

ILLUMINATED GEMSTONE ASSEMBLY

Technical Field

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The invention relates to an assembly for illuminating a gemstone. In particular, the invention may relate to an assembly for illuminating a diamond.

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Background

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It is well known that both natural and synthetic diamonds, and some other gemstones, luminesce when illuminated by ultraviolet (UV) light. The emitted luminescence may be fluorescence i.e. light emitted by a stone while under illumination, or phosphorescence i.e. light emitted by the stone after the illumination ceases, or a combination thereof.

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The type of luminescence emitted by a gemstone may be used to assist in its identification. Additionally, it is known to illuminate gemstones to produce luminescence for purely aesthetic purposes. WO2006/090378A2, for example, describes setting a gemstone into a mount comprising a UV light source coupled to a power supply. The UV light source illuminates the gemstone causing the stone to luminesce, providing attractive optical effects. The mount may comprise a piece of jewelry, an ornament, a sculpture, a car, and the like.

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It is also known to provide an earring, and in particular an ear stud, comprising a gemstone illuminated by a coloured LED light source. For example, US6568824B2 describes an illuminated ear stud for a pierced ear. The ear stud consists of a bezel, which comprises an LED embedded in an acrylic gemstone, an elongate shaft for passing through the ear and connected to the bezel, and a battery power source for receiving the shaft at the rear of the ear. Electrical connectivity occurs once the shaft is received in the battery power source, thereby causing the LED to illuminate the stone. The battery housing also acts as a clasp for retaining the ear stud on the ear.

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Alternatively, it is known to provide selective electrical connectivity (i.e. to switch the LED on and off) by twisting, pulling or pushing the bezel with respect to the battery

power source, thereby enabling a user to wear the ear stud without illumination if desired.

5 However, conventional illuminated ear studs (or studs for use with other types of piercing) are often too heavy to be comfortable for the user to wear. Additionally, the user may find it difficult or fiddly to push, pull or twist the bezel and/or the battery housing into the correct position to switch the LED on and off. Where the battery power source also acts as the clasp for the ear stud, the stud may be lost if the shaft and battery housing are not properly connected. Further, the electrical connections between
10 the LED and the power source may not be sufficiently robust and may become damaged with prolonged use, to the extent that the LED may no longer operate to illuminate the gemstone. Finally, the battery power source may not be replaceable and/or rechargeable, thereby limiting the life span of the illuminated ear stud.

15 The above problems with conventional illuminated ear studs are a particular issue where the gemstone provided in the stud is a natural or synthetic gemstone, such as a diamond, rather than an inexpensive artificial stone. In this case, it is particularly desirable for the ear stud to provide reliable and robust connectivity between the stud and the power source housing, and for the battery power source to be replaceable
20 and/or rechargeable.

The above problems may also apply where the gemstone to be illuminated is incorporated into other items of jewellery, fashion items or accessories.

25 **Summary**

In one aspect there is provided an assembly comprising a gemstone holder and a battery housing. The gemstone holder comprises a bezel portion providing a mount for receiving a gemstone and a shaft portion comprising an elongate shaft, the elongate
30 shaft comprising first and second electrically conducting portions. The battery housing comprises a battery power source and a plurality of apertures; wherein a first one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a first connector within the housing, and a second one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a
35 second connector within the housing. Also included in the assembly is a light emitting

diode, LED, configured to illuminate the gemstone. Engagement of the end portion of the shaft with the first connector completes an electrical circuit between the battery power source and the LED, and engagement of the end portion of the shaft with the second connector does not complete the electrical circuit.

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The first one and the second one of said plurality of apertures may be provided on the same side or different sides of the housing.

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The shaft portion and bezel portion may include interconnecting complementary profiles, such that torque applied to the bezel portion is transferred to the shaft.

The end portion of the shaft may comprise a screw thread and the first and second connectors may be threaded connectors.

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The end portion of the shaft may engage with the first and second connectors with one of: a snap fit, a bayonet fit, a friction fit.

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The LED may be housed within the bezel portion and configured to illuminate a gemstone mounted in an outer face of the bezel portion upon completion of the electrical circuit.

The LED may be housed within the battery housing and the elongate shaft may comprise a light guide for guiding light to the bezel portion.

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The platform may be rigidly connected to the shaft distal to the end portion.

The platform may define a complementary profile of the shaft portion.

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The shaft may define a bore therethrough for housing a conducting pin. The pin may be connected to the LED at a first end and configured to connect to the first or second connector at a second end.

The conducting pin may have a non-stick coating.

