

ROPE CHAIN

Field of Invention

The present invention relates to a jewellery chain, in particular, a spiral diamond cut rope chain.

5 Background Art

The following discussion of the background to the invention is intended to facilitate an understanding of the present invention only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge of the person skilled in the art in any jurisdiction as at the priority date of the invention.

A rope chain is a metal chain comprising of several links which pattern the shape of a rope. In particular, the rope chain is made up of a series of links that are intertwined with one another to define a double helix structure comprising grooves.

15 The double helix structure is then subjected to a process called "diamond cutting" to enhance the light reflective property of the resultant rope chain (colloquially known as "sparkling quality"). Diamond cutting involves using sharp diamond cutting tools to cut off portions or segments of the rope chain (usually known as "faceting"), and making use of various methods for cutting into the surface of the links so that these facets which will reflect light in various angles, making the resultant diamond cut rope chain shinier than a raw or non-diamond-cut rope chain. However, the process of diamond cutting is challenging.

Conventionally, the rope chain is externally cut such that faceting is carried out at a distance from the grooves. As illustrated in Figs. 1A and 1B, prior art diamond cut rope chains P1000 are made up of a first plurality of links P100 that are intertwined with a second plurality of links P200 to form a plurality of grooves P300 (P300a, P300b, P300c). Prior art diamond cut rope chains P1000 are cut such that the facets P350 (P350a, P350b, P350c) extend longitudinally along the rope chain in a single plane that extends parallel to the longitudinal centre (or axis) L of the chain.

Consequently, the prior art diamond cut rope chain P1000 would reflect light such that the reflected light from each facet will be aligned substantially in a direction T_1 that is parallel to the longitudinal centre L of the chain P1000 (Fig. 1B). Similarly and as illustrated in Fig. 1C, a prior art diamond cut rope chain P1000', which has a right twist and is the mirror image of P1000, would reflect light such that the reflected light from each facet will be aligned substantially in the direction T_1 as well.

Prior art diamond cut rope chains may have edges that can get tarnished after prolonged wear because of abrasion on the surface of the wearer's skin, clothes and/or hair. As such, the life span of the sparkling quality of the diamond cut rope chains may be decreased over time. Furthermore, the edges of the diamond cut rope chains may be sharp and cause tears or scratches on the surface of the wearer's clothes and/or accessories.

In addition, prior art diamond cut rope chains may destroy the original structure of the rope chain and/or distort its shape. This is because the facets are formed on the outer periphery of the rope chain. As illustrated in Fig. 1D and 1E, prior art diamond cut rope chain P1000' may comprise eight facets that are formed on the outer periphery of the rope chain P1000', such that each facet is a distinct reflecting surface aligned in a manner corresponding to one of the eight faces of an octagon. Consequently, the reflected light from each facet of the rope chain P1000' will be aligned substantially in the direction T_1 . As prior art rope chain P1000' is limited to having eight distinct reflecting planes that reflect light in such a manner when rotated about the longitudinal centre L by (but not limited to) every 45 degrees with respect to an axis perpendicular to the longitudinal centre L, the sparkling quality of the rope chain P1000' is limited to a certain extent. The limitation of faceting prior art rope chains to form eight distinct reflecting planes may be due to the use of two gang tool components, each gang tool component comprising four flat diamond tools for faceting. Furthermore, prior art rope chains such as P1000 or P1000' are not rotated about the longitudinal centre L of the chain during faceting, thereby preventing access to portions of the links that are directly adjacent to the grooves

P300 or P300'. As facets are formed on the outer periphery of the rope chain, the outer periphery of the rope chain is no longer substantially rounded, and its aesthetic appeal may be compromised.

5 In light of the above, there exists a need to develop a rope chain that ameliorates or overcomes the above disadvantages.

The present invention seeks to provide a rope chain that addresses the aforementioned need at least in part.

Summary of the Invention

10 In an aspect of the invention, there is provided a rope chain comprising a double helix structure comprising a first plurality of links intertwined with a second plurality of links to form a plurality of grooves; wherein the first plurality of links comprises at least one facet; and wherein each facet is located directly adjacent to the plurality of grooves.

15 Preferably, the double helix structure has a substantially curved peripheral surface.

Preferably, the substantially curved peripheral surface comprises a portion of the first plurality of links that does not have a facet and a portion of the second
20 plurality of links that does not have a facet.

