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PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO A PEDAL CYCLE HEADLAMP

(71) We, THE EVER READY COMPANY (GREAT BRITAIN) LIMITED, a Company incorporated under the laws of Great Britain, or Ever Ready House, 1255 High Road, Whetstone, London N20 0EJ, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to pedal cycle headlamps and to lenses for use in pedal cycle headlamps.

It is well known to provide pedal cycle headlamps which may be dynamo operated or battery operated and which include a filament bulb located substantially centrally in a reflector and arranged to direct light through a front glass or other light transmitting member. In accordance with the present invention, such a glass or light transmitting member is adapted to modify the light distribution transmitted and is referred to as a lens. It is however to be understood that the term "lens" as used in this specification is not to be limited to a member having convex or concave surfaces but may include any shaped formation used to modify the light distribution or transmitted light.

The present invention provides a lens for a pedal cycle headlamp, which lens comprises a transparent member adapted to fit the front of a cycle headlamp, said member having formed thereon a first set of elongated prisms arranged to extend horizontally and thereby modify the transmitted light distribution in the vertical direction and a second set of elongated prisms arranged to extend vertically and thereby modify the transmitted light distribution in the horizontal direction, the second set of prisms comprising two groups of prisms symmetrically arranged on opposite sides of

a central vertical axis of the lens and spaced apart and the first set of prisms being off-set above or below the centre of lens, the central region of the lens and an outer region of the lens surrounding said first and second sets of prisms having no prisms, the lens being arranged to produce a predetermined pattern of luminous intensity values in both the horizontal and vertical planes when impinged upon by a parallel beam of light.

Preferably said central region is formed by part of the lens having flat parallel front and back faces.

Preferably the first set of prisms is located symmetrically above the central axis of the lens.

In one embodiment the prisms of the first set have faces of varying inclination to the plane of the lens so as to provide a desired modification of the light distribution.

The prisms of the second set of prisms may also have faces of varying inclination to the plane of the lens and is desired the height of the prisms may be varied, for example, by a progressive reduction in the height of the prisms on moving away from the centre of the lens.

Preferably at least part of the lens area having no prisms is provided with elongated lens elements extending in a vertical direction. Preferably, the lens elements are provided on an annular region of the lens surrounding the first and second sets of prisms.

Preferably light diffusing means is provided on at least part of the area of the lens. Preferably diffusing means is provided in a central area of the lens located between the two groups of second prisms. Diffusing means may also be provided over at least part of the area carrying prisms.

The invention includes a lens as aforesaid together with a parabolic reflector and a filament bulb at the focus of the parabolic

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reflector.

The lens as aforesaid may be formed of moulded plastics material.

Preferably the first and second sets of 5 prisms are provided on the rear face of the lens. The lens elements may be formed on the front face of the lens.

The invention also includes a pedal cycle headlamp incorporating a lens as aforesaid. The cycle lamp may be battery 10 operated.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings in which:—

Figure 1 is a section through a battery operated pedal cycle headlamp in accordance with the present invention.

Figure 2 is a front view of the lens used 20 in the cycle lamp of Figure 1.

Figure 3 is a vertical section on the line 3-3 in Figure 2.

Figure 4 is a horizontal section on the line 4-4 in Figure 2.

Figure 5 shows a view similar to Figure 3 illustrating the optical paths through the horizontal prisms, and

Figure 6 is a view similar to Figure 4 showing the optical paths through one set 30 of vertical prisms.

In this example, a pedal cycle headlamp comprises a casing 11 incorporating two batteries 12. The casing is provided with a bracket 13 incorporating a spring member 35 14 arranged to engage a supporting bracket on a pedal cycle. A parabolic reflector 16 is attached to the front of the casing 11 and is provided with a filament bulb 17 centrally located at the focus of the parabolic reflector with the filament lying in a horizontal plane. The bulb 17 is connected via contacts 18 and 19 to the battery 12 and the supply of power to the bulb is controlled by a switch 20.