The LED may be configured to emit ultraviolet light upon completion of the electrical circuit. The gemstone may be selected in order to luminesce upon illumination by ultraviolet light.

5 The LED may be a 3.4V LED.

The first connector may be electrically connected to a first PCB within the housing. The second connector may be attached to a second PCB within the housing.

10 The first and second PCBs may be flexible PCBs.

The first and second PCBs may be connected by a flexible portion.

The housing may comprise a frame therein for holding the battery power source.

15 The side or region of the housing defining the first aperture may be marked by one or more of: indicia, raised portions, indented portions.

20 The housing may be comprised of an upper and a lower portion. Each portion may comprise an opposing face.

The battery may be a cell battery.

The battery may be a re-chargeable battery.

25 The gemstone may be a natural diamond.

The assembly may be a stud for a piercing. The assembly may be a stud for an ear piercing.

30 The stud may comprise a front, or display, portion including the gemstone and the LED. The LED may be configured to emit ultraviolet light. The stud may comprise a rear portion including the battery configured to power the LED. The stud may be configured such that the LED illuminates the diamond when the front and rear portions are assembled with the rear portion in a first orientation, and such that the LED does not

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illuminate the diamond when the front and rear portions are assembled with the rear portion in a second, different orientation.

5 In a further aspect there is provided a gemstone holder comprising a bezel portion providing a mount for receiving a gemstone; and a shaft portion comprising an elongate shaft, the elongate shaft comprising first and second electrically conducting portions.

10 In another aspect there is provided a battery housing comprising a battery power source and a plurality of apertures. A first one of said plurality of apertures is configured to enable engagement of an end portion of a shaft with a first connector within the housing. A second one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a second connector within the housing. Engagement of the end portion of the shaft with the first connector completes an electrical circuit between the battery power source and an LED electrically connected to the shaft, and engagement of the end portion of the shaft with the second connector does not complete said electrical circuit.

Brief Description of the Drawings

20 Some preferred embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 is a side view and Figure 2 is a top down view of an illuminated ear stud according to the present invention;

25 Figure 3 is a perspective view of the bezel and shaft portions of the ear stud;

Figure 4 is a top down view of the bezel portion, illustrating alternative configurations;

Figures 5a and 5b are cross-sectional views through the bezel and shaft portions, and

Figure 5c is a close up of the bezel head of Figure 5a;

30 Figure 6 illustrates bezel and shaft portions disassembled into bezel, electronic and base sub-assemblies;

Figure 7 illustrates further details and configurations of the sub-assemblies;

Figure 8 is an exploded view of a battery portion of the ear stud;

Figures 9a and 9b illustrate cross-sectional views of the battery portion of Figure 8 assembled with the shaft portion in on and off positions, respectively;

35 Figure 9c illustrates perspective views of the assembled ear stud of Figures 9a and 9b;

Figure 10 is an exploded view of an alternative battery portion;

Figure 11 is a perspective view of the ear stud of Figure 10, shown without a battery housing;
Figure 12a illustrates perspective views of the alternative battery portion;
Figure 12b illustrates the alternative battery portion assembled with the bezel and shaft portions;
Figure 13 illustrates an exemplary electrical circuit for use with the ear stud;
Figures 14a and 14b illustrate an electrical connection between the shaft portion and battery portion;
Figure 14c illustrates exemplary active and passive printed circuit boards; and
Figures 15a and 15b illustrate alternative bezel and shaft portion configurations.

Detailed Description

Described herein is an assembly comprising a gemstone holder and a battery housing. The gemstone holder comprises a bezel portion providing a mount for receiving a gemstone; and a shaft portion comprising an elongate shaft, the elongate shaft comprising first and second electrically conducting portions. The battery housing comprises a battery power source and a plurality of apertures. A first one of the plurality of apertures is configured to enable engagement of an end portion of the shaft with a first connector within the housing, and a second one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a second connector within the housing. Also comprised in the assembly is a light emitting diode, LED, configured to illuminate the gemstone. Engagement of the end portion of the shaft with the first connector completes an electrical circuit between the battery power source and the LED, and engagement of the end portion of the shaft with the second connector does not complete the electrical circuit.

In one example, the assembly comprises an illuminated stud for a piercing (optionally an ear piercing), as described with reference to Figures 1 to 15. It will be appreciated that although reference is made herein to an ear stud, the described stud is not limited to use with a standard lobe piercing, but may be used for other types of ear piercings (e.g. helix, rook, tragus etc.) Alternatively or additionally, the ear stud described herein may be used with other types of facial and body piercings (e.g. nose, eyebrow, lip and belly piercings).