Preferably, the second plurality of links comprises at least one facet, and wherein each facet is located directly adjacent to the plurality of grooves.

Preferably, the at least one facet on the first plurality of links are on a different
25 plane from the at least one facet on the second plurality of links.

Preferably, the at least one facet on the first plurality of links and the at least one facet on the second plurality of links are facing inwards and towards a longitudinal centre of the rope chain.

Preferably, the at least one facet on the first plurality of links and the at least one facet on the second plurality of links are at an angle of about 35 degrees from the longitudinal centre of the rope chain.

5 Preferably, the at least one facet on the first plurality of links and the at least one facet on the second plurality of links is shaped like a leaf.

Preferably, the first plurality of links is made up of a hollow wire or a solid wire.

Preferably, the second plurality of links is made up of a hollow wire or a solid wire.

Preferably, the first plurality of links and the second plurality of links have a substantially circular cross-section.

10 Preferably, each facet directly adjacent to the plurality of grooves has a uniform surface area.

Preferably, the rope chain further comprises an engaging means capable of attaching a first end of the double helix structure to a second end of the double helix structure.

15 Preferably, the engaging means is a clasp.

In another aspect of the invention, there is provided a method of manufacturing a rope chain, comprising providing a double helix structure comprising a first plurality of links intertwined with a second plurality of links to form a plurality of grooves; creating at least one facet on the first plurality of links; wherein each facet is located
20 directly adjacent to the plurality of grooves.

Preferably, the method further comprises creating at least one facet on the second plurality of links, wherein each facet is located directly adjacent to the plurality of grooves.

Preferably, the step of creating the at least one facet on the first plurality of links and/or the second plurality of links makes use of a faceting structure capable of holding and mounting the rope chain.

5 In another aspect of the invention, there is provided a faceting structure for creating at least one facet on a plurality of links, wherein the faceting structure is capable of being used in a method as described above.

Preferably, the faceting structure comprises two bobbins arranged in a vertical direction such that one bobbin is positioned directly above the other bobbin.

10 Preferably, the faceting structure further comprises air cylinder holders comprising clamps, wherein the air cylinder holders are connected adjacently to the bobbins.

Preferably, the faceting structure further comprises a diamond cutting tool holder comprising a single point diamond cutting tool.

Preferably, the single point diamond tool comprises a diamond tip and a carbide shank attached to the diamond tip.

15 Preferably, the diamond cutting tool holder further comprises a sliding means capable of controlling the movement of the single point diamond cutting tool.

Preferably, the faceting structure further comprises sensors disposed at one end of the faceting structure, wherein the sensors are capable of positioning the single point diamond cutting tool.

20 Preferably, the faceting structure further comprises at least one or more motors, wherein the at least one or more motors is selected from the group comprising of a hollow shaft motor, a linear drive stepper motor and a motor capable of rotating the single point diamond cutting tool.

25 Preferably, each motor comprises a built-in encoder capable of detecting a length of a rope chain.

Preferably, the faceting structure further comprises a motorized stage, wherein the diamond cutting tool holder is mounted on the motorized stage.

Preferably, the sensors are connected to the motorized stage via an arm.

Other aspects of the invention will become apparent to those of ordinary skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying drawings.

Brief Description of the Drawings

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

- 10 Fig. 1A illustrates a perspective view of a prior art diamond cut rope chain;
Fig. 1B illustrates a simplified plan view of a prior art diamond cut rope chain with a left twist without indication of the facets (in other words, an uncut rope chain with a left twist), the reflected light from each facet aligned substantially in a direction T_1 ;
Fig. 1C illustrates a simplified plan view of a prior art diamond cut rope chain with a
15 right twist without indication of the facets (in other words, an uncut rope chain with a right twist), the reflected light from each facet aligned substantially in a direction T_1 ;
Fig. 1D illustrates a cross-sectional view of the rope chain of Fig. 1C, each of the eight facets aligned in a manner corresponding to one of the eight faces of an
20 octagon;
Fig. 1E illustrates the octagon of Fig. 1D, the dotted lines representing the alignment of reflected light from each facet in the direction T_1 ;
Fig. 2A illustrates a plan view of a rope chain with a left twist in accordance with an embodiment of the invention;
25 Fig. 2B illustrates a plan view of a rope chain with a right twist in accordance with an embodiment of the invention;
Fig. 2C illustrates a plan view of a rope chain with a left twist in accordance with an embodiment of the invention;
Fig. 2D illustrates a plan view of a rope chain with a right twist in accordance with
30 an embodiment of the invention;

