

INTERNALLY ILLUMINATED RETROREFLECTIVE DEVICE

BACKGROUND

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FIGS. 1a and 1b show a prior art pedestrian crossing commonly referred to as a Belisha Beacon. The Belisha Beacon 10 includes a colored plastic globe 12 housing a flashing interior light (not shown) housed within globe 12. The interior light is normally powered by a bulb on a flashing circuit. The flash commonly lasts one second in both the on and off states. This type of beacon 10 is typically mounted on a black and white pole 16 or post positioned adjacent to either side of a pedestrian crossing 18. The Belisha Beacon 10 provides motorists with additional visibility to pedestrian crossings, especially at night. Belisha Beacons are commonly used in the United Kingdom, Ireland, and in the former British crown colonies of Singapore and Hong Kong. However, this type of prior art beacon has some drawbacks. First, because the globe is illuminated by an internal light source and is intended to "glow in the dark," the globe is translucent and thus provides limited daytime visibility. Second, the colored globe is typically made of a non-colorfast plastic material, so that the beacon adds little daytime or even nighttime visibility as the beacon ages. As the color of the globe fades, the ability of a pedestrian or driver to differentiate the color of the beacon from other lights diminishes, especially at night. Third, if the fuse or bulb of the internal light source burns out, the globe no longer functions at night, since visibility of the beacon at night without internal illumination is limited.

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FIGS. 2a and 2b show a prior art pedestrian crossing beacon disc 30 including first and second opposed retroreflective surfaces 32 and 34 separated by a minimal disc thickness. Similar to the Belisha Beacon, discs 30 are typically mounted on a black and white pole or post 16 positioned adjacent to either side of a pedestrian crossing 18. While the pedestrian crossing beacon discs have many advantages over the prior art Belisha Beacons, these discs also have some drawbacks. First, these pedestrian crossing beacon discs provide limited nighttime visibility because the discs are only visible at night when the retroreflective material is within range of, and illuminated by, an external light source, such as by vehicle headlights.

Second, the discs can become discolored by traffic grime and pollution, resulting in reduced effectiveness.

SUMMARY

5 Various embodiments described in the present application relate to an internally illuminated retroreflective device. The internally illuminated retroreflective device can, for example, be used as a pedestrian crossing. However, it will be appreciated by one of ordinary skill in the art that the present disclosure has a wider field of use and that the present application is not limited to the described construction and uses and that the present applicant intends this disclosure to include all constructions and uses.

10 One embodiment of the present application is an internally illuminated retroreflective device that includes a cylinder having two generally parallel opposed ends separated by a cylindrical surface and a light source housed within the area formed by the cylindrical surface.

15 The device also includes at least one circular disc that is capable of attachment to at least one of the opposed ends of the cylinder. Each circular disc includes an optically transmissive material affixed to a retroreflective material, and each disc may be attached to the cylinder such that the optically transmissive material is adjacent to the cylindrical surface.

20 Another embodiment of the present application is an internally illuminated retroreflective device including a housing having an open end and a light source positioned within the housing. The internally illuminated retroreflective device further includes at least one disc that is capable of attachment to the open end. The disc includes a retroreflective material and may include an optically transmissive material.

25 Another embodiment of the present application is an internally illuminated retroreflective device including (1) a primary light source that emits light and that is positioned within a housing; and (2) a retroreflective material positioned adjacent to the housing such that light emitted by the primary light source passes through the housing and the retroreflective material.

30 Another embodiment of the present application is a disc that includes an optically transmissive polymeric material affixed to a retroreflective material. The disc is capable of

attachment to an internally illuminated retroreflective device that includes (1) a housing and (2) a light source positioned within the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

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The present application will be further explained with reference to the appended Figures, wherein like structure is referred to by like numerals throughout the several views, and wherein:

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FIGS. 1a and 1b are, respectively, a schematic diagram and a cross-sectional view of a prior art Belisha Beacon.

