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Light assembly for attachment to a surface of a vehicle

Abstract

A light assembly for attachment to a surface of a vehicle. The light assembly includes a light head including a light and a vehicle base configured to be removably coupled to the surface of the vehicle. The vehicle base includes a magnet configured to secure the vehicle base to the surface of the vehicle and a battery compartment configured to receive a battery for powering the light. The light head is removably coupled to the vehicle base.

Inventors: **Schermerhorn; Joshua (Wauwatosa, WI), Proeber; David (Milwaukee, WI), Adams; Josh (Milwaukee, WI), Wenzel; Duane W. (Mukwonago, WI)**

Applicant: **MILWAUKEE ELECTRIC TOOL CORPORATION** (Brookfield, WI)

Family ID: **1000008763279**

Assignee: **MILWAUKEE ELECTRIC TOOL CORPORATION (Brookfield, WI)**

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Primary Examiner: Williams; Joseph L

Attorney, Agent or Firm: Michael Best & Friedrich LLP

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a divisional of U.S. Non-Provisional patent application Ser. No. 18/118,760 filed on Mar. 8, 2023, now U.S. Pat. No. 12,030,427, which is a divisional of U.S. Non-Provisional patent application Ser. No. 17/717,796 filed on Apr. 11, 2022, now U.S. Pat. No. 11,613,202, which is a continuation of U.S. Non-Provisional patent application Ser. No. 16/990,523 filed on Aug. 11, 2020, now U.S. Pat. No. 11,299,087, which is also a continuation of U.S. Non-Provisional patent application Ser. No. 16/669,108 filed on Oct. 30, 2019, now U.S. Pat. No. 10,744,928, which is also a continuation of

U.S. Non-Provisional patent application Ser. No. 16/140,682 filed on Sep. 25, 2018, now U.S. Pat. No. 10,493,901, which claims priority to U.S. Provisional Patent Application No. 62/562,897 filed on Sep. 25, 2017, and U.S. Provisional Patent Application No. 62/727,303 filed on Sep. 5, 2018, the entire contents of all of which are incorporated herein by reference.

FIELD OF THE INVENTION

(1) The present invention relates to light assemblies, and more particularly to light assemblies that are mountable on vehicles.

BACKGROUND OF THE INVENTION

(2) Vehicles sometimes included mounted lights to allow an operator to illuminate a work area. Mounted lights can produce a spot light to illuminate one specific area of the work area.

SUMMARY OF THE INVENTION

(3) The present invention provides, in one aspect, a light assembly for attachment to a surface of a vehicle. The light assembly includes a light head including a light. The light assembly further including a vehicle base configured to be removably coupled to the surface of the vehicle. The vehicle base includes a magnet configured to secure the vehicle base to the surface of the vehicle and a battery compartment configured to receive a battery for powering the light. The light head is removably coupled to the vehicle base.

(4) Other features and aspects of the invention will become apparent by consideration of the following detailed description and accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a front perspective view of a light assembly.
(2) FIG. **2** is a rear perspective view of the light assembly of FIG. **1**.
(3) FIG. **3**. is a front perspective view of a light unit of the light assembly of FIG. **1**
(4) FIG. **4**. is a rear perspective view of the light unit of FIG. **3**.
(5) FIG. **5** is a perspective view of the light unit of FIG. **3** with portions removed.
(6) FIG. **6** is another perspective view of the light unit of FIG. **3** with portions removed.
(7) FIG. **7** is a front perspective view of a mount of the light assembly of FIG. **1**.
(8) FIG. **8** is a rear perspective view of the mount of FIG. **7**.
(9) FIG. **9** is a plan view of the underside of the mount of FIG. **7**.
(10) FIG. **10** is a perspective view of a battery for powering the light assembly of FIG. **1**.
(11) FIG. **11** is a rear perspective view of the light assembly of FIG. **1** with the battery mounted into the light assembly.
(12) FIG. **12** is a perspective view of the light assembly of FIG. **1** mounted to a vehicle for use at a worksite.
(13) FIG. **13** is a perspective view of a mount of the light assembly of FIG. **1** with a wire harness.
(14) FIG. **14** is a perspective view of the wire harness of FIG. **13**.
(15) FIG. **15** is a plan view of a remote of the light assembly of FIG. **1**.
(16) FIG. **16** is a perspective view of another embodiment of a light assembly with a light head secured in a first base.
(17) FIG. **17** is a perspective view of the first base of FIG. **16**.
(18) FIG. **18** is a perspective view of the light head of FIG. **16**.
(19) FIG. **19** is an enlarged perspective view of the light head of FIG. **16**.
(20) FIG. **20** is a perspective view of the light head of FIG. **16** secured in a second base.
(21) FIG. **21** is a perspective view of the second base of FIG. **20**.
(22) FIG. **22** is a perspective view of the second base of FIG. **20**.
(23) FIG. **23** is a cross-sectional view of the light head of FIG. **16**.

