to that of a conventional seal-beam headlamp. However, any mounting which will permit selective positioning of the headlamp about a horizontal and a vertical axis will be satisfactory. If it is desired to use a single headlamp for both "high beam" and "low beam" illumination, suitable provisions can be made for rotating the headlamp about a horizontal axis to achieve the desired lighting pattern. Additionally, it will be appreciated that the lens 70 may take the form of a plurality of individual rectangular facets and thereby permit the use of a headlamp having an angular installation with respect to the front of the vehicle.

Although only one form of this invention has been shown and described, other forms will be readily apparent to those skilled in the art. Therefore, it is not intended to limit the scope of this invention by the embodiment selected for the purpose of this disclosure but only by the claims which follow.

I claim:

1. A sealed-beam headlamp, comprising: a housing having a rectangular frontal opening and a rearwardly located surface having a reflective finish, said surface being in the form of a segment of a parabolic cylinder generated from a focal axis; an optical column secured within said housing between said focal axis and said reflecting surface, said optical column comprising a laminae of optical discs having a thickness of less than 0.005 inch and being formed of a light-transmitting material having a high-refractive index, each of said discs being mutually separated by an interface having a low-refractive index whereby said optical column restricts light directed therethrough into planes substantially normal to said surface; an opening extending through said housing and said column at said focal axis; a light source positioned within said opening which upon being illuminated directs light through said optical column; and a rectangular optical lens and a refraction grating located at said frontal opening, said optical lens and said refraction grating cooperating to distribute reflected light from said surface in a desired illumination pattern outwardly of said housing.

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