FIGS. 2a and 2b are schematic diagrams of a prior art pedestrian crossing beacon disc.

FIG. 3 is a front view of one embodiment of an internally illuminated retroreflective device.

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FIG. 4 is a perspective view of the internally illuminated retroreflective device of FIG. 3.

FIG. 5 is a side view of the internally illuminated retroreflective device of FIG. 3.

FIG. 6 is an exploded view of the internally illuminated retroreflective device of FIG. 3.

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FIG. 7 is a cross-sectional view of the internally illuminated retroreflective device of FIG. 3 from the side view of FIG. 5.

FIGS. 8a and 8b are respective perspective and rear views of one embodiment of an internally illuminated retroreflective device.

FIGS. 9a and 9b are respective perspective and rear side views of one embodiment of an internally illuminated retroreflective device.

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FIGS. 10a and 10b are respective perspective and side views of one embodiment of an internally illuminated retroreflective device.

FIGS. 11a, 11b, and 11c are respective perspective, front, and side views of one embodiment of an internally illuminated device.

DETAILED DESCRIPTION

Various embodiments of the present application provide an internally illuminated retroreflective device, optionally adapted to be attached to a support means, including a light source positioned within a housing. At least a portion of the housing comprises, has applied thereto, or has attached to it a retroreflective material. The retroreflective material is positioned adjacent to the housing such that light emitted by the primary light source passes from the interior to the exterior of the housing through the retroreflective material. In an embodiment where the housing has the retroreflective material applied thereto, at least a portion of the housing may be formed of an optically transmissive material that permits light to pass from the interior of the housing to the retroreflective material. The internally illuminated retroreflective device may, for example, be used as a pedestrian crossing beacon.

FIGS. 3-7 show various views of one exemplary embodiment of an internally illuminated retroreflective device 100 attached to a support means 102. In FIGS. 3-7, internally illuminated retroreflective device 100 is side-mounted to a substantially vertical support means 102 (shown as a hollow post or pole) via two u-clasps 103 that are removably attached to retroreflective device 100. Retroreflective device 100 includes a housing 104, which is shown in FIGS. 3-7 as a substantially cylindrical housing having two circular open ends 106 and 108. Onto at least one of circular open ends 106 and 108 of housing 104 may be fitted or attached a disc 112 that includes a retroreflective material 114 adhered to an optically transmissive material 116. In FIGS. 3-7, disc 112 is affixed to housing 104 by (1) positioning disc 112 adjacent to one of open ends 106 and 108 such that optically transmissive material 116 is adjacent to the surface of housing 104; and (2) placing a circular rim 118 adjacent to retroreflective material 112 and attaching or affixing circular rim 118 to cylindrical housing 104 using a fastening mechanism 122, such as, for example, screws or nails. In an alternative embodiment, circular rim may be screwed onto housing 104 and will not include a fastening mechanism. In some embodiments, discs 112 may be quickly and easily removed and replaced if or when retroreflective material 114 experiences optical degradation. Fitted within housing 104 is a light source. FIGS. 3-7 show an embodiment in which primary light source

124 includes two light bulbs 126. But any light source known to those of skill in the art may be employed in the internally illuminated retroreflective device of the present application.

In the embodiment shown in FIGS. 3-7, housing 104 is substantially cylindrical and includes two circular open ends 106 and 108. A preferred size of cylindrical housing 104 is approximately 500 mm in diameter and approximately 150 mm in depth, which is the size preferred or required when internally illuminated retroreflective device 100 is used as a Belisha Beacon for pedestrian crossings in New Zealand. However, the size and shape of device 100 and of housing 104 may be configured to any desired specifications appropriate for the desired use of the internally illuminated retroreflective device. FIGS. 8-11 show some exemplary alternative shapes of housing 104. FIGS. 8a and 8b show triangular and rectangular internally illuminated retroreflective devices, respectively 150 and 152. FIGS. 9a and 9b show a different type of cylindrical housing 154. FIGS. 10a and 10b show two joined oval or elliptical shaped retroreflective devices 160. FIGS. 11a, 11b, and 11c show a polygonal retroreflective device 170. Each of these retroreflective devices will be discussed in greater detail below.

