A surgical retractor has a shaft with an integral blade. The shaft and the blade are joined at an angle. The blade has an upper surface. A plurality of LED lights are embedded within the blade and are exposed at the upper surface. The blade surrounding the LED lights is opaque. The retractor may further include a camera mounted on the blade. Also disclosed is a surgical retractor kit including a mounting ring, at least one of the aforementioned surgical retractors, and a coupler for releaseably mounting the retractor to the ring.
Surgical Retractor with Light

Field of the Invention

A surgical retractor with a light is disclosed herein below.

Background of the Invention

Surgical retractors with lights are known. For example, see: U.S. Pat. No. 4,562,832 (Wilder), US Publication No. 2007/0060795 (Vayser), and U.S. Pat. Nos. 7,384,392 & 8,012,089 (both to Bayat). Wilder discloses a retractor with a flexible light pipe. Vayser, in FIG. 1, shows a retractor 1 with a LED (light emitting diode) light 3 and a battery 4. The LED and battery are “all mounted on a strip of tape.” Vayser, Paragraph 10. Thus, as the invention is described in the independent claims, the lighting components are ‘releasably securable’ to the retractor. Bayat, on the other hand, shows in FIG. 7, a plurality of LED’s along the longitudinal axis of the blade and discloses that the LEDs may be located ‘within the profile of the blade.’ Bayat ‘392, column 4, lines 45-58; and Bayat ‘089, the paragraph bridging columns 5 and 6. Bayat goes on to say that the “blade near the light is constructed of a translucent or transparent material to allow the blade to pass through the blade.” Ibid. Bayat ‘089 also discloses a camera, see FIG. 7, as part of the retractor.

While these retractors are a solution to the problem of providing a light on a retractor, there is room for improvement. The retractor disclosed below is an improvement over these known retractors with a light.

Summary of the Invention

A surgical retractor has a shaft with an integral blade. The shaft and the blade are joined at an angle. The blade has an upper surface. A plurality of LED lights are embedded within the blade and are exposed at the upper surface. The blade surrounding the LED lights is opaque. The retractor may further include a camera mounted on the blade. Also disclosed is a surgical retractor kit including a mounting ring, at least one of the aforementioned surgical retractors, and a coupler for releasably mounting the retractor to the ring.

Description of the Drawings

For the purpose of illustrating the invention, there is shown in the drawings a form that is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalties shown.

FIG. 1 is an illustration of a first embodiment of the present invention.

FIG. 2 is an enlarged illustration of a part of the first embodiment.

FIG. 3 is an enlarged illustration of the first embodiment with parts shown in phantom to illustrate certain internal components.

FIG. 4 is a sectional view taken along section lines 4-4 of FIG. 2.

FIG. 5 is a sectional view taken along section lines 5-5 of FIG. 2.

FIG. 6 is an illustration of a second embodiment of the present invention.

FIG. 7 is an illustration of the second embodiment with a power source attached thereto.

FIG. 8 is an illustration of a third embodiment of the present invention.

FIG. 9 is an illustration of a fourth embodiment of the present invention.

Description of the Invention

Referring to the figures, where like numerals refer to like elements, there is shown in FIG. 1 a first embodiment of the surgical retractor 10. Retractor 10 has a shaft 12 and a blade 14. Shaft 12 and blade 14 are joined together at an angle, are integral, and the angle may be adjustable (that is the angle between the blade and the shaft may be changed by, for example, bending by hand or by the inclusion of a pivoting mechanism (not shown)). In this embodiment, the angle may be 90° (but may be at other angles, e.g., 45-135°, or 55-115°, or 55-85°). Additionally, shaft 12 may be telescoping (not shown), so that its length may be changed. The material may be opaque (i.e., non-light transmitting or non-transparent). The blade and shaft may be made of any material, metal or plastic. The material may be chosen so that the retractor is autoclavable. The plastics may be: polyolefins (e.g., polypropylene), ultra high molecular weight polyethylene, polyamides, polyetherketones (PEEKs), polyphenyl sulfones, acetals, and/or thermoplastic elastomers (e.g., EDPM rubber crosslinked with polypropylene). One such material may be ULTEM HU1004 (PEEK) available from Sabic Innovative Plastics of Pittsfield, Mass.

The blade 14 has an upper surface 16 that may be concave (or flat, or convex). A plurality (at least two) of LED (light emitting diode) lights 18 may be disposed along the longitudinal axis of the blade 14. In this embodiment, four lights 18 are shown in line along the axis; however, other configurations of these lights are possible (e.g., multiple rows and/or columns or other geometric configurations). The LED lights face up from the upper surface 16. Face up as used herein means that the major axis of the LED light may be at any angle from 1 to 179° (or 45 to 135°) from the plane of the upper surface 16. The LED lights may each face up at differing angles.

A second surface 20 may also be associated with the upper surface 16 and is located on that portion of the upper surface 16 closer to the shaft 12. This second surface 20 is disposed on the upper surface 16 at an angle and is located behind the LED lights 18. The angle may be such that second surface 20 faces away from the upper surface 16.

