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

(11) EP 0 930 457 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.07.1999 Bulletin 1999/29

(51) Int Cl.[6]: **F21M 3/26**

(21) Application number: **99100711.3**

(22) Date of filing: **15.01.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **15.01.1998 US 7725**

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(54) Polarized headlamps and rear view mirrors

(57) The present invention provides an apparatus including polarized headlamps (14) for a trailing vehicle (12) and polarized rear view mirrors (18) for a leading vehicle (16). Preferably, each headlamp (14) includes a body (22) having an illuminating element (24) disposed therein and a lens (36) secured to the body (22) such that the illuminating element (24) is enclosed therein. Similarly, each rear view mirror (18) includes a frame (32) and a lens (38) secured to the frame (32). The headlamp lens (38) is polarized in a first direction (25) to reduce the intensity of radiation (20) emitted therefrom. Further, the mirror lens (18) is polarized in a second direction (40), orthogonal to the first direction (25), to reduce the intensity of the reflected headlamp radiation (20') a second time. As such, the intensity of the observable reflected headlamp radiation (20') is greatly reduced while the intensity of reflected ambient light remains observably unaffected.

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Description

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention generally relates to light intensity reduction apparatus, and, more particularly, to polarizing apparatus for reducing the intensity of reflected automobile headlight illumination and corresponding driver blindness and/or eye fatigue.

2. Discussion

[0002] Night time vehicle operation involves the employment of headlamps to illuminate the road and traffic ahead of a vehicle as well as to make one's own vehicle more visible to opposing traffic. Most vehicles are equipped with a two-stage headlight system providing low-beam illumination and high-beam illumination for this purpose. Typically, the low-beam illumination is less intense and therefore illuminates a smaller area than the high-beam illumination.

[0003] Often, a trailing vehicle's headlights, especially in the high-beam mode, impinge upon a leading vehicle's rear view mirrors. These include both the main rear view mirror secured to the front windshield and the side rear view mirrors secured to the driver and passenger doors. The mirrors typically reflect the headlight illumination towards the driver's eyes. This often causes driver blindness and/or eye fatigue.

[0004] Prior art attempts to alleviate this problem include manually adjusted rear view mirrors having a day time mode and a night time mode and mirrors having light sensitive coatings deposited thereon. Manually adjusted mirrors have degraded night vision capability due to the apparent darkening of the viewed scene visible on the reflective surface in the night time mode. As such, the visibility of the scene surrounding the trailing vehicle is sacrificed since the intensity of reflected ambient light, as well as reflected headlamp illumination, is reduced.

[0005] Light sensitive coatings deposited on vehicle mirrors work to alter the mirror's reflectivity by darkening when impinged upon by a trailing vehicle's headlamp illumination. Although somewhat effective, these types of mirrors are expensive to install and are prone to failure due to their complexity. Also, these mirrors do not selectivity filter headlamp illumination from ambient light and therefore reduce the visibility of the entire reflected scene.

[0006] Therefore, it is desirable to provide an apparatus for selectively reducing the perceived intensity of rear view mirror reflected headlamp illumination from trailing vehicles without reducing the intensity of ambient light and thus, the visibility of the surrounding scene, to avoid driver blindness and/or eye fatigue and to provide a more reliable reflected image for estimating the distance and/or speed of trailing vehicles.

SUMMARY OF THE INVENTION

[0007] The above and other objects are provided by an apparatus including polarized headlamps for a trailing vehicle and polarized rear view mirrors for a leading vehicle. Preferably, each headlamp includes a body having an illuminating element disposed therein and a lens secured to the body such that the illuminating element is enclosed therein. Similarly, each rear view mirror includes a frame and a lens secured to the frame. The headlamp lens is polarized in a first direction to reduce the intensity of radiation emitted from the illumination element by nearly fifty percent. Further, the mirror lens is polarized in a second direction, orthogonal to the first direction, to reduce the intensity of the reflected headlamp radiation by nearly an additional fifty percent. As such, the intensity of the observable reflected headlamp radiation is greatly reduced while the intensity of reflected ambient light remains observably unaffected.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] In order to appreciate the manner in which the advantages and objects of the invention are obtained, a more particular description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings only depict preferred embodiments of the present invention and are not therefore to be considered limiting in scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