- Although the following description of the inventive assembly relates to an exemplary illuminated ear stud, it will be appreciated that in further examples the assembly may comprise or may be comprised within other items of jewellery, fashion items and accessories. These may include (but are not limited to) bracelets, rings, pendants, brooches, hairclips, buttons, cufflinks, tie clips, money clips, watches, necklaces, lockets, sunglasses, smartphone cases or add-ons, display and storage cases, handbags, luggage, clothing, headwear, shoes and the like.
- Figures 1 and 2 respectively illustrate side and top down (i.e. plan) views of an exemplary illuminated ear stud. The stud generally comprises three portions: a bezel portion 100, in which one or more gemstones 10, such as natural or synthetic diamonds and the like, are mounted; a battery portion 300, configured to house a battery power source; and a shaft portion 200, connected to the bezel portion 100 and configured to be selectively connectable to the battery portion 300. In use, the bezel portion 100 may be worn at a front or display side of a user's ear, the shaft portion 200 may pass through a pierced hole in the user's ear (for example, through the ear lobe), and the battery portion 300 may be connected to the shaft portion 200 at a rear side of the user's ear.
- Figure 3 illustrates the bezel portion 100 and shaft portion 200 of the exemplary ear stud. One end of the shaft portion 200 is connected to the bezel portion 100, as will be discussed in more detail below, while the other, distal end of the shaft portion 200 may terminate in a screw thread 210.
- In one non-limiting example, the bezel portion 100 may have a diameter of approximately 5.5 mm and/or a height of approximately 5 mm. Although the illustrated bezel portion 100 is substantially cylindrical in shape, it will be appreciated that the bezel portion may be shaped in different ways, for example, as a cube. Similarly, the diameter and other dimensions of the bezel portion may be varied as desired, within the constraints of the specific application.
- In another non-limiting example, the shaft portion 200 may have a length of approximately 14 mm. The shaft portion 200 may have a diameter of approximately 1 mm. However, the length and diameter of the shaft portion may be varied as desired,

within the requirements of the piercing (or other application) for which the stud is to be used. It will be appreciated that where the inventive assembly is used with other jewellery and/or fashion/accessory items, as discussed above, the shaft and bezel may be dimensioned according to the requirements of the particular application. The shaft
5 may, for example, be sufficiently long to extend into the apertures in the battery housing without separating the bezel and battery housing from one another if the assembly is not used for a piercing.

As best illustrated in Figure 4, one or more gemstones 10, such as natural or synthetic
10 diamonds, may be set or mounted into a top 110 or other outer face of the bezel portion 100. Illustrated in Figure 4 from left to right are a 0.2 carat stone, a 0.5 carat stone, and a 7 x 0.015 carat pave arrangement mounted into the bezel top face 110. It will be appreciated that other sizes, combinations of sizes, and arrangements of single or multiple cut or rough stones may be provided in the top face 110, or elsewhere in the
15 bezel portion 100, as required.

The stones 10 may be mounted so as to be substantially flush with the top face 110, or may stand proud of the top face 110, or other outer surface of the bezel portion 100. The stones 10 may be mounted to or in the bezel portion 100 by various methods, such
20 as adhesive means, clips, brackets and the like, as is known in the art. For example, translucent epoxy or silicone may be used to fix the stone in place while still allowing illumination of the stone by the LED. In a further example, to ensure even lighting of the stone or stones mounted in the bezel, a diffuser (not shown) may be provided between the LED 120 and bezel top 110 or other outer face.

Figures 5a and 5b are cross-sectional views along mutually orthogonal lines AA and BB respectively of Figure 3, and illustrate both the exemplary bezel portion 100 and shaft portion 200. The shaft portion 200 comprises a shaft 220 defining a longitudinal
25 bore 225. The bezel portion comprises a bezel head 130 in which a stone 10 is mounted. An interior of the bezel head 130 is configured to receive an LED 120 and associated printed circuit board (PCB) 125 therein. The bezel head 130 also defines a light path 140 through which light from the LED 120 may travel to illuminate the stone
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The LED 120 may be configured to be powered by a battery source in order to selectively emit one or more of coloured, UV, or infrared (IR) light. In one example, the LED may be a 3.4 volt (V) LED emitting UV light (i.e. light in the wavelength range 100 nm to 400 nm). Where the LED 120 is configured to emit UV light, the stone 10 may luminesce when illuminated, as discussed above.