Housing 104 may be constructed from any material with sufficient durability appropriate to the desired use of the internally illuminated retroreflective device. Exemplary materials include metal, wood, retroreflective or reflective material, plastic, and the like. One exemplary preferred metal for use in constructing the housing is aluminum, and one exemplary preferred plastic is polycarbonate. Exemplary methods by which the housing may be formed include, for example, extrusion, roll forming, molding, casting, boring, and other similar methods.

In embodiments where at least a portion of housing 104 is formed of a material that is not optically transmissive, such as, for example, metal or wood, housing 104 preferably includes open portions, such as circular open ends 106 and 108 in the embodiment shown in FIGS. 3-7. Into at least one of the open portions may be placed, positioned, or fitted a disc that includes an optically transmissive retroreflective material. As is described in greater detail below, one exemplary embodiment of the disc includes only retroreflective material. Another exemplary embodiment of the disc includes an optically transmissive material that is attached to or positioned adjacent to a retroreflective material.

In embodiments where housing 104 is formed of a material that is optically transmissive (*e.g.*, transparent or translucent), such as, for example, plastic or retroreflective material, housing 104 may or may not include open portions such as circular open ends 106 and 108. In embodiments where housing 104 is formed of an optically transmissive material other than a retroreflective material, at least a portion of housing 104 preferably has a retroreflective material attached, applied, or adjacent to housing 104. In such embodiments, housing 104 is preferably formed of a clear, non-reflective material, and more preferably a clear, non-reflective, and colorless material.

In embodiments where housing 104 is formed of a retroreflective material, housing may or may not include open portions, such as circular open ends 106 and 108. In these embodiments, the retroreflective material preferably has sufficient durability for the desired use of the retroreflective device. Further, the retroreflective material preferably has sufficient flexibility to ensure its even and aesthetically pleasing application to housing 104.

In other embodiments, housing 104 is formed of more than one material, preferably at least one of which is a material listed above.

Disc 112 may be positioned adjacent to, fitted into, or affixed to at least a portion of housing 104. The use of disc 112 may be especially preferred in embodiments including at least one open end, such as the open ends 106 and 108 of FIGS. 3-7. One embodiment of disc 112 includes an optically transmissive (*e.g.*, translucent or transparent) material 116 onto or adjacent to which a retroreflective material 114 is applied, affixed, or positioned. However, disc 112 may include only a sheet of retroreflective material, or may include additional layers, such as liners, protective films, colored films, enhancing films, and the like. The resulting disc 112 transmits at least some of the light emitted by primary light source 124 to the exterior of housing 104. Exemplary optically transmissive materials include plastics, glass, and other similar materials. One exemplary plastic that is capable of use in the present application is polycarbonate. In some embodiments, optically transmissive material 116 is a clear, rigid material. Optically transmissive material 116 may be colored or colorless. Preferably disc 112 is removably attached, affixed, or positioned adjacent to housing 104. The removability of disc 112 from housing 104 facilitates removal and/or replacement of retroreflective material 114 and/or optically transmissive material 116 from housing 104, due, for example,

to wear, mechanical damage, or to a desire to change the color or other properties of the retroreflective or optically transmissive materials.

Disc 112 may be attached or affixed or held adjacent to housing 104 using any known fastening means suitable for the intended use of the internally illuminated retroreflective device. Some exemplary fastening means include bolts, screws, nails, adhesive, and screwable attachments, threaded attachments, and the like. Disc 112 may be threaded or screwed onto housing 104. Additionally, as is shown in FIGS. 3-7, disc 112 may include or be positioned adjacent to a rim 118 that is attached, affixed, or positioned adjacent to housing 104. Rim may be formed of any material appropriate to the intended end use of internally illuminated retroreflective device 100, and one exemplary material includes black cast vinyl 3M Scotchal™ Graphic Film, such as 3650, 180, and 7725 manufactured by the assignee of the present application. In one exemplary implementation of this embodiment, the entire edge of disc 112 is fully covered by rim 118 and thus weather protected. One exemplary over cover is between approximately 0.3 mm and 3 mm, but this will vary based on the size and shape of housing 104 and the intended use of retroreflective device 100.

