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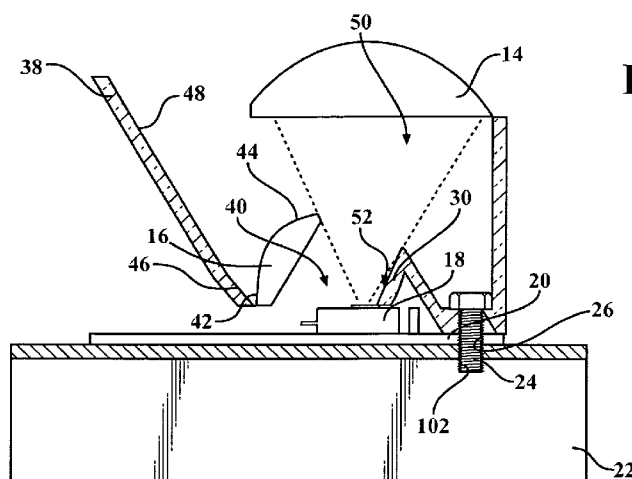


FIG. 4

(57) Abstract: The optics system is a lamp assembly which produces the desired beam pattern by using a reflector, a lens, a retainor lens, and an LED as a light source. The lamp assembly has three main components (the reflector, the lens, and the retainor lens) that maintain proper alignment between the light source and the reflector, the lens, and the retainor lens. The optical system collects substantially 100% of the light from the light source while effectively shaping the beam pattern using both cylindrical and revolved reflector elements. The lens has a saddle-shape which is used with the surface of a revolution to eliminate any "dogbone" light pattern shape. The use of a reflective element forms the foreground of the beam pattern.

HYBRID PROJECTOR LED LOW BEAM HEADLAMP

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No.
5 61/399,968 filed on July 20, 2010. The disclosure of the above application is
incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to an optical system which collects
10 substantially all of the light emitted from a light source to produce a desired
beam pattern.

BACKGROUND OF THE INVENTION

Current headlamps which incorporate the use of a light emitting diode
15 (LED) use a projector type lens, reflector optics, or closely coupled optics.
These types of headlamps suffer from low optical efficiency, high cost, or poor
beam pattern distribution.

Accordingly, there exists a need for a headlamp having an LED light
source which also includes an optical system that is able to collect
20 substantially all of the light produced by the LED light source, and produce a
desired beam pattern efficiently.

SUMMARY OF THE INVENTION

The optical system of the present invention solves the drawbacks of
25 previous designs by using an optical system that collects substantially 100%
of the light emitted from the light source and effectively directs it to produce
the desired beam pattern. This is achieved by a complex combination of
different optical control methods including reflector and lens optics. More
specifically, the optics system is a lamp assembly which produces the desired
30 beam pattern by using a reflector, a lens, a retainer lens, and an LED as a
light source. The cost of producing the lamp assembly according to the
present invention is controlled by a design that reduces the optical part count

to three main components that maintain proper alignment between the light source and the reflector, the lens, and the retainer lens.

The innovative optical system of the present invention collects substantially 100% of the light from the light source while effectively shaping the beam pattern using both cylindrical and revolved reflector elements. The combination of a saddle-shaped lens element and the surface of a revolution eliminates any "dogbone" light pattern shape, and the use of a reflective element forms the foreground of the beam pattern. The present invention has the combination of a prism and culminating lens with a culminating and flat reflective reflector. Another feature of the present invention is the integration of retaining features in a retainer lens and the reflector.

In one embodiment, the lamp assembly of the present invention has a light source in the form of a light emitting diode, a reflector operable for producing a desired beam pattern with light emitted from the light emitting diode, and at least one cylindrical extrusion sidewall formed as part of the reflector which is operable for forming a central portion of the desired beam pattern.

The present invention also includes a vertical culminating reflector segment formed as part of the reflector, and is operable for controlling a vertical edge profile of the wide angle spread light portion and the hotspot portion of the desired beam pattern. The lamp assembly also includes two lenses, a lens mounted to the reflector operable for forming a foreground portion of the desired beam pattern, and a retainer lens connected to and supporting a portion of the reflector operable for directing a portion of the light emitted from the light emitting diode toward the vertical culminating reflector segment. The retainer lens, the light emitting diode, and the reflector mounted to a printed circuit board (PCB).

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

Figure 1 is a first perspective view of a hybrid optic LED headlamp,
5 according to the present invention;

Figure 2 is a second perspective view of a hybrid optic LED headlamp with half of the reflector removed, according to the present invention;

Figure 3 is a third perspective view of a hybrid optic LED headlamp with the lens and retainer lens removed, according to the present invention;

10 Figure 4 is a sectional side view of the hybrid optic LED headlamp taken along lines 4-4 of Figure 1, according to the present invention;

Figure 5 is a sectional bottom view of a lens and a heat sink used for a hybrid optic LED headlamp taken along lines 5-5 of Figure 1, according to the present invention;

15 Figure 6 is a sectional bottom view of a retainer lens, an LED, and a heat sink used for a hybrid optic LED headlamp taken along lines 6-6 of Figure 1, according to the present invention;

Figure 7 is a perspective view of a lens used for a hybrid optic LED headlamp, according to the present invention;

20 Figure 8 is a perspective view of a retainer lens used for a hybrid optic LED headlamp, according to the present invention;

Figure 9 is a perspective view of a reflector used for a hybrid optic LED headlamp, according to the present invention;

25 Figure 10 is a perspective view of a hybrid optic LED headlamp used as part of an array of a headlamp for an automobile, according to the present invention; and

Figure 11 is a perspective view of an alternate embodiment of a hybrid optic LED headlamp, according to the present invention.

30 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

Referring to the Figures generally, and with specific reference to Figure 1, a lamp assembly according to the present invention is shown generally at 10. The lamp assembly 10 includes a reflector 12, a lens 14, a retainer lens 16, an LED 18, a printed circuit board (PCB) 20, a heatsink 22, and a plurality of fasteners 24. Referring now to Figure 2, a perspective view of the lamp assembly 10 is shown with a section of the reflector 12 removed for a better view of the interior of the assembly 10. One of the fasteners 24 in the interior of the reflector 12 is visible, as well as one of a plurality of apertures 26 present in the PCB 20. Some of the apertures 26 are used for providing proper alignment, others are used for receiving one of the fasteners 24, the function of which will be described later.

Referring now to Figure 3, the interior of reflector 12 is shown having the lens 14 and the retainer lens 16 removed, allowing the light emitting area, shown generally at 28, of LED 18 to be seen more clearly. The assembly 10 includes a foreground illumination reflector 30, which collects at least some light emitted from the light emitting area 28 and directs it forward out of the reflector 12 such that the light reflected by the foreground illumination reflector 30 passes through the lens 14. A cylindrical extrusion sidewall 32 is also part of the reflector 12; the cylindrical extrusion sidewall 32 is adjacent to and extends away from the foreground illumination reflector 30. The cylindrical extrusion sidewall 32 reflects the light emitted from the LED 18, and concentrates the light to form the central portion of the beam pattern. At least one revolution 34 is formed with the cylindrical extrusion sidewall 32. In this embodiment, there are two revolutions 34 which reflect light to form the hotspot portion of the beam pattern and maintains a flat angular presentation of the light source image, thereby keeping the hotspot tight vertically. The reflector 12 also includes side wall reflector segments 36; the side wall reflector segments 36 are connected to the cylindrical extrusion sidewall 32 and the revolution 34. The side wall reflector segments 36 are substantially flat, and function to reflect light from the LED 18 to produce wide angle spread light.