(24) FIG. **24** is a cross-sectional view of the light head of FIG. **16**.
(25) FIG. **25** is a cross-sectional view of the light head of FIG. **16**.
(26) FIG. **26** is a perspective view of a light of the light head of FIG. **16**.
(27) FIG. **27** is an exploded view of the light of FIG. **26**.
(28) FIG. **28** is a cross-sectional view of the light of FIG. **26**.
(29) FIG. **29** is a perspective view of a reflector of the light of FIG. **26**.
(30) FIG. **30** is a cross-sectional view of a reflector of the light of FIG. **26**.
(31) FIG. **31** is a rear perspective view of a lens of the light of FIG. **26**.
(32) FIG. **32** is a front perspective view of a lens of the light of FIG. **26**.
(33) FIG. **33** is a cross-sectional view of a lens of the light of FIG. **26**.
(34) FIG. **34** is a plan view of a remote for the light assembly of FIGS. **16-33**.
(35) FIG. **35** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(36) FIG. **36** is a plan view of the light head secured in the first base of FIG. **35**.
(37) FIG. **37** is a plan view of the light head being released from the first base of FIG. **35**.
(38) FIG. **38** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(39) FIG. **39** is a plan view of the light head being secured in the first base of FIG. **38**.
(40) FIG. **40** is a plan view of the light head secured in the first base of FIG. **38**.
(41) FIG. **41** is a plan view of the light head being released from the first base of FIG. **38**.
(42) FIG. **42** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(43) FIG. **43** is a plan view of the light head secured in the first base of FIG. **42**.
(44) FIG. **44** is a plan view of the light head being released from the first base of FIG. **42**.
(45) FIG. **45** is a plan view of the light head being released from the first base of FIG. **42**.
(46) FIG. **46** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(47) FIG. **47** is a plan view of the light head being secured in the first base of FIG. **46**.
(48) FIG. **48** is a plan view of the light head secured in the first base of FIG. **46**.
(49) FIG. **49** is a plan view of the light head being released from the first base of FIG. **46**.
(50) FIG. **50** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(51) FIG. **51** is a plan view of the light head being secured in the first base of FIG. **50**.
(52) FIG. **52** is a plan view of the light head secured in the first base of FIG. **50**.
(53) FIG. **53** is a plan view of the light head being released from the first base of FIG. **50**.
(54) FIG. **54** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(55) FIG. **55** is a plan view of the light head secured in the first base of FIG. **54**.
(56) FIG. **56** is a perspective view of a different embodiment of complimentary mounting structures of a light head and a first base.
(57) FIG. **57** is a plan view of the light head secured in the first base of FIG. **56**.
(58) FIG. **58** is a plan view of the light head being removed from the first base of FIG. **56**.
(59) FIG. **59** is a perspective view of a light head mounted in a first base according to an embodiment of the invention.
(60) FIG. **60** is a perspective view of a first housing portion of the light head of FIG. **59**.
(61) Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the

purpose of description and should not be regarded as limiting.

DETAILED DESCRIPTION

(62) As shown in FIGS. **1-4**, a light assembly **10** that is mountable to a vehicle is provided. The light assembly **10** includes a light unit **14** that is selectively mounted in a mount **18**. The light unit **14** and the mount **18** are both made of robust materials to permit the light assembly **10** to withstand 24/7 exposure to harsh environmental conditions over the life of the light assembly **10**. As shown in FIGS. **3** and **4**, the light unit **14** includes a base **22** and a head **26** with a light source **30** including a lens covering a plurality of LEDs (not shown). The head **26** also includes a heat sink **34** to dissipate heat while the light source **30** is in use. In some embodiments, the heat sink **34** is enclosed within a housing of the head **26**, rather than being exposed. The base **22** defines a battery pack recess **38** with battery contacts **42**. The base **22** includes two mating edges **46** that are configured to facilitate mounting the base **22** within the mount **18**. The base **22** also includes a handle **50** so an operator may carry the light unit **14**.

(63) As shown in FIG. **5**, a pedestal **54** is rotatably coupled to the base **22**. The pedestal **54** is capable of rotating 370 degrees about a first axis **58** defined by the pedestal **54**. The pedestal **54** includes a bracket **62** with two arms **66** that define a second axis **70**. The head **26** is coupled to the pedestal **54** via the arms **66**. In some embodiments, the head **26** is pivotable with respect to pedestal **54** about the second axis **70** over a range of 90 degrees. In other embodiments, the head **26** is pivotable with respect to the pedestal **54** over a range of 270 or more degrees. In some embodiments, the head **26** includes a semi-circular portion **74** with a toothed edge and the pedestal **54** includes a pinion gear **78** engageable with teeth (not shown) of the toothed edge to permit the head **26** to pivot about the second axis **70**.