While any retroreflective material may be used in connection with the present application, one preferred retroreflective material is a non-metalized microprismatic retroreflective material, such as, for example, Diamond Grade™ translucent microprismatic sheeting, such as 3990T and 4090T manufactured by 3M Company (the assignee of the present application). The retroreflective material is preferably translucent to enable light to be transmitted from the side of the retroreflective material that is adjacent to or comprises the exterior of the housing to the outwardly facing side of the retroreflective material and/or the exterior of the housing. One side of the retroreflective material may optionally comprise an adhesive material. The adhesive material facilitates application and adherence of the retroreflective material to a portion of the external surface of the housing or to the optically transmissive material in the disc. The adhesive material may include a protective liner that is removed when the retroreflective material is applied to the external surface of the housing or to the optically transmissive material in the disc. The retroreflective material may optionally be colored, which may improve the daytime and/or nighttime visibility of the internally

illuminated retroreflective device. In some embodiments, the retroreflective material has a fluorescent color, such as, for example, orange, yellow, or yellow-green. In some embodiments, the retroreflective material is removable from the housing or disc, which allows the retroreflective material to be removed or replaced, due, for example, to wear, or due to a
5 desire to change the color or other properties of the retroreflective material. The internally illuminated retroreflective device optionally includes a protective overlay film on the exterior side of each portion of retroreflective material.

The light source may be any light source capable of placement within housing 104. Optionally, the light source may be adapted to flash, which may serve to help the internally
10 illuminated retroreflective device stand out from its surroundings or may be so designed to meet assigned specifications.

Depending on the desired use for the internally illuminated retroreflective device, the device may optionally be attached to a support means, such as support means 102 of FIGS 3-7. Where the internally illuminated retroreflective device is to be used as a pedestrian
15 crossing beacon, the support means may be any structure that serves to elevate the internally illuminated retroreflective device above the level of the pedestrian crossing where the device is placed. The support means preferably allows the internally illuminated retroreflective device to be visible to vehicles and pedestrians before they cross the pedestrian crossing. The internally illuminated retroreflective device is preferably visible to the driver of the vehicle
20 when the vehicle comes within a reasonable distance of the pedestrian crossing. This "reasonable distance" may be governed by local traffic rules or regulations. Suitable support means include, for example, posts, poles, vertical or horizontal railings, and the like. The internally illuminated retroreflective device may also be attached to stationary objects, such as, for example, frameworks or buildings.

Where a support means is present, the internally illuminated retroreflective device may be attached to the support means in any way that does not substantially disadvantage the desired use of the internally illuminated retroreflective device. One exemplary attachment means is shown in FIGS. 3-7, in which housing 104 is side-mounted to a post or pole via an external mounting bracket, specifically by two u-clasps 103. However, any mechanical or
30 chemical attachment device may be used, including, for example, screws, bolts, nails,

adhesives, bands, clamps, and the like. In an alternative embodiment, part of the curved surface forming the substantially cylindrical housing may be slightly flattened, so as to facilitate side-mounting attachment of housing 104 to support means 102 and/or to facilitate accommodation of the primary light source 124. The cross-section of the cylindrical housing may thus be substantially circular, with a small segment of the circular cross-section removed. Additionally, a separate bracket may adapt the housing, such as, for example, a circular housing, for attachment or positioning adjacent to the profile of any support means. Also, the housing may be attached or placed adjacent to the top of a support means, such as, for example, a post.