Connected and adjacent to the side wall reflector segments 36 is a vertical culminating reflector segment 38, and the vertical culminating reflector

segment 38 is operable with the retainer lens 16 (shown in Figures 1 and 2) to control the vertical edge profile of the wide angle spread light and a portion of the hotspot light reflected from surface of revolution 34.

Referring now to Figure 4, the control of how all the light emitted from the LED 18 by the assembly 10 is shown. The light emitting area 28 of the assembly 10 has several zones through which the light from the LED 18 is directed. Some of the light emitted from the LED 18 passes through a bottom zone, generally shown at 40, and is intercepted by the retainer lens 16. The retainer lens 16 has two distinct areas, a prism area 42, which simply bends the light while maintaining a general dispersion angle, and a focusing section 44 that generally culminates the light. All of the light that passes through the prism area 42 and the focusing section 44 is redirected forward and aligned horizontally by a first reflector segment 46 formed as part of the vertical culminating reflector segment 38, and the reflector segment 46 then focuses the dispersive light from prism area 42. A second reflector segment 48 is also formed as part of the vertical culminating reflector segment 38, and the reflector segment 48 redirects the already culminated light from the focusing section 44. The light emitting area 28 of the assembly 10 also has a forward zone, generally shown at 50, and the light emitted that passes through the forward zone 50 is intercepted and culminated by lens 14. The light emitted that passes through a top zone, generally shown at 52, is intercepted by the foreground illumination reflector 30, and is directed towards the lens 14 that culminates the light into a portion of the foreground of the beam pattern.

With reference to Figure 5, a bottom view through the center of the lens 14 is shown illustrating how all of the light is controlled as the light from the LED 18 is emitted outwardly toward the lens 14. Again, the light emitting area 28 has several zones in which the light from the LED 18 passes through. Light emitted from the LED 18 in a center zone 54 passes through the lens 14 and contributes to the medium spread portion of the beam pattern. Light emitted from LED 18 in a left zone 56 and a right zone 58 is culminated horizontally, the light then passes through the lens 14 contributing to the hotspot portion of the beam pattern.

Figure 6 is a sectional bottom view through the retainer lens 16 and reflector 12 illustrating how all of the light is controlled as the light from the LED 18 is emitted outwardly from the reflector 12 in the area not covered by the lens 14. Light emitted from the LED 18 into a center section 60 of the light emitting area 28 passes through the retainer lens 16 and then either reflects off the side wall reflector segment 36, or reflects directly off the vertical culminating reflector segment 38. The light reflected by these segments 36,38 makes up the widest spread portion of the beam pattern. There are also areas the light passes through to form part of the hotspot portion of the beam pattern. Light passing through the right area 62 and left area 64 is reflected off the surface of the revolution 34 and then through retainer lens 16 and reflects off the vertical culminating reflector segment 38. This portion of the light contributes to the near hotspot area of the beam pattern.

Figure 7 is an enlarged perspective view of the lens 14. Molded into the lens 14 is a retention snap feature, shown generally at 66. Instead of having a cylindrical shape, the lens 14 has a saddle shape achieved by the use of a saddle surface, shown generally at 68, that corrects the dogbone beam pattern shape in the wide spread light portion of the beam pattern that would occur if the lens 14 were of a simple cylindrical shape.

Referring now to Figure 8, details of the retainer lens 16 are shown. The retainer lens 16 has an alignment nub 70 which locates the retainer lens 16 relative to the LED 18. The alignment nub 70 locates in one of the apertures 26 in the PCB 20 shown in Figure 2. The lens 16 also has one or more attachment legs 72; each attachment leg 72 has an aperture 88 to receive one of the fasteners 24. The lens 16 also has a relief area 74, which allows for flexing of a snap feature 76 during assembly.

Figure 9 shows further details of the reflector 12 with the lens 14 and retainer lens 16 removed. The reflector 12 has alignment nubs 78 formed as part of a reflector standoff feature 80. The alignment nubs 78 locate the reflector 12 relative to the LED 18 by locating in apertures 26 in the PCB 20 shown in Figure 2. The cylindrical extrusion sidewalls 32 are mounted on the reflector standoff feature 80. The reflector standoff feature 80 properly positions the reflector 12 to the proper height above the LED 18. The reflector

12 has a snap feature 82 which engages the snap feature 76 on the retainer lens 16 when assembled. There is an aperture 84 which allows for attachment with one of the fasteners 24. Another aperture 86 provides a mating snap feature for the snap feature 66 on the lens 14. Use of a high reflective coating like silver further improves efficiency over the use of aluminum.

Referring again to the Figures generally, during assembly the retainer lens 16 is assembled to the PCB 20. One of the fasteners 24 extends through a corresponding aperture 88, through one of the apertures 26 in the PCB 20, and into an aperture (not shown) formed as part of the heat sink 22, securing the retainer lens 16 to the PCB 20 and heat sink 22. In this embodiment, there are two of the fasteners 24 which extend through the corresponding apertures 88 formed as part of each of the attachment legs 72. Each alignment nub 70 is disposed in a corresponding aperture 26 when the retainer lens 16 is connected to the PCB 20, providing proper alignment of the retainer lens 16 relative to the PCB 20. The reflector 12 is then attached to the retainer lens 16 using the snap feature 76 and the snap feature 82. More specifically, the snap feature 76 includes an angled portion 90 which deflects and snaps into place in a recess 92 formed as part of the snap feature 82. When the retainer lens 16 and the reflector 12 are in place, an arcuate surface 94 of the retainer lens 16 is in contact with a corresponding arcuate surface 96 formed as part of each of the side wall reflector segments 36.

Once the retainer lens 16 is in place and the reflector 12 is connected to the retainer lens 16, another one of the fasteners 24 is inserted through the aperture 84 formed as part of the reflector standoff feature 80, and then extends into one of the apertures 26 of the PCB 20 and into an aperture 102 formed as part of the heat sink 22, best shown in Figures 2-4. The alignment nubs 78 on the bottom of the reflector standoff feature 80 are received into a corresponding aperture 26 of the PCB 20, providing the correct positioning of the reflector 12 relative to the LED 18.

The lens 14 is then attached to the reflector 12 through the use of the retention snap features 66 being received into the corresponding apertures 86. More specifically, there is a snap feature 66 on each side of the lens 14,

and each snap feature 66 has an angled portion 98 which deflects corresponding arcuate wall portions 100 formed as part of the side wall reflector segments 30 as the lens 14 is moved past the wall portions 100. Once the lens 14 has moved enough, the angled portions 98 are in alignment
5 with the apertures 86, allowing the angled portions 98 to move into the apertures 86 as the wall portions 100 are no longer deflected. The arcuate wall portions 100 have substantially the same curvature as the lens 14, best seen in Figure 1.