The bezel head 130 is configured to prevent light leakage from the LED 120. As discussed above, the bezel head 130 provides a light path or guide 140 to direct light emitted from the LED 120 to the stone 10 mounted in the bezel head 130 and to provide light containment within the bezel head 130. It will be appreciated that in the examples in which a UV emitting LED is utilised, light containment within the bezel head 130 may be important for safety reasons.

Figures 6 and 7 illustrate further components and configurations of the bezel portion 100 and shaft portion 200, and the connection therebetween, which will now be described in more detail.

The LED 120 and associated PCB 125 are received on (Figure 7) or within (Figure 6) a platform or base 230. The interior of the bezel head 130 (which forms a bezel sub-assembly) is configured to receive the platform 230 with the LED 120 and PCB 125 attached to and/or supported thereon. The platform 230 further acts as a ground element. The LED 120 and PCB 125 are electrically and physically connected to an electrical conducting pin 240, thereby forming an electronic sub-assembly. The pin 240 is configured to pass through an aperture in the platform 230, and to be received within the bore 225 of the shaft 220. The shaft portion 200 therefore comprises first and second electrically conducting elements or portions.

As best shown in Figure 6, the screw thread 210 may be formed integrally on the shaft 220. Alternatively, as shown in Figure 7, the screw thread 210' and shaft 220' may comprise two separate elements configured to attach to one another. For example, an internal diameter of the shaft 220' may comprise a thread (not shown) configured to mate with an upper portion of the screw thread 210'. Alternatively, the screw thread 210' and shaft 220' may be attached via adhesive means, soldering, press fitting and the like. In the case where the shaft 220' and screw thread 210' are separate elements, the electrical conducting pin 240 may be insulated from the shaft portion 220'

and connected to the screw thread portion 210', thus enabling creation of an electrical circuit on contact with the battery portion 300. In the following description, reference to the shaft 220 and screw thread 210 may also apply to the alternative shaft portion 220' and screw thread portion 210'.

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While threading provides a good approach to connection between the shaft portion 200 and battery portion 300 in terms of secure hold and user experience, it will be appreciated that alternative forms of connection may be envisaged (e.g. clamps, clips, snap fit, bayonet fit, friction fit, and the like).

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The platform or base 230 is rigidly attached to the shaft 220, for example, by moulding, welding or adhesive means, thereby forming a base sub-assembly. The platform 230 is configured to enable torque applied by a user to the bezel head 130 to be transferred via the platform 230 to the screw thread 210 of the shaft 220. As illustrated in both Figure 6 and 7, to this end the platform or base 230 defines a profile (e.g. is shaped to define cams 235, such as shaped corners) which slots into a corresponding complementary profile in the interior of the bezel head 130 (not shown), thereby enabling transfer of torque. This "cam" structure can take many possible non-circular or "keyed" shapes – for example, square, triangle, round with a flat side, etc.

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The torsional connection between the bezel head 130 and the platform or base 230, which in turn is rigidly connected to the shaft 220 and screw thread 210, provides the stud with a high degree of torsional strength while protecting the electrical connection between the LED 220, PCB 225 and electrical conducting pin 240. This also enables a user to apply sufficient torsional force to form a robust electrical connection between the bezel portion 100, shaft portion 200 and battery portion 300, as will be described in more detail below.

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Essentially, the interior of the bezel head 130 and the platform or base 230 on which the LED 120 and LED PCB 125 are mounted/received are mutually shaped or configured to prevent the bezel head 130 and platform or base 230 from rotating relative to one another. In other words, once the platform 230 is received within the bezel head 130, a torsional force (torque) applied to the bezel head 130 is transferred to the platform 230 and therefore to the shaft 220 and screw thread 220 of the shaft.

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This force is passed to the platform 230 and shaft 220 rather than to the LED 120, PCB 125 and conducting pin 240.

5 In this example, the diameter of the shaft 220 must be sufficiently small (approximately 1mm) to enable the shaft 220 to pass through a pierced hole in a user's ear (or other location). However, the shaft 220 diameter must also be large enough to accommodate the electrical conducting pin 240 therethrough, and the screw thread 210. In addition, the electrical conducting pin 240 diameter must be large enough such that the pin 240 does not deform on connection with the battery portion 300. In order to maximise the
10 wall thickness of the shaft 220 and the pin 240 diameter, in one example a chemical non-stick coating is provided on an exterior surface of the pin 240. This coating provides good insulation whilst being extremely thin.

15 The modular arrangement of the bezel portion 100 and shaft portion 200 into bezel, electronic and base sub-assemblies, as described above, enables different stone sizes and setting types to be accommodated without the need to change the remaining components for each variation.