(64) As shown in FIGS. **7-9**, the mount **18** defines a recess **82** to receive the base **22** of the light unit **14**. The mount **18** includes a quick release actuator **86** and mechanism (not shown) to decouple the base **22** from the mount **18** when an operator desires to remove the light unit **14** from the mount **18**. As shown in FIG. **8**, within the recess **82**, two laterally extending grooves **90** are defined which are configured to slideably receive the mating edges **46** of the base **22** when the base **22** is mounted within the mount **18**.

(65) As shown in FIG. **9**, the mount **18** includes a plurality of vacuum cups **94** to facilitate attachment to a surface, such as the surface of a vehicle or a surface of an extension of the vehicle, such as a bucket **102** shown in FIG. **12**. The mount **18** can also include magnets (not shown) and/or rubber pads (not shown) in lieu of or in combination with the vacuum cups **94** to facilitate attachment to the surface of the vehicle **98**. If vacuum cups **94** are employed, the mount **18** can include two shanks **106** to facilitate release of the vacuum cups **94** in order to decouple the mount **18** from the surface. In some embodiments, the mount **18** is hard-mounted to a surface via bolts or fasteners, thus allowing a more permanent mounting arrangement on a surface.

(66) As shown in FIG. **10**, in some embodiments, a battery pack **110** can be used to power the light source **30** of the light unit **14**. As shown in FIG. **11**, the battery **110** can be locked in the light assembly **10** when the light unit **14** is mounted to the mount **18**. In some embodiments, the battery pack **110** is a power tool battery pack that is capable of being used in other power tools. In some embodiments, the battery pack **110** is built into and not removable from the light unit **14** or the mount **18**. In some embodiments, the battery pack is a 12V, 18V, 40V, 60V, 80V or 120V battery pack. In some embodiments, when a non-12V battery pack **110** is used, electronics (not shown) in the light unit can up-convert the 12V DC into the battery voltage or down-convert the battery pack voltage for constant light output across voltages. In some embodiments, the LEDs of the light source **30** are capable of receiving multiple voltages, allowing the light output to vary based on the source. A series of conductive wires (not shown) electrically couple the battery pack **110** to the light source **30**. In some embodiments, a slip ring is employed in the pedestal **54** to permit the pedestal **54** to continuously rotate with respect to the base **22**. In other words, the pedestal **54** can rotate 360 degrees in one direction with respect to the base **22** and then continue rotating.

(67) In some embodiments, as shown in FIGS. **13** and **14**, the mount **18** is hardwired to provide power to the light source **30**. For example, a wire harness **112** electrically couples the mount **18** to either the terminals of a vehicle battery or to the vehicle's cigarette plug. Thus, when the light unit **14** is mounted in the mount **18**, the light source **30** can be powered from the vehicle, via the mount **18**, rather than from the battery **110**. For example, when the light unit **14** is mounted to the mount **18**, the light source **30** can be powered by a 12V DC line in of the mount **18** that is electrically coupled to the vehicle through the harness **112**. In all embodiments, the mount **18** is capable of utilizing the wiring harness **112**, but not every mount **18** needs to be hardwired because an operator has the option of using battery pack **110**. The light assembly **10** is weatherproof either through use of a cover when the light unit **14** is not mounted on the mount **18**, or a weatherproof connector.
(68) As shown in FIG. **12**, the light assembly **10** is schematically shown being mounted to a bucket **102** on a boom arm **114** of a vehicle **118**. In many instances, power utility linemen, municipalities, and utility contractors face situations that require them to survey a work area **122** while in their vehicle **118** in order to find out what is causing an electrical outage. The light source **30** is capable of generating a flood light **126** over the entire work area **122** and is also capable of generating a long-distance spot light **130** capable of illuminating specific areas that are a significant distance away from the light assembly **10**. The flood light **126** and spot light **130** functions of the light source **30** can be used separately or together.
(69) As shown in FIG. **15**, the direction of the light source **30** may be controlled by a remote control **134**. The remote control **134** has a “home” button to reposition the head **26** to a predetermined position with respect to the first and second axes **58**, **70**. In some embodiments, the remote control **134** can include a D-pad **138** with up, down, right and left buttons to control the rotation and pivotal movement of the head **26** about the first and second axes **58**, **70**, respectively. The remote control **134** can also include a power button **142** to control powering on and off of the light source **30**. In some embodiments, power button **142** can also control the “home” function to reposition the head **26**, as described above. In some embodiments, the remote control **134** includes a joystick (not shown) in addition to or in lieu of the D-pad **138** to control the movement of the head **26** and thereby the direction of the light source **30**. In some embodiments, the joystick or another button on the remote control **134** can control the speed at which the head **26** rotates and pivots with respect to the first and second axes **58**, **70**. In some embodiments, there are two distinct speeds at which the head **26** can rotate and pivot: “Faster” or “Slower.” However, in other embodiments, the remote control provides for infinite control of speed within a speed range defined by maximum and minimum speeds, allowing the operator to use a variety of different speeds within that range to rotate and pivot the head **26**. In some embodiments, the remote control **134** includes a mode button **146** to allow an operator to choose spot light mode, flood light mode, or simultaneous flood and spot light mode. In some embodiments, the remote control includes an intensity button **150** to control the luminescent intensity of the light source **30**. In some embodiments, the mount **18** includes the aforementioned controls of the remote control **134**, so an operator can control the power to the light source **30**, the movement of the head **26**, the speed of rotation and pivoting, and the mode and intensity of the light source **30** by operating the controls on the mount **18**. In some embodiments, the remote control **134** communicates via radio frequency with the light assembly **10** to control rotation of the head **26** about the first and second axes **58**, **70**. In some embodiments, the D-pad **138**, power button **142**, mode button **146**, and intensity button **150** are prevented from being inadvertently actuated, such that an inadvertent drop of the remote **134** which accidentally engages any of the D-pad **138**, power button **142**, mode button **146**, and intensity button **150** does not respective actuation. In some embodiments, the remote **134** includes a toggle switch to turn the remote **134** off, such that none of the D-pad **138**, power button **142**, mode button **146**, and intensity button **150** may be actuated. In some embodiments, the remote **134** includes a depression that receives a snap clip, which can in turn be mounted on a mount on, e.g., the vehicle's dash. In some embodiments, the remote **134** includes a tether or lanyard to be, e.g., looped around an operator's