Fig. 3A illustrates a simplified plan view of a rope chain with a left twist in accordance with an embodiment of the invention without indication of the facets, the reflected light from each facet aligned substantially in a direction S_1 ;

Fig. 3B illustrates a simplified plan view of a rope chain with a right twist in accordance with an embodiment of the invention without indication of the facets, the reflected light from each facet aligned substantially in a direction S_2 ;

Fig. 4A is a photograph of a rope chain with a right twist, in accordance with an embodiment of the invention;

Fig. 4B illustrates the shape of a facet in accordance with an embodiment of the invention;

Fig. 4C is a photograph illustrating an exploded view of Fig. 4A, indicating the shape of a facet in accordance with an embodiment of the invention;

Fig. 5A illustrates a cross-sectional view of the rope chain of Fig. 3B;

Fig. 5B illustrates a cross-sectional view of the rope chain of Fig. 3A;

Fig. 6 is a schematic diagram of a method of manufacturing the rope chain in accordance with an embodiment of the invention;

Fig. 7A illustrates an exploded view of a diamond cutting tool contacting a raw rope chain with a left twist placed on an anvil in accordance with an embodiment of the invention;

Fig. 7B illustrates an exploded view of a diamond cutting tool contacting a raw rope chain with a right twist placed on an anvil in accordance with an embodiment of the invention;

Fig. 8 illustrates an alignment procedure used in the method of manufacturing the rope chain in accordance with an embodiment of the invention;

Fig. 9A illustrates a diamond cutting tool holder in accordance with an embodiment of the invention;

Fig. 9B illustrates a side view of a diamond cutting tool in accordance with an embodiment of the invention, the shaded areas indicating the ends of a protruded portion of the elongated portion;

Fig. 9C illustrates another side view of the diamond cutting tool of Fig. 9B, the dotted lines indicating the positioning of a hole in the elongated portion of the diamond cutting tool;

Fig. 9D illustrates an exploded view of the diamond tip of the diamond cutting tool of Fig. 9B;

Fig. 9E illustrates a top view of a diamond cutting tool having an angle α_1 ;

Fig. 9F illustrates a top view of a diamond cutting tool having an angle α_2 , wherein the surface area (or size) of the facet formed by the diamond cutting tool having an angle α_2 is different from the surface area (or size) of the facet formed by the diamond cutting tool of Fig. 9E;

Fig. 9G is a photograph of the diamond cutting tool of Fig. 9B; and

Fig. 9H illustrates a top view of the elongated portion of a diamond cutting tool (in other words, the shank) in accordance with an embodiment of the invention.

Other arrangements of the invention are possible and, consequently, the accompanying drawings are not to be understood as superseding the generality of the preceding description of the invention.

Description of Embodiments of the Invention

Particular embodiments of the present invention will now be described with reference to the accompanying drawings. The terminology used herein is for the purpose of describing particular embodiments only and is not intended to limit the scope of the present invention. Other definitions for selected terms used herein may be found within the detailed description of the invention and apply throughout the description. Additionally, unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one or ordinary skill in the art to which this invention belongs. Where possible, the same reference numerals are used throughout the figures for clarity and consistency.

The term “directly adjacent” used throughout the specification will be understood by a skilled person to refer to a facet that is in close proximity to a groove of a rope chain, such that the facet is located along the internal track of the rope chain. Preferably, the facet faces inwards and towards the longitudinal centre L of the rope chain because of the close proximity of the facet to the groove. For example, a

facet 220'b that is directly adjacent to a groove 300'b faces inwards and towards the longitudinal centre L of the rope chain 1000' (Fig. 4A).

The terms "longitudinal axis L" and "longitudinal centre L" are used interchangeably throughout the specification.