20 Figures 8 to 12 illustrate two embodiments of a battery portion 300, 300' of the ear stud.

In the embodiment 300 illustrated in Figures 8 and 9, the battery portion 300 comprises a battery 310, a lower housing 320, an upper housing 325, a frame 330, a printed circuit board (PCB) 340 and threaded contacts 350. In the alternative embodiment
25 300' illustrated in Figures 10, 11 and 12, the battery portion 300' comprises the battery 310, a lower housing 320', an upper housing 325', a frame 330', a passive printed circuit board (PCB) 340', an active PCB 345' and threaded contacts 350'.

30 In one example, the threaded contacts 350, 350' may be soldered to the PCBs 340, 340', 345' to provide a robust attachment method that requires no fasteners. A soldered attachment creates an electrical connection, and also provides precise positioning which may be more difficult to achieve using other methods. It will be appreciated that where the shaft 220 does not terminate in a threaded portion, as discussed above with reference to Figures 6 and 7, rather than being threaded the

contacts or connectors 350, 350' attached to the PCBs 340, 340', 345' may be correspondingly configured so as to receive the end portion of the shaft 220.

5 In both embodiments 300, 300' the battery 310 may comprise a button or coin cell battery and the frame 330, 330' is configured to hold the battery 310 and associated PCB 340, 340', 345' in position. The lower 320, 320' and upper 325, 325' housing are configured to be joined together to form a unit with the battery 310, frame 330, 330' and PCBs 340, 340', 345' therein. The lower 320, 320' and upper 325, 325' housings may be joined together by a threaded connection, by a snap fit connection, by screws or the like. Ideally, the lower 320, 320' and upper 325, 325' housings may be joined so as to be separable by a user in order to replace or recharge the battery 310. Alternatively, the housings may be sealed during manufacture.

15 In both embodiments 300, 300', the pair of threaded contacts 350, 350' are connected to the PCB 340, 340', 345' and are configured to receive the screw thread 210 or other attachment of the shaft 220. Once the screw thread 210 is received in one of the threaded contacts 350, 350', the conducting pin 240 housed within the bore 225 of the shaft 220 and extending therefrom makes contact (electrical or physical, or both) with the respective PCB 340, 340', 345'.

20 In both embodiments 300, 300', each of the upper 325, 325' and lower housings 320, 320' are provided with an aperture for receiving the shaft 220. The apertures in the upper 325, 325' and lower housing 320, 320' may be located such that they do not align with one another. In alternative embodiments the battery portion may be configured such that both apertures are provided in the same side or face of the housing.

25 One aperture (for example, the aperture in the upper housing 325, 325') enables the conducting pin 240 to complete an electrical circuit between the battery 310 and LED 120, while the other aperture (for example, the aperture in the lower housing 320, 320') does not.

30 For example, as illustrated in Figure 9a, when the shaft 220 is torsionally inserted into the aperture 360 in the upper housing 325 and is received by the threaded contact or connector 350, the conducting pin 240 comes into contact with a first positive metal

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battery contact 355 on the PCB 340. This contact enables power from the battery 310 to be passed to the LED 120, thereby illuminating the gemstone 10 mounted in the bezel head 130. (NB in the case where the shaft 220' and screw thread 210' form two separate portions, the PCB 340 may include two positive contacts 355 which engage the shaft portion 220' and screw thread portion 210' respectively. A third metal contact (not shown) may be provided on the PCB 340 that would wrap around the battery 310 to make contact with the negative terminal).

However, as further illustrated in Figure 9b, (in which the housing 320, 325 is shown in the same orientation as in Figure 9a but rotated by 180 degrees) when the shaft 220 is torsionally inserted into the aperture in the lower housing 320 (not shown) and is received by the second threaded contact or connector 350, the conducting pin 240 does not make contact with the positive contact 355 on the PCB 340. Therefore, the battery 310 does not supply power to the LED 120 and the stone 10 is not illuminated. In this sense the second threaded connector 350 may be considered to be a "blank", and may not include any conducting elements.

The upper 325 and/or lower housings 320 may be marked by indicia, colours, shapes, embossed, indented or raised portions or the like so as to indicate to a user in which aperture to insert the shaft 220 depending upon whether the user wishes the stone to be illuminated by the LED 120, or not. Figure 9c illustrates the assembled ear stud, with the bezel portion 100 and shaft portion 200 inserted in a first position (left), in which the shaft 220 is inserted into an aperture in the upper housing 325, and the stone 10 mounted in the bezel 130 is illuminated by the LED 120, and in a second position (right) in which the shaft 220 is inserted into an aperture in the lower housing 320, and the stone 10 mounted in the bezel 130 is not illuminated by the LED.