The shaft 12 and the blade 14 have a common lower surface 21. A channel 22 is cut into the lower surface 21 of the blade 14 and the shaft 12. The channel 22 houses electrical connectors 26 (for example, see FIG. 3) that connect the LED lights 18 with a power source. The channel 22 is closed and sealed with a closure member 26. The closure member 26 may be flush with the lower surface 21. The closure member 26 may be sealed in the channel 22 by use of an adhesive. The adhesive may be any adhesive, it may be autoclavable. Such adhesives may be epoxies or polyurethanes. One such adhesive may be Locite’s HYSOL M-21HP or M-121HP available from Henkel Corporation of Rocky Hill, Conn.

The lower surface of the blade (not shown) may also have either a smooth surface or a gripping surface. The gripping surface may be used to maintain the retractor in place when inserted into the patient. The gripping surface (e.g., non-skid) may be, for example, roughened or ribbed.
In the first embodiment 10, the electrical connectors 26 may be in communication with a cord 30 that is used to connect with a remote power source, as will be understood by those of ordinary skill. Alternatively, the first embodiment may be battery powered as discussed below with regard to the second embodiment (and all of the variants of the second embodiment, discussed below, may be incorporated with the first embodiment).

A gripping surface 28 is located at the lower end of the shaft 12. The gripping surface 28 may be adapted for gripping by hand or with clamps.

Referring to FIGS. 2, 4, and 5, the placement of LED lights 18 is explained. In FIG. 4, LED light 18 has a lens 32 mounted on a base 34. At least a portion of the lens 32 of the LED light 18 may be exposed at surface 16. The outer surface of the lens 32 may be flush with upper surface 16 or may protrude above upper surface 16 (as shown in FIGS. 4 and 5). The LED light 18 is sealed within the blade 14 and there is no cover or blade material exposing the LED light 18. The base 34 may be contained within channel 22. The electrical connectors 26 may be attached to the base 34.

The LED light 18 may be sealed in the channel 22 by use of an adhesive. The adhesive may be any adhesive, it may be autoclaveable. Such adhesives may be epoxies or polyurethanes. One such adhesive may be Loctite® HYLOS M-21 HP or M-1211HP available from Henkel Corporation of Rocky Hill, Conn.

The LED lights 18 may produce at least 90 lumens (or at least 180 lumens of light). The LED lights 18 may be autoclaveable. The LED lights 18 may be on a dimmer switch. The LED light may be a LUXEON Rebel LXML-PWCL-00090 available from Philips Lumileds Lighting Co. of San Jose, Calif.

A camera 23 may be included in the retractor 10 (see FIGS. 2 and 3). Camera 23 may be a still camera or a motion camera. This camera may be based upon CCD (charged-coupled device) technology. In this embodiment, the camera 23 may be placed in the blade 14 on the second surface 20 behind LED lights 18. In this placement, the camera's field of vision is directed generally down the length of blade 14 and angled away from the upper surface 16, so that the camera 23 is looking at the operative field. This angle (as measured from behind surface 20) may be from 5-90°, or 15-80°, or 30-75°. Thus, the LED lights 18 illuminate, while the camera 23 sees the illuminated area. The camera 23 may transmit/store images in any fashion, i.e., via cable, or wireless transmission, or retained in a memory device for later retrieval.

Referring to FIGS. 6 and 7, a second embodiment of the surgical retractor 10' is shown. Generally, second embodiment 10' is similar to first embodiment 10; accordingly, the discussion of the first embodiment 10 is included herein. This embodiment may be used 'hands-free,' that is the retractor remains in place without additional securement (hand-held or mechanical) by the weight of the retractor when the blade is inserted into an orifice (such as a vagina or an anus).

Surgical retractor 10' has a shaft 12 and a blade 14. Shaft 12 and blade 14 are joined together at an angle, are integral, and the angle may be adjustable (that is the angle between the blade and the shaft may be changed by, for example, bending by hand or by a pivoting mechanism (not shown)). Additionally, a pair of re-enforcing wings 36 may be located at the intersection of the shaft 12 and the blade 14. In this embodiment, the angle may be 45-135°, or 55-115°, or 55-85° (but may be at other angles, e.g., 90°). Additionally, shaft 12 may be telescoping (not shown), so that it's length may be changed. The blade and shaft may be made of any material, metal or plastic. This material may be opaque (i.e., non-light transmitting or non-transparent). The material may be chosen so that the retractor is autoclavable. The plastics may be: polyolefins (e.g., polypropylene, ultra high molecular weight polyethylene), polyamides, perfluoropolymers, polyolefins, polyethersketones (PEEKs), polyphe-nyl sulfones, acetals, and/or thermoplastic elastomers (e.g., EPM rubber crosslinked with polypropylene). One such material may be ULTEM HU1004 (PEEK) available from Sabic Innovative Plastics of Pittsfield, Mass.