FIG. 1 is a schematic view of a leading vehicle and a trailing vehicle including the components of a light intensity reduction apparatus in accordance with the present invention;

FIG. 2 is a perspective view of a headlamp incorporating a lens polarized in a first direction in accordance with the present invention;

FIG. 3 is a perspective view of a rear view mirror incorporating a lens polarized in a second direction in accordance with the present invention; and

FIG. 4 is a plan view of an alternate embodiment polarized rear view mirror in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] The present invention is directed towards a light intensity reduction apparatus including a plurality of headlights having lenses polarized in a first direction and a plurality of rear view mirrors including a reflective surface polarized in a second direction orthogonal to the first direction. In combination, the polarization of the headlamps and the orthogonal polarization of the rear

view mirrors combine to reduce the intensity of reflected radiation from a trailing vehicle's headlamps as observed by the driver of a leading vehicle. As such, the present invention reduces the potential for driver blindness and/or eye fatigue as well as enhanced visibility of the reflected scene surrounding the trailing vehicle.

[0010] Referring now to the figures, a pair of vehicles are shown schematically in FIG. 1 and are indicated generally at 10. The trailing vehicle 12 includes a plurality of headlamps 14 operable in a low beam mode and a high beam mode. As is known, the headlamps are typically employed during night time driving conditions to illuminate the road and traffic in front of the trailing vehicle 12.

[0011] Also depicted in FIG. 1 is a leading vehicle 16 including a plurality of rear view mirrors 18 enabling the leading vehicle driver to observe the traffic conditions rearward of the leading vehicle 16. As illustrated, the radiation 20 from the headlamps 14 of the trailing vehicle 12 impinge upon the rear view mirrors 18 of the leading vehicle 16. The rear view mirrors 18 reflect the radiation 20' towards the eyes of the leading vehicle driver. As described in greater detail below, in accordance with the teachings of the present invention, the driver is not blinded nor experiences excessive eye fatigue since the radiation 20 emitted from the headlamps 14 is polarized in a first direction and, when reflected from the rear view mirrors 18, is polarized in a second direction thereby reducing its intensity as observed by the driver.

[0012] Referring now to FIG. 2, a headlamp 14 is shown in greater detail. The headlamp 14 includes a headlamp body 22 encompassing an illumination element or bulb 24. A lens 26 is secured about its periphery to the body 22 to enclose the bulb 24 therein. A plurality of leads 28 electrically interconnect the bulb 24 with a power source 30.

[0013] The lens 26 is polarized in a first direction such that the waveform of the radiation 20 (FIG. 1) emitted from the headlamp 14 assumes a pre-selected shape. Preferably, the lens 26 is polarized with one of any number of linear polarizing devices although other polarization techniques may be employed. Even more preferably, the lens 26 is polarized by depositing a coating 27 thereon embodying a sheet polarizer. In this case, approximately forty-eight percent of light generated by the bulb 24 parallel to the axis of the polarizer 25 and virtually zero percent of light perpendicular to the axis 25 is transmitted through the lens 26. Advantageously, human eyes are essentially unable to detect the decrease of the light intensity due to this level of polarization. Therefore, the forward illuminating ability of the headlamp 14 is perceptively unimpaired. Also, the visibility of the headlamp 14 from bystanders is not noticeably effected.

[0014] Referring now to FIG. 3, a rear view mirror 18 is illustrated in greater detail. The rear view mirror 18 includes a body or frame 32 coupled to a first end of a bracket 34. The opposite end of the bracket 34 is coupled to the windshield 36 to support the mirror 18 therefrom. A mirrored (e.g., silvered) lens 38 is connected about its periphery to the frame 32. It should be noted that although a center rear view mirror 18 is depicted, the present invention is equally applicable to side mirrors.