In the embodiment illustrated in Figures 10, 11 and 12, there are two PCBs 340', 345' within the housing 320', 325'. As in the embodiment of Figure 8, each PCB 340', 345' has a threaded contact or connector 350' attached thereto, each configured to receive the screw thread portion 210 of the shaft 220. One of the PCBs 340' is a passive PCB which acts as a negative battery contact. This passive PCB 340' does not provide electrical connectivity between the battery 310 and the LED 120 and its associated PCB 125. The second PCB 345' is an active PCB which includes a positive battery contact 355' thereon. The housing 320', 325' therefore houses therein two sets of

substantially identical and symmetrically opposite components (i.e. PCBs 340', 345' and threaded connectors 350').

5 As described above with reference to Figures 9a, 9b and 9c, a user may insert the shaft 220 into a first aperture in the housing when it is desired to power the LED with the battery and illuminate the stone, and into a second aperture in the housing when it is desired for the stone mounted in the bezel head to remain unilluminated. In other words, to illuminate the stone the portions of the stud may be assembled with the battery portion in a first orientation, and to wear the stud without illuminating the stone the portions of the stud may be assembled with the battery portion in a second, different orientation.

10 Figure 11 illustrates the assembled ear stud of Figure 10 with the housing 320', 325' omitted for clarity. The shaft 220 is shown in the first position, in which the shaft 220 has been inserted into an aperture in the upper housing 325' and the threaded portion 210 of the shaft 220 has been torsionally connected to the threaded contact 350' on the second, active PCB 345'.

20 Figure 12a illustrates the housing 320', 325' with the lower housing 320' facing upwards (left) and with the upper housing 325' facing upwards (right). It can be seen that an exterior surface of the upper housing 325' includes a raised shape 370' which indicates to a user that the shaft 220 should be torsionally connected to the battery portion 300' via the aperture in the upper housing 325' when the user wishes the stone 10 to be illuminated by the LED 120. It will be appreciated that the illustrated shape 370', which represents a cut diamond gemstone, may be replaced by other shapes or indicia. However, a raised (or indented) shape is advantageous in that a user can determine which side or region of the housing is the "positive" or "active" side simply by touch.

30 Figure 12b illustrates the assembled stud with the shaft 220 inserted into the upper housing 325'.

The ear stud described above is configured such that a user may switch the LED on or off by removing the battery portion from the shaft portion and turning it over, then reconnecting the battery portion to the shaft portion. Alternatively, a user may switch

the LED on or off by removing the battery portion from the shaft portion and reconnecting the shaft portion to a different region of the same side of the battery portion. This design avoids the need for a user to precisely position the battery housing relate to the bezel portion by pulling, twisting etc. Additionally, there is no requirement for an on/off switch, which would add to the size, weight and complexity of the ear stud. The ear stud of the present invention is therefore more compact (i.e. miniaturised) and lighter than conventional illuminated ear studs.

Figure 13 illustrates an exemplary circuit design showing how the LED in the bezel portion is driven by the battery and associated PCB or PCBs. The illustrated circuit design may apply to the embodiments of both Figures 8 and 10.

Driving a 3.4V UV LED, such as that described above, is electrically complicated, requiring a highly specific battery type and arrangement of circuitry. This circuit design may differ from a standard LED circuit because the battery delivers 1.2V, but the LED requires 3.4V. To accomplish this step up in voltage, a specialized circuit may be used. The stud acts as the switch and connector for this novel circuit design.

When replacing the cell battery with a rechargeable battery, this arrangement may be adapted by replacing the battery and driving circuitry. However, because all of the driving circuitry is contained inside the battery portion, it is possible to either switch to rechargeable technology entirely or provide both non-rechargeable and rechargeable options. In a rechargeable battery design, another variant of the housing may be used, including a charging connection.

The electrical arrangement illustrated herein allows for a very compact assembly without any wire. In production, the PCB boards illustrated in Figure 10 may be combined using Flex PCB technology (i.e. PCBs comprising a thin insulating polymer film having conductive circuit patterns affixed thereto and typically supplied with a thin polymer coating to protect the conductor circuits).

Figures 14a, 14b and 14c illustrate further detail of the electrical connection between the shaft 220, conducting pin 240 and active PCB 345'. While these Figures illustrate the embodiment shown in Figure 10, the following description may also apply to the embodiment of Figure 8.