Once assembled, the lamp assembly 10 provides high efficiency by
10 collecting substantially 100% of the light produced by the LED 18, and shaping the beam pattern using the lenses 14,16, the reflector 30, and the various sidewalls 32, revolution 34, and segments 36,38. Furthermore, the lamp assembly 10 is easily assembled to the PCB 20 and heat sink 22.

Figure 10 shows an application of the lamp assembly 10 according to
15 the present invention, which includes an array, shown generally at 104 used for functioning as a headlamp for an automobile. There are two lamp assemblies 10 on one end of the array, and a plurality of lighting devices 106 which also make up part of the array 104. The lamp assemblies 10 are used to produce a beam pattern having a hot spot portion, and medium spread
20 portion.

Referring to Figure 11, an alternate embodiment of the lamp assembly 10 is shown, with like numbers referring to like elements. However, in this embodiment, the lamp assembly 10 is disposed within a casing 108 having several flanges 110 which include apertures 112. Several of the fasteners 24
25 may be extended through the apertures 112 to connected the casing 108 to a corresponding mount on a vehicle, allowing the lamp assembly 10 to be located as desired.

The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the essence of the invention are
30 intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A lamp assembly, comprising:

5 at least one light source;

a reflector positioned in proximity to said at least one light source, such that light emitted from said at least one light source is reflected by said reflector, producing a desired beam pattern;

10 at least one lens connected to said reflector, a portion of said light emitted from said at least one light source passes through said at least one lens, producing a portion of said desired beam pattern; and

at least one retainer lens connected to said reflector, said at least one retainer lens operable for directing at least a portion of said light emitted from said at least one light source to said reflector.

15

2. The lamp assembly of claim 1, wherein a portion of said light emitted from said at least one light source that passes through said lens forms at least a portion of a foreground portion of said desired beam pattern.

20

3. The lamp assembly of claim 2, said lens further comprising a saddle surface, said saddle surface being shaped such that at least a portion of said light passing through said lens forms at least a portion of said foreground portion of said desired beam pattern.

25

4. The lamp assembly of claim 1, at least a portion of said reflector being mounted to and connected to said retainer lens.

5. The lamp assembly of claim 1, said reflector further comprising:

30 at least one cylindrical extrusion sidewall operable for forming a central portion of said desired beam pattern with a portion of said light emitted from said at least one light source;

at least one sidewall reflector segment connected to said at least one cylindrical extrusion sidewall, said at least one sidewall reflector segment

operable for reflecting at least a portion of light emitted by said at least one light source to form a wide angle spread light portion of said desired beam pattern; and

5 a vertical culminating reflector segment connected to said at least one sidewall reflector segment, said vertical culminating reflector segment operable for controlling a vertical edge profile of said wide angle spread light portion and a hotspot portion of said desired beam pattern.

10 6. The lamp assembly of claim 5, said at least one cylindrical extrusion sidewall further comprising at least one revolution formed as part of said at least one cylindrical extrusion sidewall and connected to said at least one sidewall reflector segment, said revolution operable for directing at portion of said light emitted from said at least one light source.

15 7. The lamp assembly of claim 6, said light emitting area further comprising:

a center section, a portion of said light emitted by said light emitting diode passes through said center section and passes through said retainer lens and reflects off of either of said side wall reflector segment or said
20 vertical culminating reflector segment to produce at least a portion of said widest spread portion of said beam pattern;

a right area, a portion of said light emitted by said light emitting diode passes through said right area is reflected off of said revolution, passes through said retainer lens and reflects off of said vertical culminating reflector
25 segment, forming at least a portion of said hotspot portion of said desired beam pattern; and

a left area, a portion of said light emitted by said light emitting diode passes through said left area is reflected off of said revolution, passes through said retainer lens and reflects off of said vertical culminating reflector
30 segment, forming at least a portion of said hotspot portion of said desired beam pattern

8. The lamp assembly of claim 5, said retainer lens further comprising:

a prism area, a portion of light emitted from said at least one light source passes through said prism area to form dispersive light, and is directed forward and aligned horizontally by said vertical culminating reflector segment to focus said dispersive light emitted from said prism area; and

a focusing section located in proximity to said prism area, said focusing section operable for culminating light emitted from said at least one light source as light from said at least one light source passes through said focusing section.

9. The lamp assembly of claim 8, said vertical culminating reflector segment further comprising:

a first reflector segment operable for directing light received from said prism area out of said reflector, and focusing said dispersive light from said prism area; and

a second reflector segment operable for directing culminated light from said focusing section to form at least a portion of said hotspot portion of said desired beam pattern.

10. The lamp assembly of claim 5, said reflector further comprising a foreground illumination reflector located in proximity to said at least one light source and adjacent said at least one cylindrical extrusion sidewall, said foreground illumination reflector operable for directing light to said lens.

11. The lamp assembly of claim 10, further comprising a reflector standoff feature, said at least one cylindrical extrusion sidewall connected to and extending away from said reflector standoff feature, said foreground illumination reflector connected to said reflector standoff feature.

12. The lamp assembly of claim 10, said light emitting area further comprising:

5 a top zone adjacent said foreground illumination reflector, a portion of light emitted by said light emitting diode passes through said top zone, is reflected by said foreground illumination reflector, and is directed towards said lens;

a bottom zone, a portion of said light emitted by said light emitting diode passes through said bottom zone prior to passing through said retainer lens; and

10 a forward zone substantially located between said top zone and said bottom zone, a portion of said light emitted by said light emitting diode passes through said forward zone prior to passing through said lens.

13. The lamp assembly of claim 1, said light emitting area further comprising:

15 a right zone, a portion of light emitted by said light emitting diode passes through said right zone and is culminated horizontally and then passes through said lens to form part of said hotspot portion of said desired beam pattern;

20 a left zone, a portion of light emitted by said light emitting diode passes through said left zone and is culminated horizontally and then passes through said lens to form part of said hotspot portion of said desired beam pattern; and

25 a center zone located between said right zone and said left zone, a portion of light emitted by said light emitting diode passes through said center zone and then through said lens to form a portion of said medium spread portion of said desired beam pattern.

14. The lamp assembly of claim 1, said at least one light source
30 further comprising at least one light emitting diode.

15. The lamp assembly of claim 1, further comprising:

a printed circuit board;

a plurality of apertures formed as part of said printed circuit board; and

a plurality of fasteners, at least one of said plurality of fasteners

5 extending through a portion of said retainer lens and one of said plurality of apertures, securing said retainer lens to said printed circuit board, and another of said plurality of fasteners extending through said reflector and another of said plurality of apertures, securing said reflector to said printed circuit board.

10

16. A lamp assembly, comprising:

a light emitting diode;

a reflector operable for producing a desired beam pattern with light emitted from said light emitting diode;

15 at least one cylindrical extrusion sidewall formed as part of said reflector, said at least one cylindrical extrusion sidewall operable for forming a central portion of said desired beam pattern;

a vertical culminating reflector segment having a plurality of reflector segments, said vertical culminating reflector segment operable for controlling
20 a vertical edge profile of said wide angle spread light portion and said hotspot portion of said desired beam pattern, said vertical culminating reflector segment formed as part of said reflector;

a lens mounted to said reflector, said lens operable for forming a foreground portion of said desired beam pattern;

25 a retainer lens connected to and supporting a portion of said reflector, said retainer lens operable for directing a portion of said light emitted from said light emitting diode toward said vertical culminating reflector segment; and

a printed circuit board, said retainer lens, said light emitting diode, and
30 said reflector mounted to said printed circuit board.