wrist to prevent the remote **134** from being dropped or lost.
(70) The light assembly **10** may also include a controller that allows the location of the light assembly **10** to be remotely tracked and/or controlled by a wireless device, such as a smartphone or laptop. Similarly, the light assembly **10** may be able to be "locked out" or shut down remotely and wirelessly, to inhibit unauthorized use.
(71) FIGS. **16-34** illustrate another embodiment of a light assembly. The light assembly of FIGS. **16-34** includes a light head **152** (FIGS. **16**, **18** and **20**) having a base **154**, a yoke **156**, a handle **158**, and a light **160**. In the embodiments shown in FIGS. **59** and **60**, the light head **152** has a first housing portion **161** and a second housing portion **163**. The first and second housing portions **161**, **163** are partitioned along a partition line **165** and a gasket **167** provides a waterproof seal between the first and second housing portions **161**, **163**. As shown in FIG. **60**, only a portion of the gasket **167** lies along the partition line **165**. In other embodiments, the gasket **167** does not intersect the partition line **165**. The light assembly of FIGS. **16-34** also includes a first base **162** (FIGS. **16** and **17**), a second base **166** (FIGS. **20-22**), and a remote **134′** (FIG. **34**) for wirelessly controlling the light **160**. The light head **152** is removably securable to both the first base **162** and second base **166**. The remote **134′** is similar to the remote **134**, with like elements designated with an apostrophe. In some embodiments, the light head **152** includes a pairing button that allows a smartphone to communicate with the light head **152** to remotely track or secure the light head **152**. In some embodiments, the pairing button allows the smartphone to communicate with the light head **152** via Bluetooth.
(72) As shown in FIG. **16**, the first base **162** includes a base surface **170** from which a plurality of fasteners **174** extend. Each of the fasteners **174** includes a washer **178** and a nut **182**. In operation, the fasteners **174** may extend through a surface of a vehicle, after which the washers **178** and nuts **182** may be threaded onto the fasteners **174**, such that the first base **162** is mounted to the surface of the vehicle. In some embodiments, the attachment with fasteners **174** may function as a permanent mounting arrangement, allowing the first base to be "secured to" the surface of the vehicle, such that the first base **162** is not removable from the surface of the vehicle without the use of one or more tools. With reference to FIG. **17**, the first base **162** also includes a terminal **186** and a mounting structure **190** opposite the base surface **170**. The terminal **186** is electrically connected to a conductor **194** that extends from the base surface **170** and is configured to couple to a power source of the vehicle, such as a cigarette lighter receptacle or a vehicle battery. The mounting structure **190** includes a pair of rails **198**, each with a groove **202** and a shoulder **206**. The mounting structure **190** also includes a ramp **210** with a pair of grooves **214**. In some embodiments, the first base **162** includes a security lock to lock the light head **152** to the first base **162** when the light head **152** is secured to the first base **162**. In some embodiments, the security lock includes a security screw, a barrel lock, or a pad lock. By providing the security lock, theft of light head **152** is deterred or prevented.
(73) With reference to FIGS. **18** and **19**, the base **154** of the light head **152** includes a terminal **218** in electrical communication with the light **160** and a mounting structure **222** configured to mate with the mounting structure **190** of the first base **162** to secure the light head **152** to the first base. The mounting structure **222** includes a first pair of rails **226** configured to be received in the grooves **202** of the rails **198**, a second pair of rails **230** configured to be received in the grooves **214** of the ramp **210**. The base **154** of the light head **152** also includes a ramp **234**. With reference to FIGS. **16** and **18-20**, the light head **152** also includes a pair of release actuators **238** that are biased out of the base **154** of the light head **152** to a latched position. The release actuators **238** each include a button portion **242** (FIGS. **16** and **20**) and a latch portion **246** (FIGS. **18** and **19**). The latch portions **246** each include a beveled edge **250** and a flat edge **254**.
(74) In operation, when an operator desires to secure the light head **152** to the first base **162**, the operator slides the mounting structure **222** of the light head **152** into engagement with the mounting structure **190** of the first base **162**, causing the first pair of rails **226** to be received into the grooves