In use, the user holds the bezel head 130 and inserts the shaft 220 through the piercing (or other surface). The user then brings the battery portion 300 into proximity with the shaft 220 and twists the bezel head 130 (or the battery portion 300) so as to screw the screw thread 210 of the shaft 220 into one of the apertures in the housing 320', 325', depending upon whether the user wishes the stone 10 in the bezel head 130 to be illuminated by the LED 120, or not.

Figure 14a illustrates the screw thread 210 of the shaft 220 fully engaged with the threaded contact 350' of the active PCB 345'. The conducting pin 240, which is connected to the LED 120 and the LED PCB 125, passes through the bore 225 of the shaft 220, and emerges from the end of the screw thread 210. The conducting pin 240 contacts a centre pad 355' of the active PCB 345' (NB this contact is missing on the passive PCB 340'), thereby completing the electrical circuit and allowing the battery 310 to power the LED 120, thus illuminating the stone 10 mounted in the bezel head 130.

Figure 14b illustrates a partially exploded view of the active PCB 345', shaft 220, conducting pin 240, threaded contact 350' and platform 230. The LED, LED PCB and bezel head are omitted for clarity.

It can be seen that the conducting pin 240 emerges from the bore of the shaft 220 at both the upper platform end and lower PCB end. The centre pad 355' is shown, together with an outer pad 356' which forms ground and to which the threaded contact 350' is connected. In use, the conducting pin 240 makes contact with the centre pad 355' to complete an electrical circuit and to power the LED (not shown).

As discussed, and as shown in the example of Figure 14c, the centre pad 355' is not provided on the passive PCB 340'. The secondary, passive PCB 340' (where present) provides an attachment point for the threaded contact 350' (i.e. the "blank") used when the stud is in the "off" position. The passive PCB 340' also provides contact for the negative terminal 357' of the battery. In a further example, where an active and a passive PCB are present, the PCBs may be connected via a single wire.

It will be appreciated that, in this specific example, when the user does not wish the stone 10 to be illuminated, the user may screw the shaft 220 into the opposing side of the housing 320', 325', wherein the screw thread 210 of the shaft 220 will be received by an identical threaded contact 350' attached (e.g. by soldering) to the passive PCB 340'. However, as the passive PCB 340' does not include the contact pad 355', the electrical circuit between the LED 120 and battery 310 is not completed. As previously discussed, one or both sides of the housing 320', 325' may be marked so as to indicate to a user, preferably by touch alone, which side is "active", "positive" or "on", and which side is "passive" or "off".

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Figures 15a and 15b illustrate alternative arrangements of the bezel portion 100 and shaft portion 200. Figure 15a illustrates a conducting pin, which terminates in an audio jack connector 380 and may be connected to a PCB in the battery portion 300 via this connector 380. Figure 15b illustrates an arrangement whereby the LED is located within the battery portion 300 and illumination to the bezel head is provided by a fibre optic cable (or other light guide) within the shaft 200. It will be appreciated that where the shaft portion does not terminate in a screw thread, the connectors attached to the PCB(s) may be appropriately configured to receive the end of the shaft portion i.e. may not be threaded. Of course, the "active" and "passive" connectors may not be identical but may connect to the end of the shaft portion in different ways.

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It will be appreciated that various modifications and alterations may be made to the embodiments described herein, and that elements of the described embodiments may be combined with or substituted for one another.

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The assembly described herein may be further configured to provide one or more of the following non-limiting features: body temperature sensing to change LED effect; other bio/body sensing to change LED effect; UV sunlight exposure sensing to change LED effect; synchronized LED pulses/patterns across different jewellery items on one person / on different persons; synchronized LED pulses/patterns based on music (environment (e.g. music festival) or via personal music source; multiple LEDs behind a pave setting to create dynamic patterns of light; LED as a safety feature at night; LED as a notification via smartphone (via Bluetooth or other comms); LED as notification via loved one (via Bluetooth or other comms); LED as a notification when physically close to someone with matching jewellery or activating tech or certain set criteria (e.g. dating

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profile); LED changes colour to match clothing style, makeup, or mood; LED flashing sequence used to send a message (like Morse code) or activate some external object or action or transaction. To this end, the assembly may comprise one or more sensors. As used to provide the above features, the assembly may take the form of a stud, optionally an ear stud, or may take the form of one or more of the items of jewellery, fashion items and accessories discussed above.