17. The lamp assembly of claim 16, said retainer lens further comprising:

a prism area, a portion of light emitted from said at least one light source passes through said prism area to form dispersive light, and is directed forward and aligned horizontally by one of said plurality of reflector segments to focus said dispersive light emitted from said prism area; and

a focusing section located in proximity to said prism area, said focusing section operable for culminating light emitted from said at least one light source as light from said at least one light source passes through said focusing section.

18. The lamp assembly of claim 17, said plurality of reflector segments further comprising:

a first reflector segment operable for directing light received from said prism area out of said reflector, and focusing said dispersive light from said prism area; and

a second reflector segment operable for directing culminated light from said focusing section to form at least a portion of said hotspot portion of said desired beam pattern.

19. The lamp assembly of claim 16, further comprising a foreground illumination reflector formed as part of said reflector such that said foreground illumination reflector is located adjacent said light emitting diode and said at least one cylindrical extrusion sidewall, and said foreground illumination reflector directs light to pass through said lens to form a portion of said desired beam pattern.

20. The lamp assembly of claim 19, said light emitting area further comprising:

a bottom zone, a portion of said light emitted by said light emitting diode passes through said bottom zone prior to passing through said retainer lens;

a top zone adjacent said foreground illumination reflector, a portion of light emitted by said light emitting diode passes through said top zone, is reflected by said foreground illumination reflector, and is directed towards said lens; and

5 a forward zone substantially located between said top zone and said bottom zone, a portion of said light emitted by said light emitting diode passes through said forward zone prior to passing through said lens

10 21. The lamp assembly of claim 19, further comprising a reflector standoff feature formed as part of said reflector, said reflector standoff feature connected to said printed circuit board, and said at least one cylindrical extrusion sidewall connected to and extending away from reflector standoff feature, and said foreground illumination reflector connected to and adjacent said reflector standoff feature.

15

22. The lamp assembly of claim 16, further comprising at least one sidewall reflector segment connected to said at least one vertical culminating reflector segment and said at least one cylindrical extrusion sidewall, said at least one sidewall reflector segment operable for producing a wide angle
20 spread light portion of said desired beam pattern.

23. The lamp assembly of claim 22, further comprising at least one revolution formed with said cylindrical extrusion sidewall, and connected to said at least one sidewall reflector segment, said at least one revolution
25 operable directing light from said light emitting diode to form a portion of a hotspot portion of said desired beam pattern.

24. The lamp assembly of claim 23, said light emitting area further comprising:
30 a center section, a portion of said light emitted by said light emitting diode passes through said center section and passes through said retainer lens and reflects off of either of said side wall reflector segment or said

vertical culminating reflector segment to produce at least a portion of said wide angle spread light portion of said beam pattern;

5 a right area, a portion of said light emitted by said light emitting diode passes through said right area is reflected off of said revolution, passes through said retainer lens and reflects off of said vertical culminating reflector segment, forming at least a portion of said hotspot portion of said desired beam pattern; and

10 a left area, a portion of said light emitted by said light emitting diode passes through said left area is reflected off of said revolution, passes through said retainer lens and reflects off of said vertical culminating reflector segment, forming at least a portion of said hotspot portion of said desired beam pattern.

15 25. The lamp assembly of claim 16, said light emitting area further comprising

a right zone, a portion of light emitted by said light emitting diode passes through said right zone and is culminated horizontally and then passes through said lens to form part of said hotspot portion of said desired beam pattern;

20 a left zone, a portion of light emitted by said light emitting diode passes through said left zone and is culminated horizontally and then passes through said lens to form part of said hotspot portion of said desired beam pattern; and

25 a center zone, a portion of light emitted by said light emitting diode passes through said center zone and then through said lens to form a portion of said medium spread portion of said desired beam pattern.

26. The lamp assembly of claim 16, further comprising:

a plurality of apertures formed as part of said printed circuit board

30 a plurality of fasteners, at least one of said plurality of fasteners extending through a portion of said retainer lens and one of said plurality of apertures, securing said retainer lens to said printed circuit board, and another of said plurality of fasteners extending through said reflector and

another of said plurality of apertures, securing said reflector to said printed circuit board.

27. A lamp assembly, comprising:

- 5 a reflector operable for producing a desired beam pattern;
a light emitting diode operable for emitting light toward said reflector;
a plurality of reflector segments formed as part of said reflector;
a lens connected to said reflector, said lens having a saddle surface
such that said lens forms at least a portion of a foreground portion of said
10 desired beam pattern;
a retainer lens operable for directing at least a portion of said light
emitted from said light emitting diode toward said reflector;
a prism area formed as part of said retainer lens such that a portion of
said light emitted from said light emitting diode that passes through said prism
15 area to form dispersive light and is directed forward and aligned horizontally
by one of said plurality of reflector segments to focus said dispersive light
emitted from said prism area;
a focusing section formed as part of said retainer lens, said focusing
section operable for culminating light emitted from said light emitting diode
20 that passes through said focusing section;
a printed circuit board, said retainer lens, said light emitting diode, and
said reflector being mounted to said printed circuit board;
a plurality of apertures, a portion of said plurality of apertures formed
as part of said printed circuit board; and
25 a plurality of fasteners, one of said plurality of fasteners operable for
extending through said retainer lens and into said printed circuit board,
securing said retainer lens to said printed circuit board.

28. The lamp assembly of claim 27, said reflector further
30 comprising:

a foreground illumination reflector located in proximity to said light
emitting diode;

at least one cylindrical extrusion sidewall adjacent said foreground illumination reflector, a portion of said light emitted from said light emitting diode is reflected off of said at least one cylindrical extrusion operable to form a central portion of said desired beam pattern;

5 at least one revolution formed as part of said at least one cylindrical extrusion sidewall, said at least one revolution forming at least a portion of a hotspot portion of said desired beam pattern;

at least one sidewall reflector segment connected to said at least one cylindrical extrusion sidewall and said at least one revolution, said at least one
10 sidewall reflector segment operable for directing light through said lens to produce a wide angle spread light portion of a desired beam pattern;

a vertical culminating reflector segment connected to said at least one sidewall reflector segment, said vertical culminating reflector segment operable for controlling a vertical edge profile of said wide angle spread light
15 portion and said hotspot portion of said desired beam pattern; and

a reflector standoff feature, said at least one cylindrical extrusion sidewall connected to and extending away from said reflector standoff feature, and said foreground illumination reflector connected to said reflector standoff feature.