202 of the rails **198** and the second pair of rails **230** to be received in the grooves **214** of the ramp **210**. As the light head **152** is moved relative to the first base **162**, the beveled edges **250** of the latch portions **246** of the release actuators **238** slide along the rails **198** of the mounting structure **222**, causing the release actuators **238** to be depressed into the base **154** of the light head **152**, until the flat edges **254** of the latch portions of the release actuators **238** pass by the shoulders **206**. At this point the release actuators **238** are biased outwardly to the latched position, such that the flat edges **254** are caught against the shoulder **206**, and the terminal **218** of the light head **152** has mated with the terminal **186** of the first base **162**.

(75) As shown in FIG. **16**, the light head **152** includes an indicator light **256** to indicate that the terminal **218** of the light head **152** has engaged with the terminal **186** of the first base **162**. In some embodiments, the indicator light **256** can be used to indicate that a smartphone has achieved a wireless connection with the light head **152**. Because the flat edges **254** of the latch portions **246** are caught against the shoulders **206**, the light head **152** is inhibited from moving in a first direction that would move the terminal **218** of the light head **152** away from the terminal **186** of the first base **162**. Because the first pair of rails **226** of the mounting structure **222** are caught in the grooves **202** and the second pair of rails **230** are caught in the grooves **214** of the ramp **210**, the light head **152** is inhibited from moving in a second direction that is perpendicular to base surface **170** and upward as viewed in FIG. **16**. In the illustrated embodiment, the second direction of inhibited movement is perpendicular to the first direction of inhibited movement. Because the light head is inhibited from moving in both the first and second directions, the light head **152** is secured on the first base **162**. Also, the light **160** is powered by the first base **162**, via the conductor **194** drawing power from the vehicle power source and mating connection of terminals **186**, **218**. Once the light head **152** is secured on the first base **162**, the operator may optionally actuate the security lock to lock the light head **152** to the first base **162**, such that the light head **152** cannot be removed from first base **162** until first unlocking the security lock.

(76) In operation, when an operator desires to remove the light head **152** from the first base **162**, the operator presses and holds each of the button portions **242** of the release actuators **238**, such that the flat edges **254** move off of the shoulders **206** of the rails **198**, thus moving the release actuators **328** from the latched position to an unlatched position. While holding the button portions **242**, the operator slides the light head **152** in the first direction, away from the terminal **186** of the first base **162**, causing the ramp **234** of the base **154** of light head **152** to slide along the ramp **210** of the mounting structure **190** of the first base **162**, making it easier for the operator to separate the light head **152** from the first base **162**.

(77) With reference to FIGS. **20** and **21**, the second base **166** includes a control interface **258** for controlling the light head **152** when the light head **152** is secured to the second base **166**. The control interface **258** includes a power button **259**, a mode button **260** for switching between spot light and flood light modes, and a flood intensity button **261** for switching between high and low intensity modes. The second base **166** also includes battery in a battery compartment **262** that is accessible via a compartment door **266**. The compartment door **266** is secured shut via one or more over-center latch mechanisms **270** and keeps the battery compartment **262** dry and protected from the elements. As shown in FIG. **21**, the second base **166** includes a plurality of magnets **274**, such that the second base **166** can be attached to and removed from the surface of a vehicle without the use of tools, thus making the second base **166** more mobile and versatile than the first base **162**. With reference to FIG. **22**, the second base **166** includes a mounting structure **190′** that is identical to the mounting structure **190** of the first base **162**, with like elements designated with an apostrophe, such that the light head **152** can be secured to and removed from the second base **166** in the exact same manner as the first base **162**. The terminal **186** of the second base **166** is in electrical communication with the battery of the second base **166**, such that when the light head **152** is secured to the second base **166**, the light **160** is powered by the second base **166**, via the battery and mating connection of terminals **186**, **218**.