FIGS. 8-11 show some exemplary alternative embodiments of the internally illuminated retroreflective device of the present application. FIGS. 8a and 8b are respective perspective and side views showing a support means 156 to which is attached or affixed a triangular-shaped internally illuminated retroreflective device 150 and two rectangular-shaped retroreflective devices 152. At least one of the devices 150 and 152 attached to support means 156 is an internally illuminated retroreflective device of the present application, and the other devices attached to support means 156 may be prior art devices. The mechanism by which triangular-shaped device 150 is attached to support means 156 may be used in connection with any of the internally illuminated retroreflective devices of the present application.

FIGS. 9a and 9b are respective perspective and side views showing a support means 156 to which is attached or affixed a cylindrically shaped internally illuminated retroreflective device 154 and two rectangular-shaped retroreflective devices 152. At least one of the devices 154 and 152 attached to support means 156 is an internally illuminated retroreflective device of the present application, and the other devices attached to support means 156 may be prior art devices. Retroreflective device 154 is attached, affixed, or mounted to the top of support means 156. Consequently, some embodiments of retroreflective device 154 may not include open portions to which may be attached a disc. Instead, retroreflective device 154 may have a flexible retroreflective material attached, affixed, or positioned adjacent to the housing of retroreflective device 154. In an alternative embodiment of retroreflective device 154, a portion of the housing may include an open portion to which may be attached a disc.

For example, the housing may include an open portion into which may be slid a panel that includes a retroreflective material.

FIGS. 10a and 10b show respective perspective and side views of another alternative embodiment of an internally illuminated retroreflective device of the present application. Retroreflective device 160 includes two separate internally illuminated components, upper component 162 and lower component 164. Both components are substantially elliptical or oval-shaped and are connected to one another via a fastening means 166. Upper component 162 includes text, and lower component 164 includes pictorials or schematics. The text, pictorials, or schematics may, of course, differ from those shown in FIGS. 10a and 10b, which are merely exemplary. Many different implementations of this embodiment exist, including, for example, (1) implementations in which only one of components 162 and 164 is an internally illuminated retroreflective device; (2) implementations in which both of components 162 and 164 are internally illuminated retroreflective devices; (3) implementations including more than two components, some or all of which may comprise internally illuminated retroreflective devices; (4) implementations in which both components include text; (5) implementations in which both components include pictorials or schematics; (6) implementations in which only the text or pictorial includes retroreflective material; (7) implementations in which the text or pictorial is printed on the top surface of a retroreflective sheeting; and (8) implementations in which the device 160 includes apertures (such as, for example, apertures that create the text or pictorials). Retroreflective device 160 may be top, bottom, or side-mounted, as is appropriate for its intended use.

FIGS. 11a, 11b, and 11c are respective perspective, front, and side views of an internally illuminated retroreflective device 170 that is bottom-mounted to a support means 172 via attachment mechanism 174. Retroreflective device 170 is a polygon-shape, specifically, a hexagonal shape, and includes text on at least one side of retroreflective device 170. The text on retroreflective device 170 may, of course, differ from that shown in FIGS. 11a, 11b, and 11c, which are merely exemplary. Further, retroreflective device 170 may include pictorials or schematics rather than or in addition to text. Many implementations of this embodiment exist, including, for example, (1) implementations in which only the text or pictorial includes retroreflective material; (2) implementations in which the text or pictorial is

printed on the top surface of a retroreflective sheeting; and (3) implementations in which the retroreflective device includes apertures (such as, for example, apertures that create the text or pictorials).

5 In another embodiment, internally illuminated retroreflective device may include a auxiliary or subsidiary light source that is positioned to enable it to emit light waves that pass or are transmitted through an optional secondary portion of the housing that may or may not comprise retroreflective material or have retroreflective material applied thereto. Secondary portion of the housing is preferably, but need not be, clear and non-reflective, which facilitates transmission of light from the primary and/or the auxiliary light source to the exterior of the housing. For example, a clear, non-reflective secondary portion of the housing may be in the form of a window formed of clear, non-reflective material. Alternatively the secondary portion of the housing may comprise one or more apertures in the housing.