20

29. The lamp assembly of claim 28, said light emitting area further comprising:

a bottom zone, a portion of said light emitted by said light emitting diode passes through said bottom zone prior to passing through said retainer
25 lens;

a forward zone, a portion of said light emitted by said light emitting diode passes through said forward zone prior to passing through said lens;

a top zone, a portion of light emitted by said light emitting diode passes through said top zone and is reflected by said foreground illumination
30 reflector, and is directed towards said lens;

a center zone, a portion of light emitted by said light emitting diode passes through said center zone and then through said lens to form a portion of said medium spread portion of said desired beam pattern;

a right zone, a portion of light emitted by said light emitting diode passes through said right zone and is culminated horizontally and then passes through said lens to form part of said hotspot portion of said desired beam pattern;

5 a left zone, a portion of light emitted by said light emitting diode passes through said left zone and is culminated horizontally and then passes through said lens to form part of said hotspot portion of said desired beam pattern;

a center section, a portion of said light emitted by said light emitting diode passes through said center section and passes through said retainer
10 lens and reflects off of either of said at least one side wall reflector segment or said vertical culminating reflector segment to produce at least a portion of said widest spread portion of said beam pattern;

a right area, a portion of said light emitted by said light emitting diode passes through said right area is reflected off of said at least one revolution,
15 passes through said retainer lens and reflects off of said vertical culminating reflector segment, forming at least a portion of said hotspot portion of said desired beam pattern; and

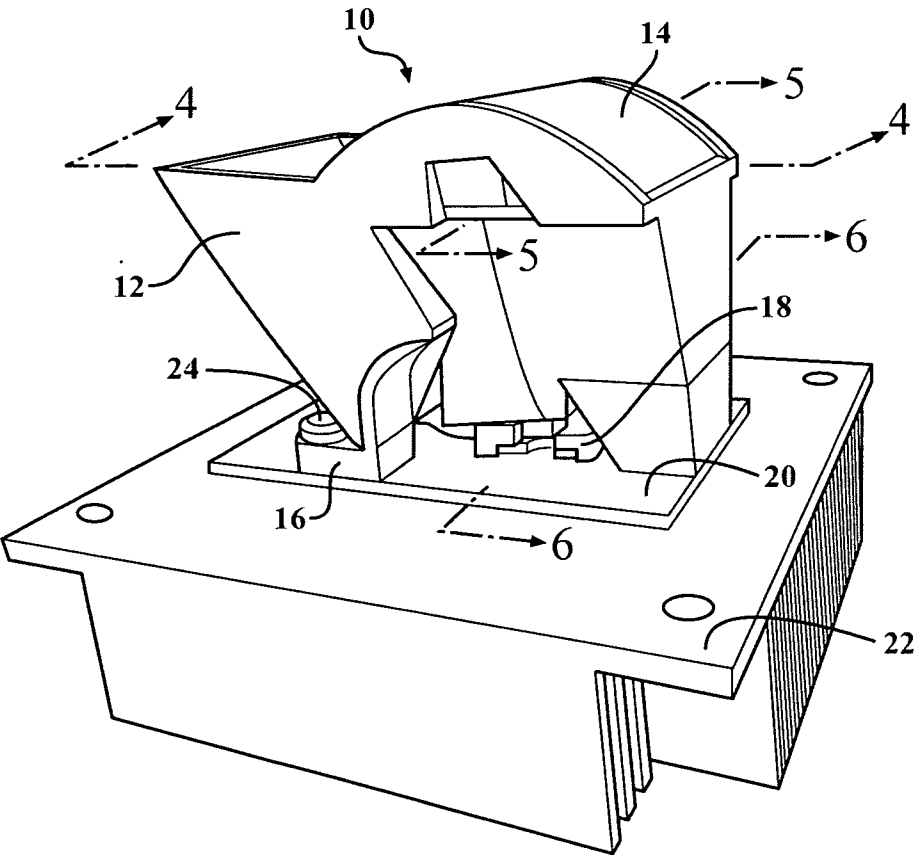
a left area, a portion of said light emitted by said light emitting diode passes through said left area is reflected off of said at least one revolution,
20 passes through said retainer lens and reflects off of said vertical culminating reflector segment, forming at least a portion of said hotspot portion of said desired beam pattern.

30. The lamp assembly of claim 28, said vertical culminating
25 reflector segment further comprising:

a first reflector segment operable for directing light received from said prism area out of said reflector, and focusing said dispersive light from said prism area;

a second reflector segment operable for directing culminated light from
30 said focusing section to form at least a portion of said hotspot portion of said desired beam pattern.

FIG. 1



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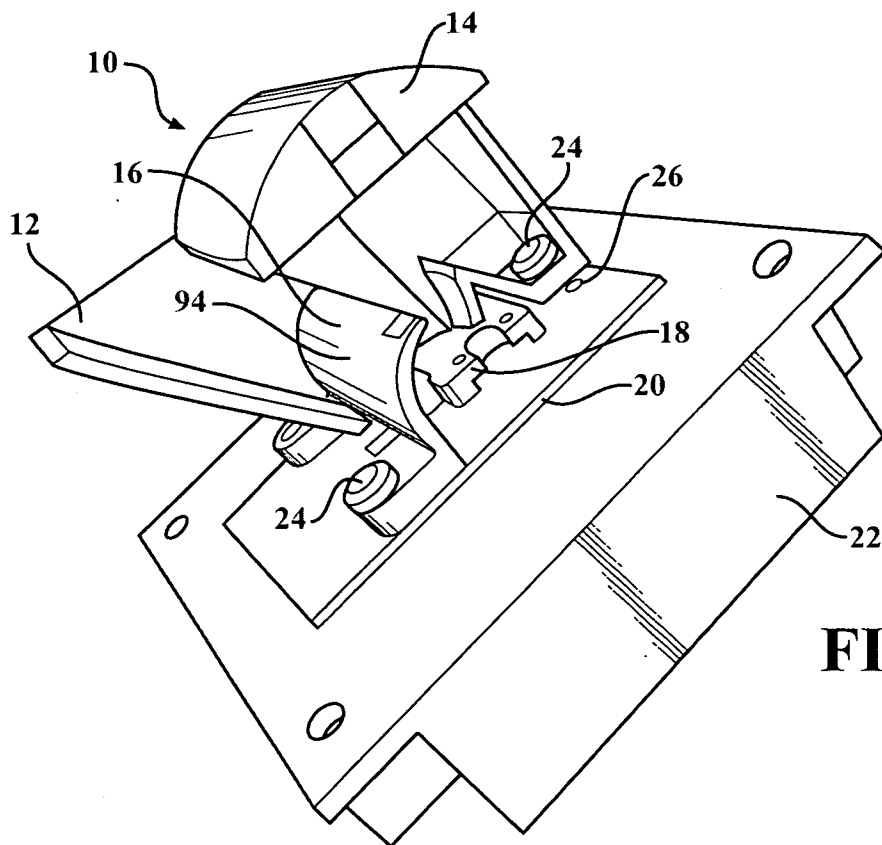