(78) Thus, the light assembly of FIGS. **16-34** provides an operator with a variety of lighting options while working with one or more vehicles. For instance, the first base **162** may be permanently secured to one vehicle and the second base **166** may be quickly switchable between being secured to a variety of different vehicles via the magnets **274**. The operator is thus afforded greater versatility when desiring to use the light head **152**, because the light head **152** mounts in the same manner to both the first and second bases **162**, **166**.
(79) With reference again to FIGS. **16** and **18**, the yoke **156** of the light head **152** includes first and second arms **278**, **280** that couple the light **160** to the yoke **156**, and permit the light **160** to rotate about a first rotational axis **282** with respect to the yoke **156**, as explained in further detail below. With reference to FIGS. **23-25**, the yoke includes a first motor **286** to rotate the light **160** with respect to the yoke **156** about the first rotational axis **282** and a second motor **290** to rotate the yoke **156** with respect to the base **154** about a second rotational axis **294**. Like the light **160**, the first and second motors **286**, **290** draw power from the first and second bases **162**, **166**, depending on which base the light head **152** is secured to. As shown in FIGS. **23** and **24**, a drive shaft **296** extends from the first motor **286** and is received by a clutch **297**, which in turn drives a pinion **298**. The clutch **297** may prevent damage to the light head **152** when an operator user adjusts the light head **154** by hand. The pinion **298** is engaged with a gear train **302** terminating in an output gear **306** and arranged in the first arm **278**. As shown in FIGS. **24** and **26**, the output gear **306** drivingly engages an axle **310** of the light **160** that defines the first rotational axis **282**, thus permitting the light **160** to rotate about the first rotational axis **282** with respect to the yoke **156**. With reference to FIGS. **23** and **25**, the second motor **290** drivingly engages a yoke gear **314** to which the yoke **156** is coupled for rotation and that defines the second rotational axis **294**. The yoke gear **314** is arranged about a conduit **318** permitting passage of a conductor **322** that electrically couples the terminal **218** to the first motor **286**, the second motor **290**, and the light **160**. As shown in FIG. **25**, another conductor **326** extends through the second arm **280** to transmit power to the light **160**.
(80) As shown in FIGS. **26-28**, the light **160** includes a heat sink **330** with a plurality of fins **334**. The light **160** also includes a printed circuit board (PCB) **338** with a plurality of spot light emitting diodes **342** (LEDs) and flood light LEDs **344** mounted thereon. In some embodiments the spot light LEDs **342** and flood light LEDs **344** can be controlled independently of one another, allowing independent control of flood light and spot light modes, or simultaneous of use of both modes. The light further includes a reflector **346**, a lens piece **350**, and a cover **354** to secure the lens piece **350**, the reflector **346**, and the PCB **338** to the heat sink **330**. In some embodiments, the reflector **346** and lens piece **350** are formed as one piece. As shown in FIGS. **29** and **30**, the reflector **346** includes a plurality of cups **358** with apertures **362** to accommodate the spot light LEDs **342** and four corner pockets **364** with apertures **365** to allow passage of light from the flood light LEDs **344**. As shown in FIG. **28**, the cups **358** have a truncated frustoconical cross-sectional shape. As shown in FIGS. **26-28** and **31-33**, the lens piece **350** has a flat, outward-facing face **362** and an opposite face **366** with a plurality of total internal reflection (TIR) lenses **370**. Like the cups **358** of the reflector **346**, the TIR lenses **370** of the lens piece **350** have apertures **374** to accommodate the spot light LEDs and a truncated frustoconical cross-sectional shape. In the illustrated embodiment, the TIR lenses **370** are arranged in an array of columns and rows. In the illustrated embodiment, the TIR lenses **370** are all integrally molded or formed from the same piece of material as the lens piece **350**. In other embodiments, each individual TIR lens **370** may be formed separate and distinct from every other TIR lens **370**.
(81) FIGS. **35-58** illustrate seven different embodiments of alternative mounting structures of the light head **152** and the first and second bases **162**, **166**. For purposes of illustration, the light head **152** in the embodiments of FIGS. **35-58** is only shown being secured in the first base **162**, but as described above, because the second base **166** has the same mounting structure as the first base **162**, the light head **152** can also be secured in the second base **166** in a similar manner as in the first base **162**.