[0015] The lens 38 is polarized in a second direction such that the wavefront of the radiation 20' (FIG. 1) reflected therefrom has a predictable shape. In accordance with the present invention, the lens 38 is polarized in a direction orthogonal to the polarization of the lens 26 (FIG. 2). As such, the polarizing axis 40 of the mirror 18 is perpendicular to the polarizing axis 25 of the headlamp 14. As with the lens 26, the lens 38 may be polarized by depositing a coating thereon embodying a sheet polarizer. In this way, approximately forty-eight percent of light parallel to the axis 40 of the polarizer is reflected by the lens 38 and virtually zero percent of light perpendicular to the axis 40 is reflected. As such, the polarized light emitted from the headlamp 14, which is perpendicular to the axis 40, is polarized a second time thereby greatly reducing its intensity.

[0016] Referring now to FIG. 4, an alternate embodiment of the polarized mirror 18 is illustrated. In this embodiment, a manually rotatable polarizing filter 42 is rotatably coupled to the frame 32 adjacent the lens 38. As such, the vehicle driver may selectively rotate the filter 42 to change the angle of the polarity relative to impinging radiation to increase or decrease the observable intensity of polarized light from the headlights of trailing vehicles. A handle 44 coupled to the filter 42 is provided for this purpose.

[0017] In operation, the polarized radiation 20 from the headlamp 14 is polarized a second time by the lens 38. Since the polarization of the headlamp 14 and mirror 18 are perpendicular, the perceivable intensity of the reflected radiation 20' is greatly reduced. In contrast, the decreased intensity of the singularly polarized ambient light (via the mirror 18) is essentially undetectable by the human eye. Accordingly, the reflected image which is observable by the driver in the mirror 18 consists of intensity reduced headlamps 14 from trailing vehicles and a normally illuminated surrounding scene. It should be appreciated that rather than completely extinguishing the observable radiation 20 from the headlamps 14, the present invention enables perception of the radiation 20 as a relatively dim glow or light-spot.

[0018] In addition to the aforementioned benefits, the present invention also reduces rear view mirror observed road and windshield glare since sunlight is typically at least partially polarized by the atmosphere. Additionally, headlamp glare may be reduced as perceived by oncoming traffic and bystanders since the polarized radiation may be additionally polarized by the atmosphere, as well as other partially-polarizing surfaces upon which the emitted radiation impinges.

[0019] Those skilled in the art can now appreciate from the foregoing description that the broad teachings

of the present invention can be implemented in a variety of forms. Therefore, while this invention has been described in connection with particular examples thereof, the true scope of the invention should not be so limited since other modifications will become apparent to the skilled practitioner upon a study of the drawings, specification, and following claims.

Claims

1. Apparatus for reducing driver-perceived headlight brightness in motor vehicles comprising:

   said vehicles having headlamps including:
   a body;
   an illuminating element disposed in said body; and
   a lens secured to said body enclosing said illuminating element therein, said lens being polarized in a first direction for polarizing radiation emitted from said illuminating element in said first direction; and said vehicles having rear view mirrors including:
   a frame; and
   a lens secured to said frame, said lens being polarized in a second direction orthogonal to said first direction for polarizing said radiation in said second direction.

2. The apparatus of claim 1 further comprising

   a polarizing film deposited on said headlamp lens, and/or
   a linear polarizing device coupled to said headlamp lens, and/or
   a sheet polarizer fixed to said headlamp lens, and/or
   a polarizing film deposited on said mirror lens, and/or
   a linear polarizing device coupled to said mirror lens, and/or
   a sheet polarizer fixed to said mirror lens, and/or
   a polarized filter rotatably secured adjacent said mirror lens and providing said polarization therefor.

3. A headlamp for a motor vehicle for emitting radiation having reduced perceived brightness comprising:

   a body;
   an illuminating element disposed in said body; and
   a polarized lens secured to said body enclosing said illuminating element therein.

4. The apparatus of claim 3 further comprising

   a polarizing film deposited on said headlamp lens, and/or
   a linear polarizing device coupled to said headlamp lens, and/or
   a sheet polarizer fixed to said headlamp lens, and/or
   a rear view mirror including a lens polarized in a direction orthogonal to a polarization of said polarized lens of said headlamp.

5. A rear view mirror for a motor vehicle for reflecting radiation having reduced perceived brightness comprising:

   a frame; and
   a polarized lens secured to said frame.