The blade 14 has an upper surface 16 that may be concave (or flat or convex). A plurality (at least two) of LED (light emitting diode) lights 18 may be disposed along the longitudinal axis of the blade 14. In this embodiment, four lights 18 are shown in-line along the axis; however, other configurations of these lights are possible (e.g., multiple rows and/or columns or other geometric configurations). The LED lights 18 face up from the upper surface 16. Face up as used herein means that the major axis of the LED light may be at any angle from 1 to 179° (or 45 to 135°) from the plane of the upper surface 16. The LED lights 18 may each face up at differing angles. Further, details on the placement of the LED lights 18 may be found in the discussion of FIGS. 2-5 above.

A second surface 20 may also be associated with the upper surface 16 and is located on that portion of the upper surface 16 closer to the shaft 12. This second surface 20 is disposed on the upper surface 16 at an angle and is located behind the LED lights 18. The angle may be such that second surface 20 faces away from the upper surface 16.

The shaft 12 and the blade 14 have a common lower surface 21. A channel 22 is cut into the lower surface 21 of the blade 14 and the shaft 12. The channel 22 houses electrical connectors 26 (for example, see FIG. 3) that connect the LED lights 18 with a power source. The channel 22 is closed and sealed with a closure member 26. The closure member 26 may be flush with the lower surface 21. The closure member 26 may be sealed in the channel 22 by use of an adhesive. The adhesive may be any adhesive, it may be autoclaveable. Such adhesives may be epoxies or polyurethanes. One such adhesive may be Loctite® HYLOS M-21 HP or M-1211HP available from Henkel Corporation of Rocky Hill, Conn.

The lower surface of the blade (not shown) may also have either a smooth surface or a gripping surface. The gripping surface may be used to maintain the retractor in place when inserted into the patient. The gripping surface (e.g., non-skid) may be, for example, roughened or ribbed.

In the second embodiment 10', the electrical connectors 26 are in communication with a power source 38 removably mounted on shaft 12. Power source 38 may contain batteries 42 and may be removably mounted onto shaft 12 via a clamp 40. Additionally, this power source provides a weight, so that the retractor 10' may be used hands-free, as discussed above. Furthermore, this power source 38 is removable from shaft 12. Thus, retractor 10' may be autoclavable without the power source 38. Power source 38 may be autoclavable without the batteries 42. In this situation, a sterile sleeve (not shown) may be used to insert batteries 42 into the sterile power source 38.

A camera (not shown), as discussed above, may be included in the retractor 10'. This camera may be a still camera or a motion camera. This camera may be based upon CCD (charged-coupled device) technology. In this embodi-
ment, the camera may be placed in the blade 14 on the second surface 20 behind LED lights 18. In this placement, the camera's field of vision is directed generally down the length of blade 14 and angled away from the upper surface 16, so that the camera 23 is looking at the operative field. This angle (as measured from behind surface 20) may be from 5-90°, or 15-80°, or 30-75°. Thus, the LED lights 18 illuminate, while the camera 23 sees the illuminated area. The camera 23 may transmit/store images in any fashion, i.e., via cable, or wireless transmission, or retained in a memory device for later retrieval.

[0034] Additional variants of the second embodiment (not shown) may include: the battery source permanently fixed to the retractor; the battery source and retractor being a single, integral unit; a remote power source (as described above) with a removable weight; a remote power source (as described above) with a non-removable weight.

[0035] Referring to FIG. 8, a third embodiment of the surgical retractor 10th is shown. All of the features of the first embodiment 10 and the second embodiment 10th may be included in the third embodiment 10th. The third embodiment 10th may be generally referred to as the spectrum embodiment. Retractor 10th includes retractor 10 and a second arm 43 movably affixed to retractor 10. Retractor 10 may be the same as previously described retractors 10 and/or 10th; accordingly, further detail discussion may be found above.

[0036] The second arm 43 includes a second shaft 46 joined to second blade 44. Construction of these mating shafts should be such that visualization by the medical professional is not unduly obstructed. In this regard, reference is made to a standard 'duck bill' speculum, incorporated herein by reference. Second arm 43 may be movable along shaft 12 of retractor 10, so that blades 14 and 44 may be spaced apart. Further, blades 14 and 44 may be hinged (not shown) on shafts 12 and 46, respectively; so that the distal tips of blades 14 and 44 may be spread apart further than the hinged portions of the blades 14 and 44. Blade 44 is shown as having a concave surface with LED lights, but other configurations are possible (e.g., no lights and no concave surface).

[0037] Referring to FIG. 9, a fourth embodiment, a surgical retractor kit 48 is shown. All of the features of the first embodiment 10, the second embodiment 10th, and the third embodiment 10th may be included in the surgical retractor kit 48. The surgical retractor kit 48 may be generally referred to as a self retaining retractor system. The surgical retractor kit 48 generally includes a plurality (at least two) retractors 10 (previously discussed retractor 10th may used instead), and a holder set 49. Holder set 49 may include a stand 50, arm 52, clamps 54 for fixing and securing the stand 50 and arm 52 in place, mounting ring 56 for placement of the retractor 10, ring clamp 58, and couplers 60 for fixing the retractor(s) in place on mounting ring 56.

[0038] The present invention may be embodied in other forms without departing from the spirit and the essential attributes thereof, and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification, as indicating the scope of the invention.