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Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

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Furthermore, throughout the specification, unless the context requires otherwise, the word "include" or variations such as "includes" or "including", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

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In accordance with an embodiment of the invention and as shown in Fig. 2A, 3A and 5B, there is a true spiral diamond cut rope chain 1000 (or spiral rope chain 1000 or rope chain 1000), preferably with a left twist as shown. In other words, the rope chain 1000 comprises a double helix structure 500 that is left-handed. As will be explained in greater detail below, various embodiments of the rope chain 1000 may advantageously play a role in achieving a greater aesthetic appeal, an increased lifespan of the sparkle and increased safety to the wearer, as compared to prior art diamond cut rope chains, such as P1000 and P1000'. As illustrated in Fig. 2A, a rope chain 1000 comprises a double helix structure 500 comprising a first plurality of links 100 intertwined with a second plurality of links 200 to form a plurality of grooves 300a, 300b, 300c (collectively referred to as 300) at the intersection of the first plurality of links 100 and the second plurality of links 200. The plurality of grooves 300a, 300b, 300c are aligned parallel to each other along the direction S_1 . Each link making up the first plurality of links 100 and the second plurality of links 200 in the rope chain 1000 is generally curved, annular and, curved

again in a C-shape. The links are referred to as “annular” since these ring shaped links wrap around each other.

In various embodiments, the first plurality of links 100 comprises one or more facets 120a, 120b, 120c (collectively referred to as 120) that lie on a surface of a link making up the first plurality of links 100, such that each facet 120 is located directly adjacent to the plurality of grooves 300. Consequently, the light shining on the facets 120 would be reflected such that the reflected light is aligned substantially along the internal track of the rope chain 1000 and in the direction S_1 when rotated about the longitudinal centre L of the rope chain 1000, such that rotation of the rope chain 1000 about its longitudinal axis would lead to a sparkling effect in a spiral manner. It should be understood that light will still be reflected such that the facets 120 give rise to a shiny effect (or brilliance) even when the rope chain 1000 is not rotated about its longitudinal centre L. It should be understood that the first plurality of links 100 may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 120a and directly adjacent to the groove 300a. In various embodiments, the first plurality of links 100 may further comprise additional facets that lie on a surface of additional links making up the first plurality of links 100 such that the additional facets are adjacent to facet 120b and directly adjacent to the groove 300b. In various embodiments, the first plurality of links 100 may further comprise additional facets that lie on a surface of additional links making up the first plurality of links 100 such that the additional facets are adjacent to facet 120c and directly adjacent to the groove 300c. Consequently, the direction of reflected light shining on the facets 120 and additional facets would be aligned substantially along the internal track of the rope chain 1000 and in the direction S_1 when rotated about the longitudinal centre L of the rope chain 1000. Advantageously, the presence of additional facets which is aligned substantially in the direction S_1 enhances the shiny effect (or brilliance) of the rope chain 1000.

In various embodiments, the additional facets could be aligned in one or more other directions (not shown) to create another alignment of reflected light in one or more other directions.

5 In various embodiments, the double helix structure 500 of the rope chain 1000 has substantially curved peripheral surfaces. In particular, the peripheral surface 140a, 140b and 140c of the first plurality of links 100 does not have a facet located on a portion of the first plurality of links 100. In various embodiments, the peripheral surface 240a, 240b and 240c of the second plurality of links 200 does not have a
10 facet located on a portion of the second plurality of links 200. Consequently, the peripheral surfaces 140a, 140b, 140c, 240a, 240b and 240c of the double helix structure 500 do not have a flat surface which would extend parallel to the longitudinal centre of the rope chain 1000. Advantageously, there would not be sharp edges that can get tarnished after prolonged wear because of abrasion on
15 the surface of the wearer's skin, clothes and/or hair. This leads to an increased lifespan of the sparkle when compared to prior art diamond cut rope chains. Consequently, the rope chain 1000 is safer than prior art diamond cut rope chains because of the absence of facets that could come into direct contact of the wearer's skin, clothes and/or hair.