6. The apparatus of claim 5 further comprising

   a polarizing film deposited on said mirror lens, and/or
   a linear polarizing device coupled to said mirror lens, and/or
   a sheet polarizer fixed to said mirror lens, and/or
   a headlamp including a lens polarized in a direction orthogonal to a polarization of said polarized lens of said mirror, and/or
   a polarized filter rotatably secured adjacent said lens and providing said polarization therefor.

7. A method of reducing driver-perceived headlight brightness in motor vehicles, comprising the steps of:

   selecting a headlamp suitable for operation in a first vehicle;
   depositing a first polarizing coating on a lens of said headlamp such that a polarizing axis of said coating is in a first direction;
   selecting a rear view mirror suitable for operation in a second vehicle;
   and
   depositing a second polarizing coating on a reflective surface of said mirror such that a polarizing axis of said second coating is in a second direction, said second direction being substantially orthogonal to said first direction;
   whereby radiation emitted from said headlamp is polarized in said first direction by said first coating and is polarized in said second direction by said second coating upon impinging on said mirror.

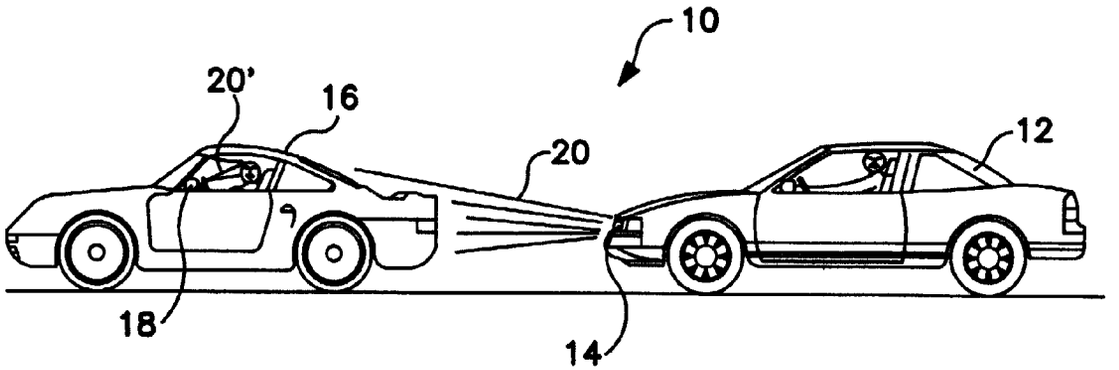

FIG. 1

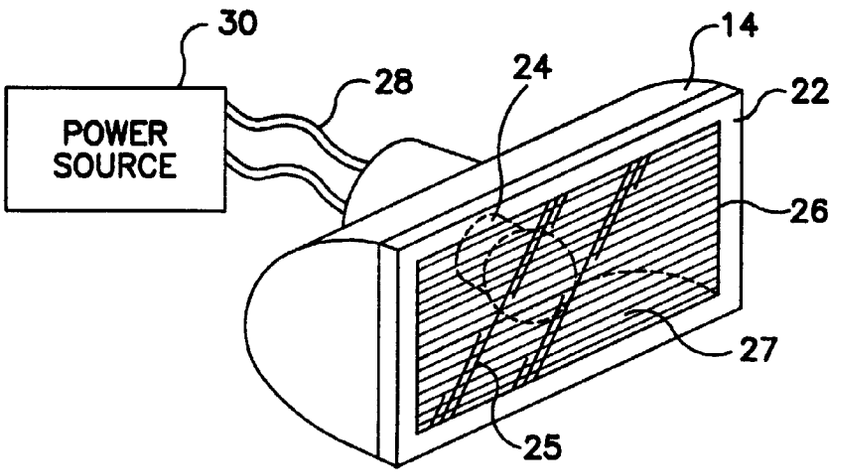

FIG. 2

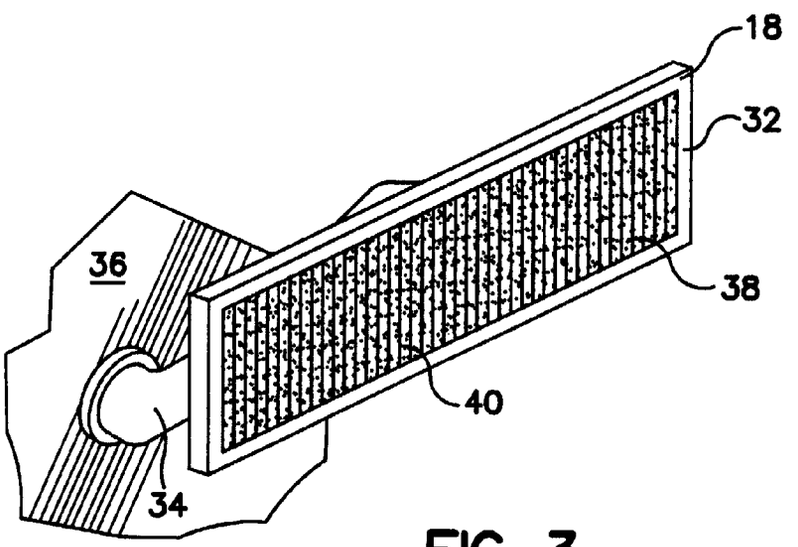

FIG. 3

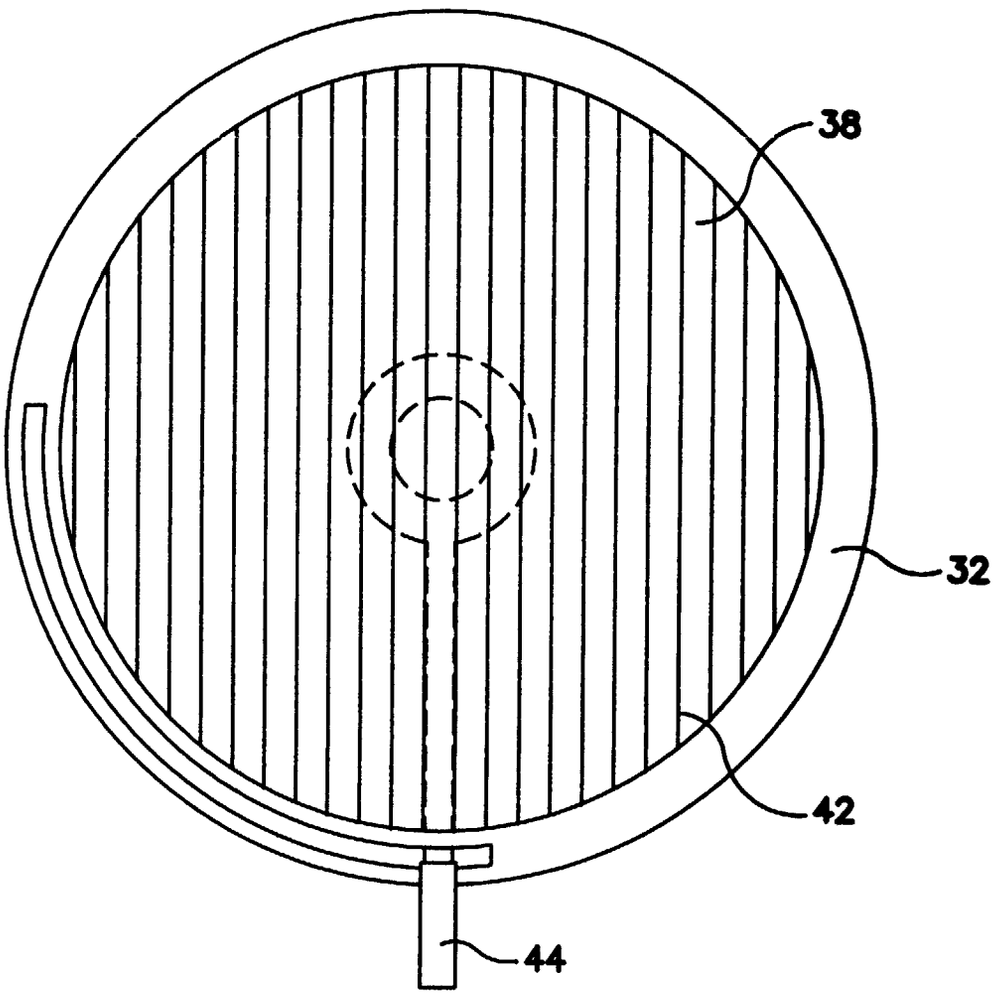

FIG. 4