45 Bonded to the front rim of the reflector 16 is a lens 21 which is shown in more detail in Figures 2, 3 and 4. It will be appreciated that the lens 21 is impinged upon by a parallel beam of light. The lens comprises a generally planar member moulded from transparent plastics material and is of circular outline, as shown in Figure 2. The lens 21 has a rear face 22 on which are formed a first set of prisms 23 and a second set of prisms 24. The front face 25 of the lens is formed with a plurality of lens elements 26 and diffusing areas 27a, 27b and 27c. These will now be described in greater detail. The first set of prisms 23 comprises 50 a plurality of elongated parallel prisms extending horizontally. The prisms are of progressively decreasing length on moving away from the central axis of the lens. The whole set of first prisms 23 is symmetrically 65 disposed relative to the vertical axis which

coincides with the section line 3-3 marked in Figure 2 and the prisms are all located above the central axis through the lens. Each of the prisms in the set 23 is of substantially the same height although the 70 lowermost prism of the set is slightly higher than the rest. Each prism has an upper face which is inclined at an angle A relative to the perpendicular to the plane of the lens and a lower face which is inclined 75 at an angle B to the perpendicular relative to the plane of the lens. The angle B for each prism in the set 23 is the same and is in this example 10°. The angle A does however vary for each of the prisms shown. 80 In the example illustrated there are seven prisms in the set 23 and their respective angles A are 36½°, 34½°, 32½°, 31°, 28½°, 27° and 51° on moving from the uppermost prism to the lowermost prism. The effect of this prism structure is shown in Figure 5 which shows the optical path of light passing through the prisms. Light 28 which comes directly from the bulb 17, up to an angle of about 65° above the horizontal, is deviated by refraction and reflection to form an emergent beam 29 lying 85 between 10° above and 5° below the horizontal.

The second set of prisms 24 consists of 95 two spaced groups 24a and 24b as shown in Figure 2. The two groups of prisms are similar in formation and are symmetrically distributed on each side of the vertical axis through the centre of the lens. The two groups are spaced apart so as to leave a central region 31 below the first set of prisms 23 and between the two groups 24a and 24b. The central region 31 is formed by a part of the lens having parallel flat front and back faces. The area 31 is formed with a diffusing areas 27b on the front surface of the lens. Each of the groups 24a and 24b of prisms are similarly 100 formed by four vertical prisms, the prisms having upper ends adjacent the lowest prism of the first set 23 and each of the prisms extending a decreasing extent downwards on moving outwardly from the centre of the lens. As can be seen from Figure 4, 105 the vertical prism 24 nearest the centre of the lens has the greatest height and the prisms have successively decreasing heights on moving outwardly from the centre of the lens. Each vertical prism has an inner 110 face inclined at an angle Y to the perpendicular to the plane of the lens and an outer face which is inclined at an angle X to the perpendicular to the plane of the lens. The inclination of the faces of the prisms varies and the angles Y for the four prisms of each set are 45°, 64½°, 74½° and 79° on moving from the innermost prism to the outermost prism of each group. The outward faces are inclined at angles X 125 130

which are $33\frac{1}{2}^\circ$, 46° , $54\frac{1}{2}^\circ$ and 60° on moving from the innermost to the outermost prism. The optical paths of light passing through the second set of prisms 24 is shown in Figure 6. Light 28 coming directly from the bulb 17 up to about 65° on either side of the axis of the lens is refracted by the prisms to give emergent beams 32 up to 82° from the axis of the lens on both sides of the axis.

As can be seen from Figure 2, an annular region 34 surrounding the prisms 23 and 24 is provided with a series of parallel vertically elongated lens elements 26. The lens elements 26 cover the whole area of the annular region 34 apart from central regions 36 and 37 which lie in the central areas on the vertical axis through the lens. Two further rectangular diffusing areas 27a and 27c are provided on the front face of the lens and cover a substantial part of the vertical prisms 24 and the end regions of the lower prisms in the set 23.