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In various embodiments, the second plurality of links 200 comprises one or more facets 220a, 220b, 220c (collectively referred to as 220) that lie on a surface of a link making up the second plurality of links 200, such that each facet 220 is located directly adjacent to the plurality of grooves 300. Consequently, the light shining on
25 the facets 220 would be reflected such that the reflected light is aligned substantially along the internal track of the rope chain 1000 and in the direction S_1 when rotated about the longitudinal centre L of the rope chain 1000, such that rotation of the rope chain 1000 about its longitudinal axis would lead to a sparkling effect in a spiral manner. In other words, when the rope chain 1000 is rotated about
30 the longitudinal centre L, the reflected light would follow the rotation of the rope chain 1000, thereby creating an effect of running lights travelling along the longitudinal centre L. The effect of running lights travelling along the longitudinal

centre L appears to move up or down along the longitudinal centre L, depending on how the rope chain 1000 is twisted. It should be understood that light will still be reflected such that the facets 220 give rise to a shiny effect (or brilliance) even when the rope chain 1000' is not rotated about its longitudinal centre L. It should be understood that the second plurality of links 200 may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 220a and directly adjacent to the groove 300a. In various embodiments, the second plurality of links 200 may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 220b and directly adjacent to the groove 300b. In various embodiments, the second plurality of links 200 may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 220c and directly adjacent to the groove 300c. Consequently, the reflected light shining on the facets 220 and additional facets would also be aligned substantially along the internal track of the rope chain 1000 in the direction S_1 when rotated about the longitudinal centre L of the rope chain 1000. Advantageously, the presence of additional facets enhances the shiny effect (sparkle or brilliance) of the rope chain 1000.

In various embodiments, the additional facets could be aligned in one or more other directions (not shown) to create another alignment of reflected light in one or more other directions.

In a preferred embodiment, each of the links making up the first plurality of links 100 and each of the links making up the second plurality of links 200 comprises a facet that lies on a surface of the link, such that each facet is located directly adjacent to the plurality of grooves 300. As such, all the links of the rope chain 1000 is faceted, thereby enhancing the shiny effect (sparkle or brilliance) of the rope chain 1000. Furthermore, when the rope chain 1000 is rotated about the longitudinal centre L by (but not limited to) 1 degree or less, light may bounce off the internal track of the rope chain 1000, thereby enhancing the sparkling quality of the rope chain 1000 by many folds. In contrast and as illustrated in Fig. 1D and 1E,

prior art diamond cut rope chain P1000' comprises eight facets that are formed on the outer periphery of the rope chain P1000', such that each facet is a distinct reflecting surface aligned in a manner corresponding to one of the eight faces of an octagon. The reflected light from each facet of the rope chain P1000' will be aligned substantially in the direction T_1 . As prior art rope chain P1000' is limited to having eight distinct reflecting planes that reflect light in such a manner when rotated about the longitudinal centre L by (but not limited to) every 45 degrees, the sparkling quality of the rope chain P1000' is limited to a certain extent. Consequently, the sparkling quality of the rope chain 1000 is greater than rope chain P1000' because of the lack of such a limitation.

In various embodiments and advantageously, there is a greater aesthetic appeal because the reflection of the light bouncing off the facets 120, 220 and additional facets presents itself as a running light display (or a spiralling shiny effect) that runs along the internal track of the rope chain 1000 in the direction S_1 when the rope chain 1000 is rotated about its longitudinal axis (or centre) L. The internal track of the rope chain 1000 comprises the grooves 300, which extends along the rope chain 1000 in a spiral fashion following the twist, specifically the left twist, of the rope chain 1000. In particular, when placed beside a prior art diamond cut rope chain such as P1000, the rope chain 1000 of the present invention appears shinier and has an enhanced sparkle. Consequently, the rope chain 1000 would be more aesthetically attractive and the demand for such a diamond cut rope chain may be greater than prior art diamond cut rope chains.

In various embodiments, the rope chain 1000 is a true spiral cut rope chain 1000 because the facets 120, 220 and additional facets faithfully follow the grooves of the rope chain 1000, such that each facet is directly adjacent to a groove. In contrast, the facets of prior art rope chains such as rope chain P1000' are formed on the outer periphery of the rope chain P1000', such that each facet is a distinct reflecting surface aligned in a manner corresponding to one of the eight faces of an octagon (Fig. 1D and 1E).

In various embodiments, the facets 120, 220 and additional facets located directly adjacent to the grooves 300 are facing inwards and towards the longitudinal centre L of the rope chain 1000. In a preferred embodiment, the facets 120, 220 and additional facets are located at an angle of about 35 degrees from the longitudinal centre L of the rope chain 1000. This advantageously leads to increased safety for the wearer and increased lifespan of the sparkle compared to prior art diamond cut rope chains. In particular, the rope chain 1000 has increased lifespan of the sparkle because it is not easy or not possible for the facets 120, 220 and additional facets to get tarnished by abrasion on the surface of the wearer's skin, clothes and/or hair.

