[0007] In certain applications, such as in floodlighting, there is a need for directional control of light emitted by the LEDs.

[0008] Previous attempts to provide lighting apparatus using LEDs for floodlighting purposes have not proved to be altogether satisfactory, as the resultant lighting often did not provide a relatively even illumination of the target area and had a tendency to produce excessive glare which could dazzle persons in the vicinity.

[0009] Accordingly, there is a need for some directional control light emitted by the LEDs.

[0010] The production of an illumination apparatus having a plurality of LEDs to provide sufficient illumination, a heat sink for dissipation heat generated by the LED, and also directional control of light emitted by the LEDs can present challenges.

[0011] It is against this background, and the problems and difficulties associated therewith, that the present invention has been developed.

SUMMARY OF INVENTION

[0012] According to a first aspect of the invention there is provided an illumination apparatus comprising a plurality of light emitting diodes (LEDs), a heat sink, and a reflector, the reflector defining a plurality of cavities in which the LEDs are accommodated, the heat sink comprising an elongate body providing a base portion and a heat dissipation portion of integral construction, wherein the base portion presents a face and the plurality of LEDs are mounted on the face of the base portion whereby heat generated by the plurality of LEDs is absorbed by the base portion and transferred to the heat dissipation portion, wherein the heat dissipation portion comprises a cooling fin assembly for dissipating heat to surrounding air, the cooling fin assembly comprising at least one longitudinal fin disposed to one side of the base portion and a plurality of lateral fins extending from the longitudinal fin, the lateral fins being disposed on opposed longitudinal sides of the longitudinal fin, and wherein the reflector is mounted on the base portion and comprises a plurality of reflector portions defining said plurality of cavities in which the plurality of LEDs are accommodated, each reflector portion being configured to receive a respective one of the LEDs, each reflector portion comprising an aperture through which the respective LED extends into the cavity, each reflector portion defining an opening and the respective cavity extending to the opening, whereby light emitted by the respective LED passes through the opening for illumination purposes, each reflector portion comprising a wall structure defining side walls and an inner wall in opposed relation to the opening, the

[0035] The LEDs 21 may be of any appropriate type suitable for the intended purpose. In this embodiment, the LEDs 21 comprise LEDs marketed under the trade mark *CREE XLamp XT-E LE.*

[0036] The various illumination apparatus 10 defining the lighting modules 20 within each row of the array 19 share a common heat sink 23, as will be explained in more detail later.

[0037] The LEDs 21 are provided by a plurality of LED modules 29. Each LED module 29 comprises the LEDs 21 mounted on a printed circuit board (PCB) 30.

[0038] In the arrangement shown, each LED module 29 corresponds to one of the lighting modules 20 within the array 19.

[0039] As mentioned above, the lighting modules 20 within each row of the array 19 share a common heat sink 23. With this arrangement, the lighting modules 20 within each row of the array 19 utilise the same heat sink 23, but are positioned at different locations on the heat sink, as will become apparent later. In particular, the common heat sink 23 is of elongate configuration and the various LED modules 29 are disposed along the elongate heat sink.

[0040] The common heat sink 23 comprises a base portion 31 and a heat dissipation portion 33. The LEDs 21 are mounted on the base portion 31, whereby heat generated by the LEDs can be absorbed by the base portion and transferred to the heat dissipation portion 33.

[0041] The heat dissipation portion 33 comprises a cooling fin assembly 35, whereby heat can be dissipated to air surrounding the fin assembly. The fin assembly 35 comprises a plurality of fins 37 disposed to one side of the base portion 31. More particularly, the fine assembly 35 comprises two longitudinal fins 41 disposed to one side of the base portion 31 and a plurality of lateral fins 43 extending from the longitudinal fins 41. The lateral fins 43 are disposed on opposed longitudinal sides of the two longitudinal fins 41. The two longitudinal fins 41 and associated lateral fins 43 are disposed in spaced-apart relation to define a gap 45 therebetween. The gap 45 facilitates air flow and can also accommodate cabling 47 for supplying electrical power to the PCB 30 to which the LEDs 21 are electrically connected in known manner.

[0042] In this embodiment, the base portion 31 and the heat dissipation portion 33 are of integral construction, although they need not necessarily be so. In the arrangement shown, the heat sink 23 comprises an extrusion. The heat sink 23 may comprise an aluminum extrusion.

[0043] The base portion 31 of the common heat sink 23 presents a face 51 on which the LEDs 21 are mounted. More particularly, the various LED modules 29 sharing the common heat sink 23 are mounted on the face 51. Specifically, the PCB 30 of each LED module 29 is affixed to the face 51 and the respective LEDs 21 electrically connected to the PCB.

[0044] The reflector 25 is mounted on the base portion 31 of the heat sink 23. The reflector 25 may be affixed to the heat sink 23 in any appropriate way; for example, by way of one of more mechanical fixings extending between the reflector and the heat sink.