As can be seen from the above description, the horizontal prisms 23 are used to modify the light distribution in the vertical direction and the vertical prisms 24 are used to modify the light distribution in the left and right horizontal directions. The lens elements 26 redistribute the light to provide sufficient light in otherwise weak light positions in the horizontal direction. The diffusing areas 27a, 27b and 27c help to achieve required light values at extreme positions to the left and right of the field of illumination of the lamp.

By using the particular configurations described above, the cycle lamp may be used to achieve the luminous intensity values required by British Standard BS AU 155, September, 1973. In particular the lamp provides a sufficiently defined high intensity zone of illumination. At no point at which light is visible more than 5° above the horizontal plane does the luminous intensity exceed 60 candelas when using fresh batteries. Furthermore, the lamp provides good spread of illumination to left and right and nowhere in the field of view 15° above or below the horizontal plane and between 80° left or right of the central axis of the lamp is the luminous intensity less than 0.05 candelas.

The invention is not limited to the details of the foregoing example.

WHAT WE CLAIM IS:—

1. A lens for a pedal cycle headlamp, which lens comprises a transparent member adapted to fit the front of a cycle headlamp, said member having formed thereon a first set of elongated prisms arranged to extend horizontally and thereby modify the transmitted light distribution in the vertical direction and a second set of elongated prisms arranged to extend vertically and

thereby modify the transmitted light distribution in the horizontal direction, the second set of prisms comprising two groups of prisms symmetrically arranged on opposite sides of a central vertical axis of the lens and spaced apart and the first set of prisms being offset above or below the centre of the lens, the central region of the lens and an outer region of the lens surrounding said first and second sets of prisms having no prisms, the lens being arranged to produce a determined pattern of luminous intensity values in both the horizontal and vertical planes when impinged upon by a parallel beam of light.

2. A lens as claimed in claim 1, wherein said central region is formed by part of the lens having flat parallel front and back faces.

3. A lens as claimed in claim 1 or 2, wherein the first set of prisms is located symmetrically above the central axis of the lens.

4. A lens as claimed in any preceding claim, wherein the prisms of the first set have faces of varying inclination to the plane of the lens so as to provide a desired modification of the light distribution.

5. A lens as claimed in any preceding claim, wherein the prisms of the second set of prisms have faces of varying inclination to the plane of the lens so as to provide a desired modification of the light distribution.

6. A lens as claimed in any preceding claim, wherein the height of the vertically extending prisms is varied by a progressive reduction in the height of the prisms on moving away from the centre of the lens.

7. A lens as claimed in any preceding claim, wherein the length of the horizontally extending prisms is varied by a progressive reduction in the length of the prisms on moving away from the centre of the lens.

8. A lens as claimed in any preceding claim, wherein at least part of the lens area having no prisms is provided with elongated lens elements extending in a vertical direction.

9. A lens as claimed in claim 8, wherein the lens elements are provided on an annular region of the lens surrounding the first and second sets of prisms.

10. A lens as claimed in any preceding claim, wherein light diffusing means is provided on at least part of the area of the lens.

11. A lens as claimed in any preceding claim, together with a parabolic reflector and a filament bulb at a focus of the parabolic reflector.

12. A battery operated pedal cycle headlamp incorporating a lens as claimed in any one of claims 1 to 13.

13. A lens for a pedal cycle headlamp

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which are $33\frac{1}{2}^\circ$, 46° , $54\frac{1}{2}^\circ$ and 60° on moving from the innermost to the outermost prism. The optical paths of light passing through the second set of prisms 24 is shown in Figure 6. Light 28 coming directly from the bulb 17 up to about 65° on either side of the axis of the lens is refracted by the prisms to give emergent beams 32 up to 82° from the axis of the lens on both sides of the axis.