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CLAIMS:

1. An assembly, the assembly comprising a gemstone holder and a battery housing,
5 the gemstone holder comprising:
a bezel portion providing a mount for receiving a gemstone;
a shaft portion comprising an elongate shaft, the elongate shaft comprising first and second electrically conducting portions;
the battery housing comprising:
10 a battery power source and a plurality of apertures; wherein a first one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a first connector within the housing, and a second one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a second connector within the housing;
15 a light emitting diode, LED, configured to illuminate the gemstone; and wherein engagement of the end portion of the shaft with the first connector completes an electrical circuit between the battery power source and the LED, and engagement of the end portion of the shaft with the second connector does not complete the electrical circuit.
- 20 2. The assembly of claim 1, wherein the first one and the second one of said plurality of apertures are provided on the same side or different sides of the housing.
3. The assembly of claim 1 or 2, wherein the shaft portion and bezel portion
25 include interconnecting complementary profiles, such that torque applied to the bezel portion is transferred to the shaft.
4. The assembly as claimed in any preceding claim, wherein the end portion of the shaft comprises a screw thread and the first and second connectors are threaded
30 connectors.
5. The assembly as claimed in any of claims 1 to 3, wherein the end portion of the shaft engages with the first and second connectors with one of: a snap fit, a bayonet fit, a friction fit.

6. The assembly as claimed in any preceding claim, wherein the LED is housed within the bezel portion and is configured to illuminate a gemstone mounted in an outer face of the bezel portion upon completion of the electrical circuit.
- 5 7. The assembly as claimed in any of claims 1 to 5, wherein the LED is housed within the battery housing and wherein the elongate shaft comprises a light guide for guiding light to the bezel portion.
- 10 8. The assembly as claimed in claim 6, wherein the shaft portion comprises a platform for mounting the LED, said platform being rigidly connected to the shaft distal to the end portion.
- 15 9. The assembly as claimed in claim 8 when dependent upon claim 3, wherein said platform defines the complementary profile of the shaft portion.
- 20 10. The assembly as claimed in any preceding claim, wherein the shaft defines a bore therethrough for housing a conducting pin, said pin connected to the LED at a first end and configured to connect to the first or second connector at a second end.
- 25 11. The assembly as claimed in claim 10, wherein said conducting pin has a non-stick coating.
12. The assembly as claimed in any preceding claim, wherein the LED is configured to emit ultraviolet light upon completion of the electrical circuit, and the gemstone is selected in order to luminesce upon illumination by ultraviolet light.
13. The assembly as claimed in any preceding claim, wherein the LED is a 3.4V LED.
- 30 14. The assembly as claimed in any preceding claim, wherein the first connector is electrically connected to a first PCB within the housing, and wherein the second connector is attached to a second PCB within the housing.
- 35 15. The assembly as claimed in claim 14, wherein the first and second PCBs are flexible PCBs and are optionally connected by a flexible portion.

16. The assembly as claimed in any preceding claim, wherein the housing comprises a frame therein for holding the battery power source.
- 5 17. The assembly as claimed in any preceding claim, wherein the side defining the first aperture is marked by one or more of: indicia, raised portions, indented portions.
18. The assembly as claimed in any preceding claim, wherein the housing is comprised of an upper and a lower portion, each portion comprising an opposing face.
- 10 19. The assembly as claimed in any preceding claim, wherein said battery is a cell battery and/or wherein the battery is a re-chargeable battery.
20. The assembly as claimed in any preceding claim, wherein the gemstone is a natural or synthetic diamond.
- 15 21. The assembly as claimed in any preceding claim, wherein the assembly is a stud for a piercing, optionally for an ear piercing.
- 20 22. The assembly as claimed in claim 21, wherein the stud comprises:
a front portion including the gemstone and the LED, the LED configured to emit ultraviolet light; and
a rear portion including the battery configured to power the LED;
the stud configured such that the LED illuminates the diamond when the front
25 and rear portions are assembled with the rear portion in a first orientation, and such that the LED does not illuminate the diamond when the front and rear portions are assembled with the rear portion in a second, different orientation.
23. A gemstone holder comprising:
30 a bezel portion providing a mount for receiving a gemstone; and
a shaft portion comprising an elongate shaft, the elongate shaft comprising first and second electrically conducting portions.
24. A battery housing comprising:

a battery power source and a plurality of apertures; wherein a first one of said plurality of apertures is configured to enable engagement of an end portion of a shaft with a first connector within the housing, and a second one of said plurality of apertures is configured to enable engagement of an end portion of the shaft with a second connector within the housing;

5 said battery housing being configured such that engagement of the end portion of the shaft with the first connector completes an electrical circuit between the battery power source and an LED electrically connected to the shaft, and engagement of the end portion of the shaft with the second connector does not complete said
10 electrical circuit.