FIG. 2

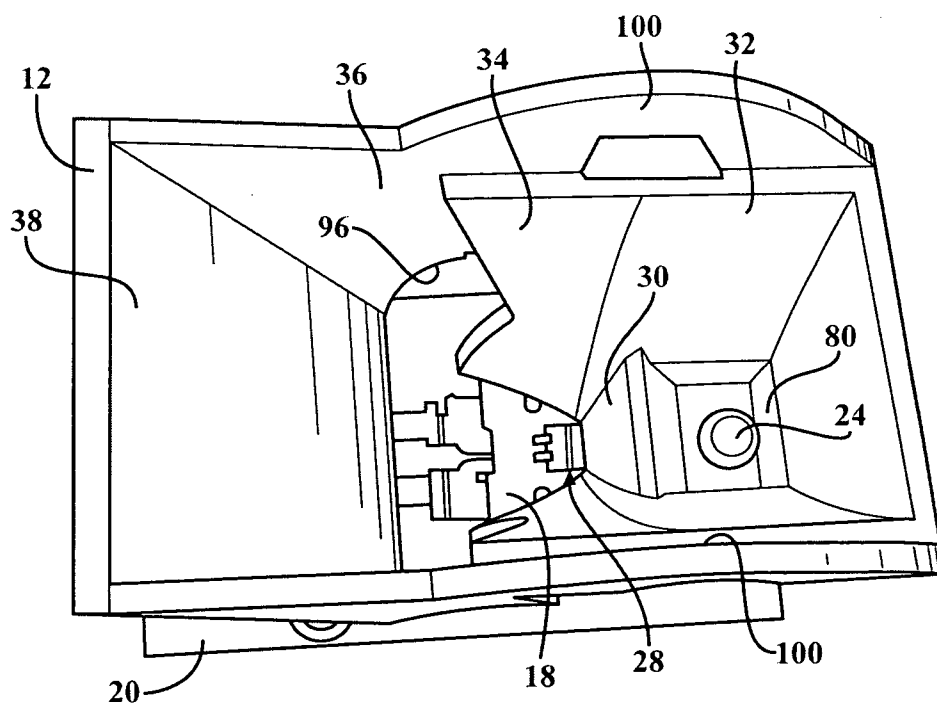


FIG. 3

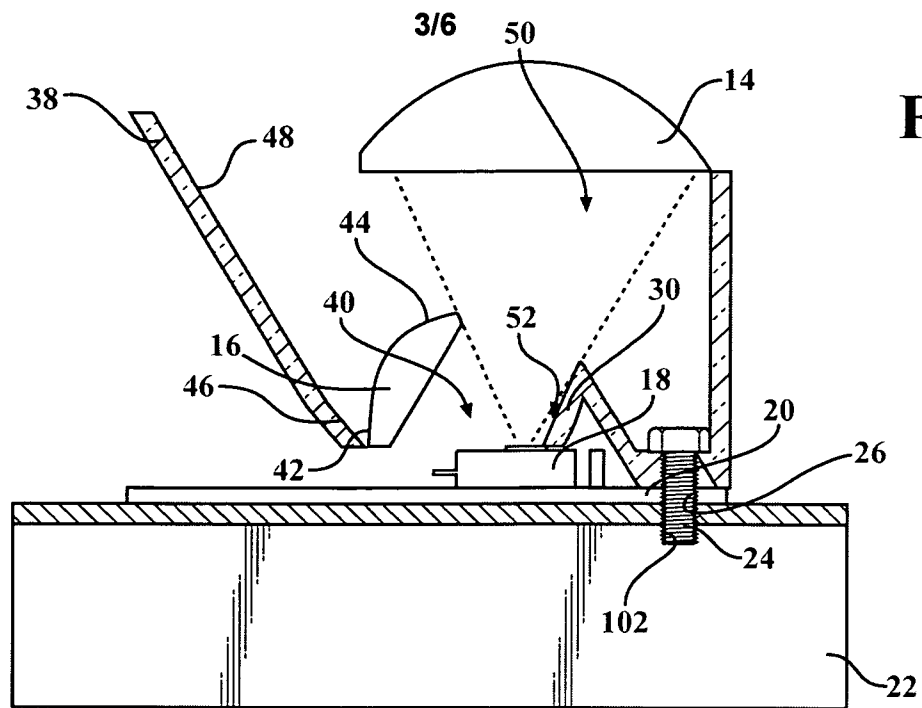
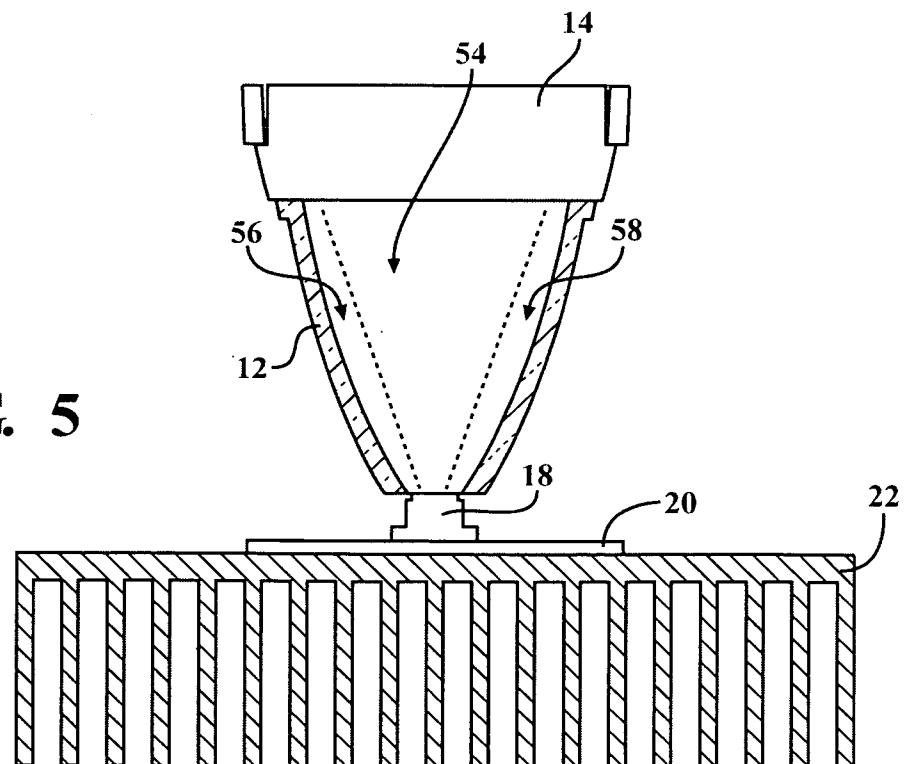
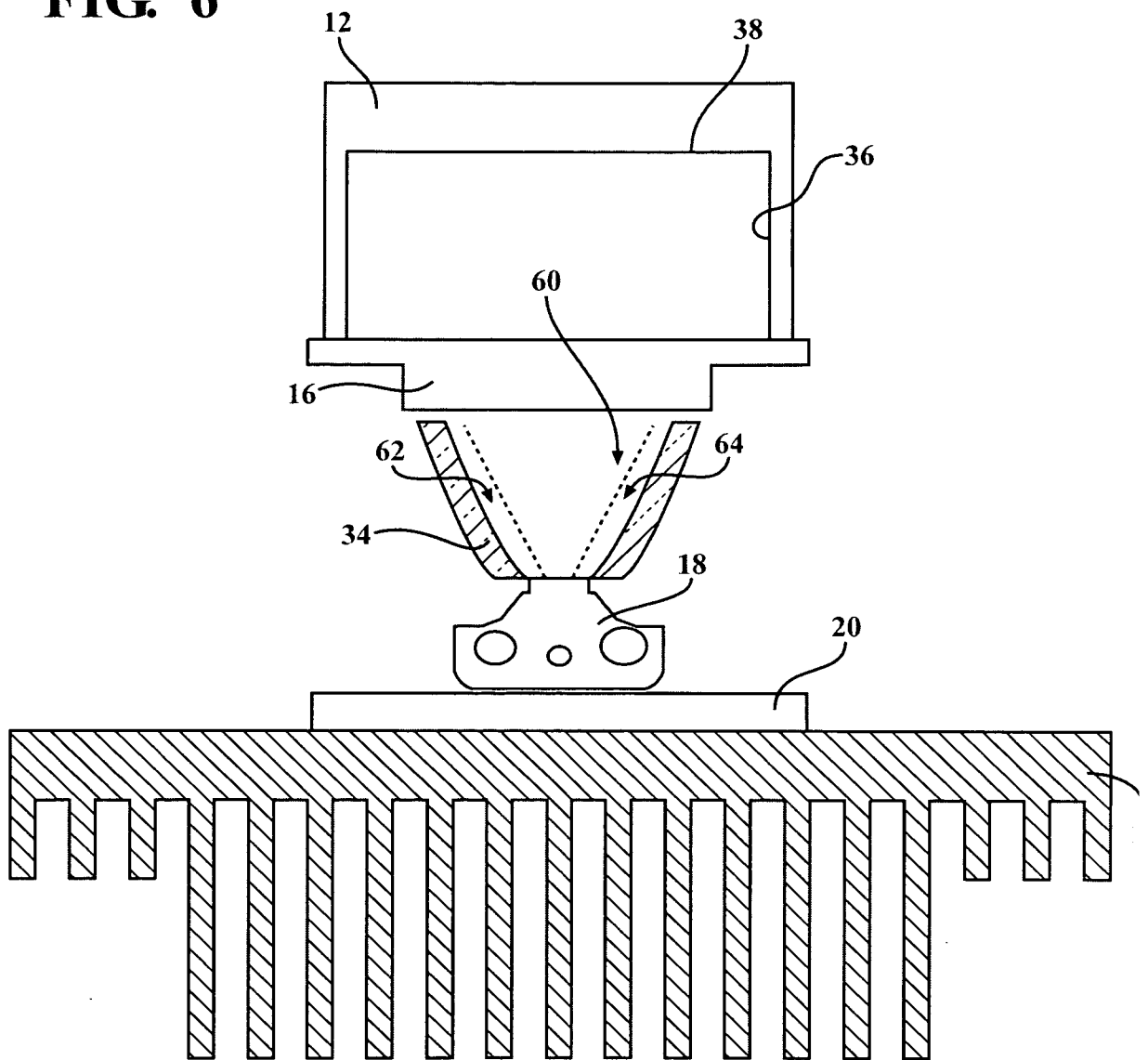