As can be seen from Figure 2, an annular region 34 surrounding the prisms 23 and 24 is provided with a series of parallel vertically elongated lens elements 26. The lens elements 26 cover the whole area of the annular region 34 apart from central regions 36 and 37 which lie in the central areas on the vertical axis through the lens. Two further rectangular diffusing areas 27a and 27c are provided on the front face of the lens and cover a substantial part of the vertical prisms 24 and the end regions of the lower prisms in the set 23.

As can be seen from the above description, the horizontal prisms 23 are used to modify the light distribution in the vertical direction and the vertical prisms 24 are used to modify the light distribution in the left and right horizontal directions. The lens elements 26 redistribute the light to provide sufficient light in otherwise weak light positions in the horizontal direction. The diffusing areas 27a, 27b and 27c help to achieve required light values at extreme positions to the left and right of the field of illumination of the lamp.

By using the particular configurations described above, the cycle lamp may be used to achieve the luminous intensity values required by British Standard BS AU 155, September, 1973. In particular the lamp provides a sufficiently defined high intensity zone of illumination. At no point at which light is visible more than 5° above the horizontal plane does the luminous intensity exceed 60 candelas when using fresh batteries. Furthermore, the lamp provides good spread of illumination to left and right and nowhere in the field of view 15° above or below the horizontal plane and between 80° left or right of the central axis of the lamp is the luminous intensity less than 0.05 candelas.

The invention is not limited to the details of the foregoing example.

WHAT WE CLAIM IS:—

1. A lens for a pedal cycle headlamp, which lens comprises a transparent member adapted to fit the front of a cycle headlamp, said member having formed thereon a first set of elongated prisms arranged to extend horizontally and thereby modify the transmitted light distribution in the vertical direction and a second set of elongated prisms arranged to extend vertically and

thereby modify the transmitted light distribution in the horizontal direction, the second set of prisms comprising two groups of prisms symmetrically arranged on opposite sides of a central vertical axis of the lens and spaced apart and the first set of prisms being offset above or below the centre of the lens, the central region of the lens and an outer region of the lens surrounding said first and second sets of prisms having no prisms, the lens being arranged to produce a determined pattern of luminous intensity values in both the horizontal and vertical planes when impinged upon by a parallel beam of light.

2. A lens as claimed in claim 1, wherein said central region is formed by part of the lens having flat parallel front and back faces.

3. A lens as claimed in claim 1 or 2, wherein the first set of prisms is located symmetrically above the central axis of the lens.

4. A lens as claimed in any preceding claim, wherein the prisms of the first set have faces of varying inclination to the plane of the lens so as to provide a desired modification of the light distribution.

5. A lens as claimed in any preceding claim, wherein the prisms of the second set of prisms have faces of varying inclination to the plane of the lens so as to provide a desired modification of the light distribution.

6. A lens as claimed in any preceding claim, wherein the height of the vertically extending prisms is varied by a progressive reduction in the height of the prisms on moving away from the centre of the lens.

7. A lens as claimed in any preceding claim, wherein the length of the horizontally extending prisms is varied by a progressive reduction in the length of the prisms on moving away from the centre of the lens.

8. A lens as claimed in any preceding claim, wherein at least part of the lens area having no prisms is provided with elongated lens elements extending in a vertical direction.

9. A lens as claimed in claim 8, wherein the lens elements are provided on an annular region of the lens surrounding the first and second sets of prisms.

10. A lens as claimed in any preceding claim, wherein light diffusing means is provided on at least part of the area of the lens.

11. A lens as claimed in any preceding claim, together with a parabolic reflector and a filament bulb at a focus of the parabolic reflector.

12. A battery operated pedal cycle headlamp incorporating a lens as claimed in any one of claims 1 to 13.

13. A lens for a pedal cycle headlamp



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substantially as hereinbefore described with reference to Figures 2 to 6 of the accompanying drawings.

14. A battery operated pedal cycle headlamp substantially as hereinbefore described with reference to Figure 1 of the

accompanying drawings.

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