In contrast and as illustrated in Fig. 1A, the facets P350a, P350b, P350c (collectively referred to as P350) of prior art diamond cut rope chain P1000 are located on a surface of a link making up the first plurality of links P100 or the second plurality of links P200 such that the facets P350 are outward facing. It would also be appreciated by a skilled person that the facets P350 on prior art rope chains such as rope chain P1000 are not directly adjacent to the grooves P300. As illustrated in Fig. 1A, the facets P350 are at a distance from the grooves P300 such that they are facing outwards (or externally) and away from the longitudinal centre L of the rope chain P1000. Consequently, the facets P350 of the rope chain P1000 may pose a risk to the wearer because the outwardly facing edges of the facets P350 may be sharp and may cause scratches or abrasion on the wearer's skin. Alternatively or in addition, the edges of the facets P350 may come into contact with the wearer's clothes and/or accessories, such as (but not limited to) hand bags. If sharp, the edges of the facets P350 may cause tears or scratches on the surface of the wearer's clothes and/or accessories. Furthermore, the facets P350 may get tarnished after prolonged wear because of abrasion on the surface of the wearer's skin, clothes and/or hair, thereby decreasing the lifespan of the sparkle of the rope chain P1000. In contrast, the afore-mentioned disadvantages are ameliorated because the facets 120, 220 and additional facets of the rope chain 1000 are facing inwards and towards the longitudinal centre L of the rope chain 1000.

In various embodiments, the first plurality of links 100 is made up of a hollow wire or a solid wire. In various embodiments, the second plurality of links 200 is made up of a hollow wire or a solid wire. Consequently, the type and amount of material used to make up the links can be tailored and the cost of manufacturing the links can be accordingly adjusted. This flexibility advantageously allows a manufacturer to suit the requests of its clients.

In various embodiments, the rope chain 1000 is made up of gold, silver, alloys, precious metals or any combinations of the aforementioned. In various embodiments, the rope chain 1000 may be costume jewellery that is made up of copper plated with gold, nickel or chrome.

In various embodiments, the rope chain 1000 further comprises an engaging means capable of attaching a first end of the double helix structure to a second end of the double helix structure. In various embodiments, the engaging means is a clasp.

Fig. 2C illustrates a true spiral diamond cut rope chain 1000 (or spiral rope chain 1000 or rope chain 1000), preferably with a left twist as shown. It should be understood that the embodiments of the rope chain 1000 of Fig. 2A may be present in the rope chain 1000 of Fig. 2C and vice versa. It should also be understood that equivalent or similar technical features of the rope chain 1000 of Fig. 2A have been labelled likewise in the rope chain 1000 of Fig. 2C.

In various embodiments, the size (or surface area) of the facets of the rope chain 1000 of Fig. 2C, such as facets 120, facets 220, differs from the size of the facets of the rope chain 1000 of Fig. 2A. As will be explained in various embodiments, with reference to Figs. 9A to 9H, the size of the facets can be varied by a diamond tool 2000. In various embodiments, the number of facets on the rope chain 1000 of Fig. 2C is the same as the number of facets on the rope chain 1000 of Fig. 2A.

Figs. 2A, 3A and 5B illustrate a true spiral diamond cut rope chain 1000 that has a left twist. It is contemplated that the orientation of the twist can be reversed. Figs. 2B, 3B, 4A to 4C and 5A illustrate a true spiral diamond cut rope chain 1000' (or

spiral rope chain 1000' or rope chain 1000'), preferably with a right twist as shown. In other words, the rope chain 1000' comprises a double helix structure 500' that is right-handed. Accordingly, exemplary, non-limiting embodiments of the rope chain 1000' will now be disclosed, wherein the rope chain 1000' is the mirror image of the rope chain 1000. It should be understood that the embodiments of rope chain 1000 may be present in rope chain 1000'. Similarly, the embodiments of rope chain 1000' may be present in rope chain 1000.