15 In some preferred embodiments, the internally illuminated retroreflective device is attached, affixed, or positioned adjacent to a support means and erected or placed near a pedestrian crossing such that the retroreflective portions of the device are perpendicular to the direction of the pedestrian crossing. This embodiment facilitates the direction of light waves emitted by the primary light source and transmitted through the retroreflective material toward vehicles approaching the intersection from one or more directions. At the same time, this embodiment may also facilitate illumination of the retroreflective material by the light waves emitted by the headlights of vehicles approaching the pedestrian crossing from one or more directions. The installation and position of the internally illuminated retroreflective device as a pedestrian crossing beacon may also allow light from the primary and/or an auxiliary light source to shine directly onto the pedestrian crossing through a secondary clear, non-reflective portion of the housing.

25 Additional exemplary uses of the internally illuminated retroreflective device of the present application include use of the device in any other retroreflective road sign including, but not limited to, all internationally or nationally recognized signs, including keep left/right arrows, regulatory signs, street name signs, guide signs, railway crossing signs, and the like.

30 The complete disclosures of all patents, patent applications, patent documents, and publications are incorporated herein by reference as if individually incorporated.

Various modifications and alterations of the methods and forms described in the present application will become apparent to those skilled in the art without departing from the spirit and scope of the inventive concept. The disclosure in this patent application is intended to encompass all such modifications and alterations within the scope of the appended claims.

What is claimed is:

1. An internally illuminated retroreflective device, comprising:
a cylinder having two generally parallel opposed ends separated by a cylindrical
5 surface;
a light source housed within the area of the cylindrical surface; and
at least one circular disc that is capable of attachment to at least one of the opposed
ends of the cylinder, the circular disc including an optically transmissive material affixed to a
retroreflective material and capable of attachment to the cylinder such that the optically
10 transmissive material is adjacent to the cylindrical surface.
2. The internally illuminated retroreflective device of claim 1, further comprising:
a vertical pole attached to the cylinder.
- 15 3. The internally illuminated retroreflective device of claim 1, in which the cylinder
is formed of a metal.
4. The internally illuminated retroreflective device of claim 3, in which the metal is
aluminum.
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5. The internally illuminated retroreflective device of claim 1, in which optically
transmissive material is formed of a plastic.
6. The internally illuminated retroreflective device of claim 5, in which the plastic is a
25 polycarbonate.
7. The internally illuminated retroreflective device of claim 1, including two circular
discs that are each capable of attachment to at least one of the opposed ends of the cylinder.

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8. A disc capable of attachment to an internally illuminated retroreflective device including (1) a cylinder having two generally parallel opposed ends separated by a cylindrical surface and (2) a light source housed within the area of the cylindrical surface, comprising:
an optically transmissive polymeric material affixed to a retroreflective material.

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9. An internally illuminated retroreflective device, comprising:
a housing having an open end;
a light source positioned within the housing; and
a disc that is capable of attachment to the open end, the disc including a retroreflective
10 material.

10. The retroreflective device of claim 9, in which the housing has a shape that is selected from a group consisting essentially of a triangle, a rectangle, a trapezoid, a square, a polygon, and an octagon.

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11. An internally illuminated retroreflective device, comprising:
a primary light source that emits light and that is substantially confined within a housing; and
a retroreflective material positioned adjacent to the housing such that light emitted by
20 the primary light source passes through the housing and the retroreflective material.

12. The internally illuminated retroreflective device of claim 11, in which the housing includes the retroreflective material.

25 13. The internally illuminated retroreflective device of claim 11, in which a disc including the retroreflective material is positioned adjacent to the housing.

14. The internally illuminated retroreflective device of claim 11, in which the disc includes an optically transmissive material affixed to the retroreflective material and the disc

may be attached to the housing such that the optically transmissive material is adjacent to the housing.

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