FIG. 4

FIG. 5



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FIG. 6

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FIG. 7

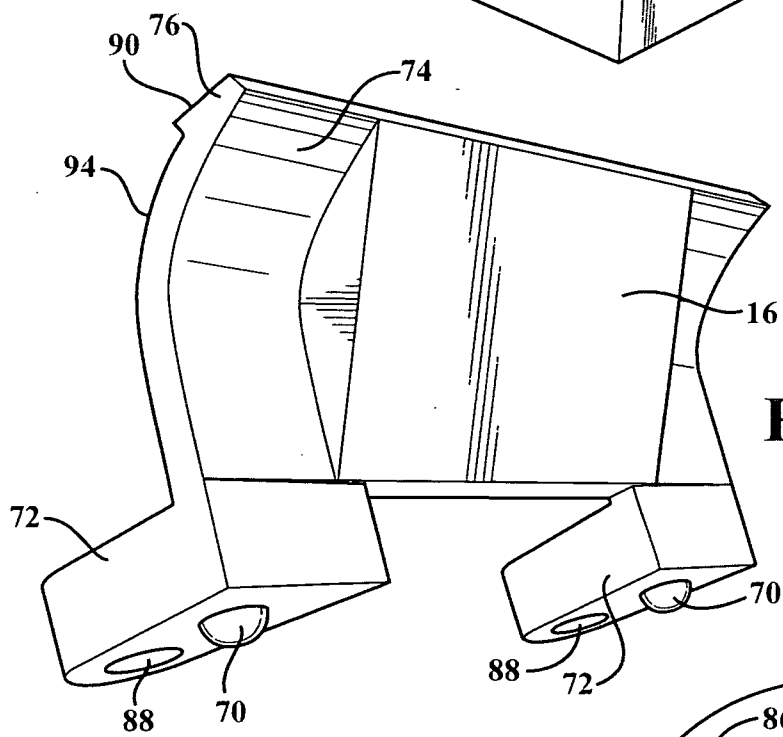
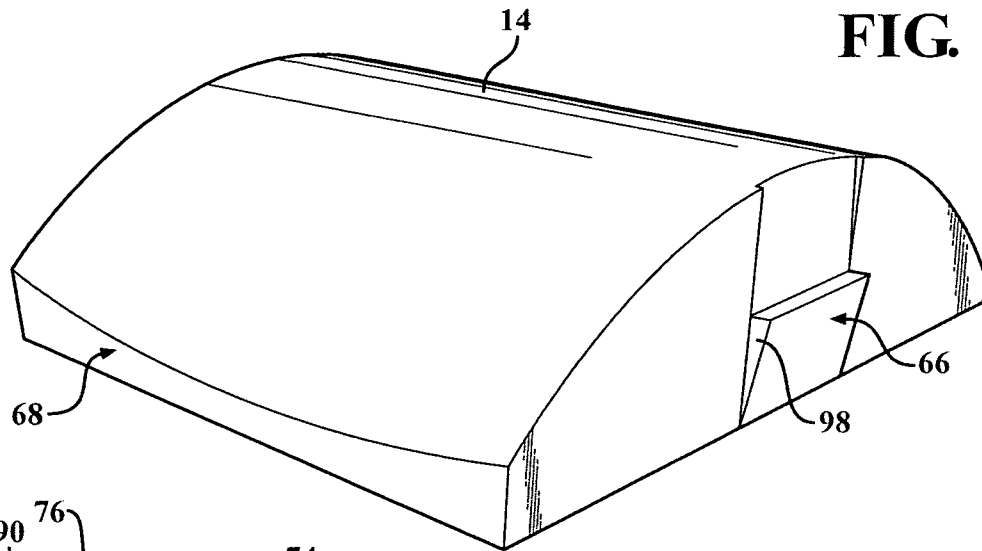
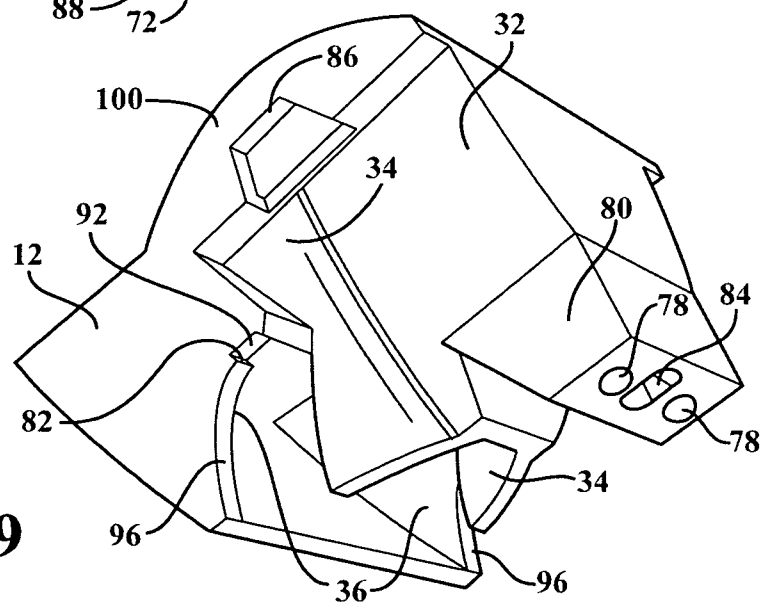