(82) In the embodiment shown in FIGS. **35-37**, the light head **152** includes a mounting structure **378** including a plurality of snap latches **382** with hooks **386** that are biased inwardly. The first base **162** includes a mounting structure **390** that includes a plurality of recesses **394** configured to catch the hooks **386** of the snap latches **382**. In operation, the light head **152** is installed by pushing the light head **152** downwardly into the first base **162**, causing the snap latches **382** to move outwardly along the first base **162** until the hooks **386** are biased into the recesses **394**, as shown in FIG. **36**, at which point the light head **152** is secured in the first base **162**. To release the light head **152**, an operator depresses a release actuator **398**, causing the snap latches **382** to move outwardly as shown in FIG. **37**, such that the hooks **386** are no longer caught in recesses **394**. The operator then lifts the light head **152** away from and out of the first base **162**.
(83) In the embodiment shown in FIGS. **38-41**, the light head **152** includes a mounting structure **402** including a plurality of recesses **406**. The first base **162** includes a mounting structure **410** that includes a plurality of latches **414** with hooks **418** configured to engage the recesses **406** of the mounting structure **402** and actuators **420** to pull the hooks **418** into a latched condition and release the hooks **418** from the latched condition. In some embodiments, the latches **414** are over-center full length latches. In operation, the light head **152** is installed by pushing the light head **152** into the first base **162**. The operator then manually manipulates the hooks **418** of the latches **414** such that the hooks **418** engage the recesses **406** and then manipulates the actuators **420** to pull the hooks **418** tautly into the recesses **418**, as shown in FIG. **39**, at which point the light head **152** is secured in the first base **162**, as shown in FIG. **40**. To release the light head **152**, an operator releases the actuators **420**, thus removing the hooks **418** from the recesses **406**, as shown in FIG. **41**. The operator then lifts the light head **152** away from the first base **162**.
(84) In the embodiment shown in FIGS. **42-45**, the light head **152** includes a mounting structure **424** including an extension **428**. The first base **162** includes a mounting structure **432** that includes a movable collar **436** that is biased away from the first base **162** to a locked position, and a slide switch **440**. In operation, the light head **152** is installed into the first base **162** by pushing the extension **428** into the collar **436**. The act of pushing down the light head **152** pushes the collar **436** down into an unlocked position, thus allowing the collar to receive the extension **428**. Once the extension **428** is secured within the collar **436**, the collar **436** is biased back to its locked position **428**, as shown in FIG. **43**. At this point, the light head **152** cannot be removed from the first base **162** because the extension **428** is locked by the collar **436**. In order to remove the light head **152** from the first base **162**, the operator first slides the slide switch **440** as indicated in FIG. **44**, thus allowing the collar **436** to be moved to the unlocked position. The operator then pulls the collar **436** down to the unlocked position, as indicated in FIG. **45**. While holding the collar **436** in the unlocked position, the operator then pulls the light head **152** away from the first base **162**.
(85) In the embodiment shown in FIGS. **46-49**, the light head **152** includes a mounting structure **444** with a first lip **448** and a second opposite lip **452** having the terminal **218**. The first base **162** has a mounting structure **456** having a latch **460** and a recess **464** with the terminal **186**. In operation, the light head **152** is installed into by inserting the sliding the second lip **452** toward and into the recess **464**, such that the terminals **186**, **218** mate. The latch **460** is then swung up to secure the first lip **448**, as shown in FIG. **47**. The light head **152** is now secured in the first base **152**, as shown in FIG. **48**, with the mounting structures **444**, **456** mating like a ski boot attaches to a ski. To release the light head **152**, the latch **460** is swung away from the first lip **448**, as shown in FIG. **49**, and the second lip **452** is slid out of the recess **464**.
(86) In the embodiment shown in FIGS. **50-53**, the light head **152** includes a mounting structure **468** with apertures **472** in the base **154**. The first base **162** has a mounting structure **476** having a slideable shelf **480** coupled to the first base **162** by two bolts **484** that extend into a recess **488** of the first base **162** when the shelf **480** abuts the first base **162** in a locked position. In some embodiments, the bolts **484** are dead bolts. In operation, to install the light head **152**, the shelf **480** is first slid away from the first base **162** to an unlocked position, as shown in FIG. **50**, resulting in