[0045] The reflector 25 comprises a plurality of reflector portions 61 defining the cavities 27 in which the LEDs 21 are accommodated. In this embodiment, each reflector portion 61 is configured to receive a respective one of the LEDs 21. In this way, the number of cavities 27 within each reflector 25 corresponds to the number of LEDs 21 within the associated the LED module 29.

[0046] Each reflector portion 61 comprises an aperture 63 through which the respective LED 21 can extend into the cavity 27 when reflector 25 is mounted on the base portion 31 of the heat sink 23.

[0047] Each reflector portion 61 defines an opening 65 to which the respective cavity 27 extends, whereby light emitted by the respective LED 21 can pass through the opening for illumination purposes.

[0048] In the arrangement shown, each opening 65 is of rectangular configuration.

[0049] Each reflector portion 61 comprises a wall structure 67 defining side walls 70, and also an inner wall 75 which is in opposed relation to the opening 65. With this arrangement, there are four side walls 70 extending between the opening 65 and the inner wall 75.

[0050] The four side walls 70 provide reflective surfaces 81 for intercepting light emitted from the respective LED 21 and directing it towards the opening 65. Similarly, the inner wall 75 also provides a reflective surface 83 for intercepting light emitted from the respective LED 21 and directing it towards the opening 65.

[0051] The reflective surfaces 81 provided by the side walls 70 are oblique to the opening 65, facilitating some directional control of light being emitted through the opening. This is achieved by forming the side walls 70 of a slanted configuration. The side walls 70 may be slanted at the same or at different angles. In the arrangement shown, the four side walls comprises first and second side walls 71, 72 disposed in opposed relation, and also third and fourth side walls 73, 74 disposed in opposed relation. The first and second opposed

CLAIMS

1. An illumination apparatus comprising a plurality of light emitting diodes (LEDs), a heat sink, and a reflector, the reflector defining a plurality of cavities in which the LEDs are accommodated, the heat sink comprising an elongate body providing a base portion and a heat dissipation portion of integral construction, wherein the base portion presents a face and the plurality of LEDs are mounted on the face of the base portion whereby heat generated by the plurality of LEDs is absorbed by the base portion and transferred to the heat dissipation portion, wherein the heat dissipation portion comprises a cooling fin assembly for dissipating heat to surrounding air, the cooling fin assembly comprising at least one longitudinal fin disposed to one side of the base portion and a plurality of lateral fins extending from the longitudinal fin, the lateral fins being disposed on opposed longitudinal sides of the longitudinal fin, and wherein the reflector is mounted on the base portion and comprises a plurality of reflector portions defining said plurality of cavities in which the plurality of LEDs are accommodated, each reflector portion being configured to receive a respective one of the LEDs, each reflector portion comprising an aperture through which the respective LED extends into the cavity, each reflector portion defining an opening and the respective cavity extending to the opening, whereby light emitted by the respective LED passes through the opening for illumination purposes, each reflector portion comprising a wall structure defining side walls and an inner wall in opposed relation to the opening, the aperture in the reflector portion through which the respective LED extend into the cavity being provided in the inner wall, the side walls and the inner wall providing reflective surfaces for intercepting light emitted from the respective LED and directing the light towards the opening, the side walls comprising first and second side walls disposed in opposed relation, the first and second walls being oblique to the opening and slanted at different angles with respect to the opening.

2. The illumination apparatus according to claim 1, wherein the plurality of LEDs are provided by one or more LED modules.

3. The illumination apparatus according to claim 2, wherein each LED module comprises two or more LEDs mounted on a printed circuit board (PCB).

4. The illumination apparatus according to claim 2 or 3, wherein the heat sink is common to a plurality of the LED modules.

5. The illumination apparatus according to claim 4, wherein the LED modules are disposed along the elongate body.

6. The illumination apparatus according to any one of the preceding claims, wherein the cooling fin assembly comprises two longitudinal fins and associated lateral fins disposed in spaced apart relation to define a gap therebetween.

7. The illumination apparatus according to any one of the preceding claims, wherein the heat sink comprises an extrusion.

8. The illumination apparatus according to any one of the preceding claims, wherein the base portion presents a face on which the plurality of LEDs are mounted.

9. The illumination apparatus according to claim 8 when dependent upon claim 2, wherein each LED module is mounted on the face of the base portion.

10. The illumination apparatus according to any one of the preceding claims, wherein the opening is of rectangular configuration.

11. The illumination apparatus according to any one of the preceding claims, wherein all of said walls provide reflective surfaces.

12. The illumination apparatus according to any one of the preceding claims, wherein the side walls further comprise third and fourth side walls disposed in opposed relation.

13. The illumination apparatus according to claim 12, wherein the third and fourth opposed side walls are slanted at the same angle with respect to the opening.

14. The illumination apparatus according to any one of the preceding claims, wherein the reflector is of integral construction, whereby the reflector portions are connected one to another to provide a single unit.