FIG. 8

FIG. 9



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FIG. 10

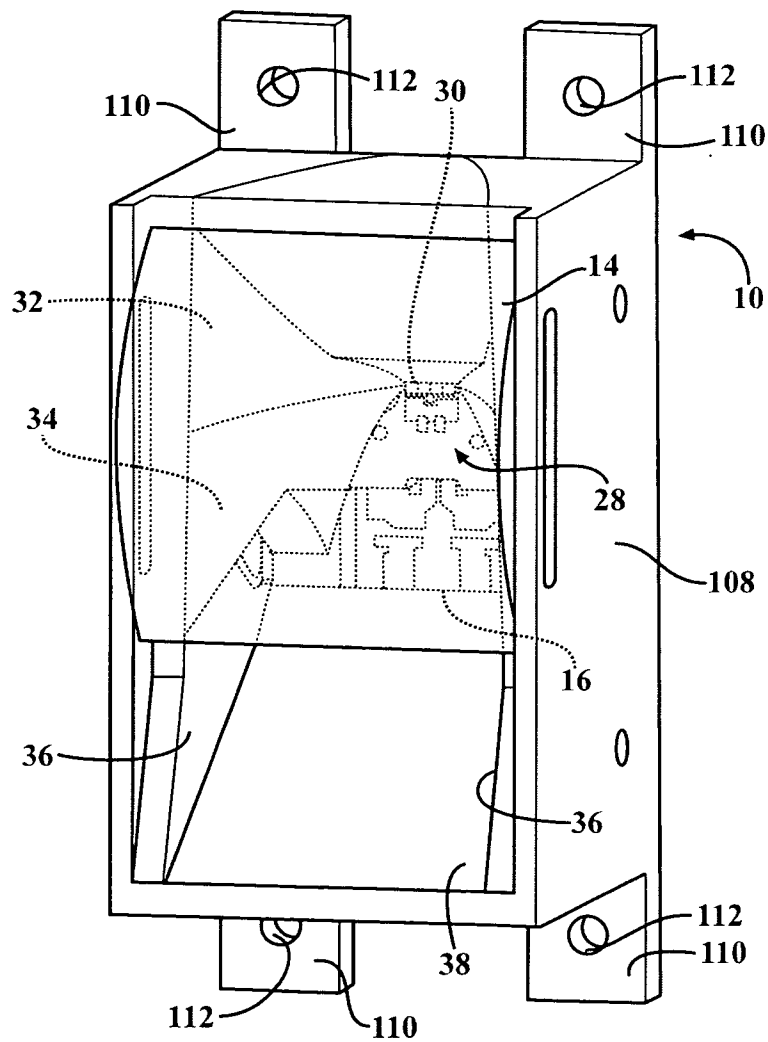
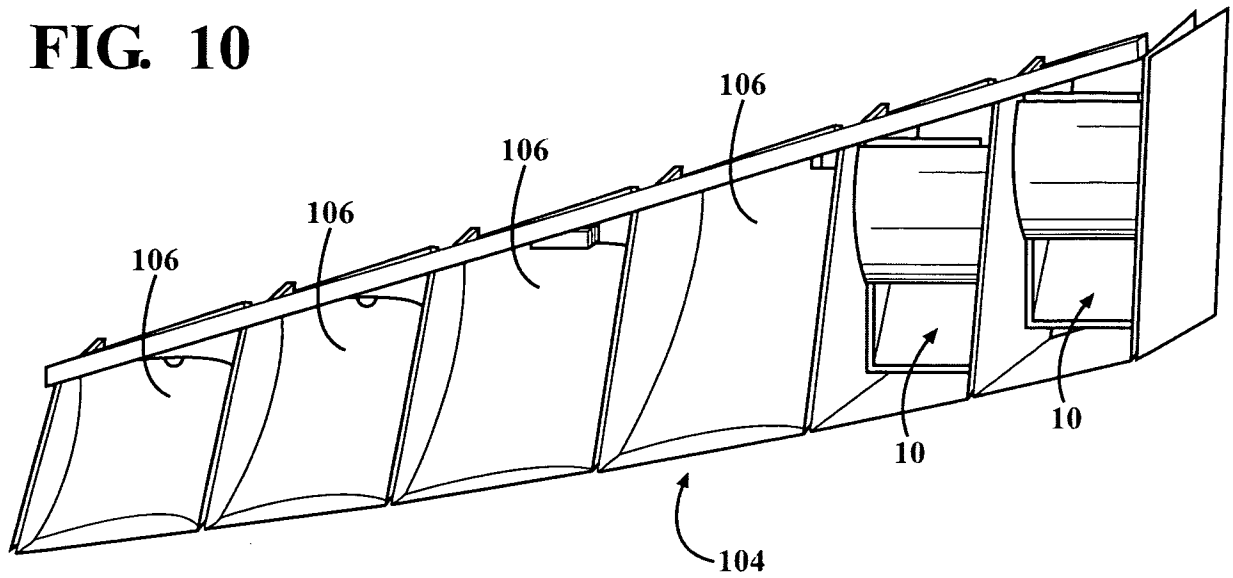


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2011/001279

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60Q1/04 F21S8/12
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B60Q F21S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/302343 A1 (SATO MASANORI [JP] ET AL) 10 December 2009 (2009-12-10)	1,2,4, 11,14, 15,19, 21,26
Y	paragraphs [0105] - [0115]; figures 3,4,5,6,9	3,5,6, 10,13, 16,22, 23,25
X	----- US 2007/109775 A1 (CHEN JEFF J [US] CHEN JEFF JIANHUA [US]) 17 May 2007 (2007-05-17)	1,13
Y	abstract; figures 1,5	13,25
X	----- WO 2006/107287 A1 (ALCELIK TURHAN [TR]) 12 October 2006 (2006-10-12)	1
	abstract; figures 1-3 ----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

16 December 2011

Date of mailing of the international search report

23/12/2011

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/001279

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 2006/209552 A1 (OKADA NORIKO [JP] ET AL) 21 September 2006 (2006-09-21) abstract; figures 2-6 -----	5,6,10, 16,22,23
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