the bolts **484** exiting recess **488**. The operator may now move the base **154** of the light head **152** into the recess **488**, such that the apertures **472** are aligned with the bolts **484**. The operator then moves the shelf **480** towards the locked position, as shown in FIG. **51**. Once the shelf **480** abuts the first base **162** in the locked position as shown in FIG. **52**, the bolts **484** are received in the apertures **472**, thus securing the light head **152** to the first base **162**. In order to remove the light head **152**, the shelf **480** is slid outwardly to the unlocked position as shown in FIG. **53**, thus removing the bolts **484** from the apertures **472**. The operator then lifts the light head **152** out of the first base **162**.
(87) In the embodiment shown in FIGS. **54** and **55**, the light head **152** includes a mounting structure **492** with a pair of radially outward extending pegs **496**. The first base **162** includes a mounting structure **500** with a pair of radially outward extending recesses **504** at a first height and a pair of adjoining, circumferential slots **508** at a second, lower height. In order to install the light head **152**, the operator pushes the light head **152** into the first base **162**, aligning the pegs **496** with the recesses **504**. Once the pegs **496** have moved through the recesses **504** and into the circumferential slots **508**, the operator rotates the light head **152** in a first direction **510** (clockwise as viewed in FIG. **54**), such that the pegs **496** become caught under an upper ceiling **512** of the slots **508**. The operator continues rotating the light head **152** until the base **154** snaps into engagement with a lock in the first base **162**. The light head **152** is now secured to the first base **162**, as shown in FIG. **55**. To remove the light head **152**, the operator presses a release actuator **516**, which disengages the lock in the first base **162**. The operator may now rotate the light head **152** a second opposite direction **518** (counterclockwise as viewed in FIG. **54**) until the pegs **496** are aligned with the recesses **504**, at which point the light head **152** may be lifted out of the first base **162**.
(88) In the embodiment shown in FIGS. **56-58**, the light head **152** includes a mounting structure **520** that includes a bar **524** and a pair of rails **528** and the first base **162** includes a mounting structure **532** that includes a pair of grooves **536** and a latch mechanism **540**. In order to install the light head **152**, the light head **152** is slid into the first base **162** as shown in FIG. **56**, while, aligning the rails **528** into the grooves **536**. Once slid in, the latch mechanism **540** engages the bar **524**, thereby inhibiting removal of the light head **152** from the first base **162**, as shown in FIG. **57**. In order to remove the light head **152**, the operator depresses a release actuator **544**, which disengages the latch mechanism **540** from the bar **524** and allows the light head **152** to be slid out of the first base **162**, as shown in FIG. **58**.
(89) Various features of the invention are set forth in the following claims.

Claims

1. A light assembly for attachment to a surface of a vehicle, the light assembly comprising: a light head including a light; and a vehicle base configured to be removably coupled to the surface of the vehicle, the vehicle base including a magnet configured to secure the vehicle base to the surface of the vehicle, and a battery compartment configured to receive a battery for powering the light, wherein the light head is removably coupled to the vehicle base.
2. The light assembly of claim 1, wherein the base includes a compartment door moveable between an open position, in which the battery can be inserted or removed from the battery compartment, and closed position, in which the battery is inaccessible within the battery compartment.
3. The light assembly of claim 2, wherein the base includes a latch mechanism configured to secure the compartment door in the closed position.
4. The light assembly of claim 3, wherein the latch mechanism is an over-center latch mechanism.
5. The light assembly of claim 1, wherein the magnet is one of a plurality of magnets.
6. The light assembly of claim 1, wherein the light is rotatable relative to the vehicle base about a rotational axis.
7. The light assembly of claim 1, wherein the vehicle base includes a control interface having a

power button, a mode button, and a flood intensity button.
8. The light assembly of claim 1, wherein the light includes a plurality of light emitting diodes and a lens.
9. The light assembly of claim 8, wherein the plurality of light emitting diodes includes spot light LEDs and flood light LEDs.
10. The light assembly of claim 9, wherein the lens has a plurality of total internal reflection lenses with apertures for accommodating the spot light LEDs.
11. The light assembly of claim 10, wherein each total internal reflection lens has a truncated frustoconical cross-sectional shape.
12. The light assembly of claim 8, wherein the light includes a heat sink with a plurality of fins.
13. The light assembly of claim 1, wherein the light head includes a release actuator movable between a latched position, in which the light head is coupled to the vehicle base, and an unlatched position, in which the light head is uncoupled from the vehicle base.
14. The light assembly of claim 13, wherein in the latched position, the release actuator is biased outwardly against the vehicle base.
15. The light assembly of claim 13, wherein the release actuator is moved to the unlatched position when depressed.
16. The light assembly of claim 1, wherein the vehicle base is a first vehicle base, and further comprising a second vehicle base configured to be removably coupled to the surface of the vehicle, and wherein the light head is also removably coupled to the second vehicle base.
17. The light assembly of claim 16, wherein the second vehicle base is configured to be coupled to the surface of the vehicle by a plurality of fasteners.
18. The light assembly of claim 16, wherein the first vehicle base has a first mounting structure and the second vehicle base has a second mounting structure substantially similar to the first mounting structure, and wherein the light head includes a third mounting structure configured to alternately mate with the first mounting structure of the first vehicle base and the second mounting structure of the second vehicle base.