In various embodiments and as illustrated in Fig. 2B, the rope chain 1000' comprises a double helix structure 500' comprising a first plurality of links 100' intertwined with a second plurality of links 200' to form a plurality of grooves 300'a, 300'b, 300'c (collectively referred to as 300') at the intersection of the first plurality of links 100' and the second plurality of links 200'. The plurality of grooves 300'a, 300'b, 300'c are aligned parallel to each other along the direction S_2 . Each link making up the first plurality of links 100' and the second plurality of links 200' in the rope chain 1000' is generally curved, annular and, curved again in a C-shape. The links are referred to as "annular" since these ring shaped links wrap around each other.

In various embodiments, the first plurality of links 100' comprises one or more facets 120'a, 120'b, 120'c (collectively referred to as 120') that lie on a surface of a link making up the first plurality of links 100', such that each facet 120' is located directly adjacent to the plurality of grooves 300'. Consequently, the light shining on the facets 120' would be reflected such that the reflected light is aligned substantially along the internal track of the rope chain 1000' and in the direction S_2 when rotated about the longitudinal centre L of the rope chain 1000, such that rotation of the rope chain 1000' about its longitudinal axis would lead to a sparkling effect in a spiral manner. In other words, when the rope chain 1000' is rotated about the longitudinal centre L, the reflected light would follow the rotation of the rope chain 1000', thereby creating an effect of running lights travelling along the longitudinal centre L. The effect of running lights travelling along the longitudinal centre L appears to move up or down along the longitudinal centre L, depending on

how the rope chain 1000' is twisted. It should be understood that light will still be reflected such that the facets 120' give rise to a shiny effect (or brilliance) even when the rope chain 1000' is not rotated about its longitudinal centre L. It should be understood that the first plurality of links 100' may further comprise additional facets
5 that lie on a surface of additional links such that the additional facets are adjacent to facet 120'a and directly adjacent to the groove 300'a. In various embodiments, the first plurality of links 100' may further comprise additional facets that lie on a surface of additional links making up the first plurality of links 100' such that the additional facets are adjacent to facet 120'b and directly adjacent to the groove
10 300'b. In various embodiments, the first plurality of links 100' may further comprise additional facets that lie on a surface of additional links making up the first plurality of links 100' such that the additional facets are adjacent to facet 120'c and directly adjacent to the groove 300'c. Consequently, the reflected light shining on the facets 120' and additional facets would also be aligned substantially along the internal
15 track of the rope chain 1000' and in the direction S_2 when rotated about the longitudinal centre L of the rope chain 1000'. Advantageously, the presence of additional facets enhances the shiny effect (or brilliance) of the rope chain 1000'.

In various embodiments, the double helix structure 500' has substantially curved
20 peripheral surfaces. In particular, the peripheral surface 140'a, 140'b and 140'c of the first plurality of links 100' does not have a facet located on a portion of the first plurality of links 100'. In various embodiments, the peripheral surface 240'a, 240'b and 240'c of the second plurality of links 200' does not have a facet located on a portion of the second plurality of links 200'. Consequently, the peripheral surfaces
25 140'a, 140'b, 140'c, 240'a, 240'b and 240'c of the double helix structure 500' does not have a flat surface which would extend parallel to the longitudinal centre L of the rope chain 1000'. Advantageously, there would not be sharp edges that can get tarnished after prolonged wear because of abrasion on the surface of the wearer's skin, clothes and/or hair. This leads to an increased lifespan of the sparkle when
30 compared to prior art diamond cut rope chains. Consequently, the rope chain 1000' is safer than prior art diamond cut rope chains because of the absence of facets that could come into direct contact of the wearer's skin, clothes and/or hair.

In various embodiments, the second plurality of links 200' comprises one or more facets 220'a, 220'b, 220'c (collectively referred to as 220') that lie on a surface of a link making up the second plurality of links 200', such that each facet 220' is located directly adjacent to the plurality of grooves 300'. Consequently, the light shining on the facets 220' would be reflected such that the reflected light is aligned substantially along the internal track of the rope chain 1000' and in the direction S₂ when rotated about the longitudinal centre L of the rope chain 1000', such that rotation of the rope chain 1000' about its longitudinal axis would lead to a sparkling effect in a spiral manner. It should be understood that light will still be reflected such that the facets 220' give rise to a shiny effect (or brilliance) even when the rope chain 1000' is not rotated about its longitudinal centre L. It should be understood that the second plurality of links 200' may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 220'a and directly adjacent to the groove 300'a. In various embodiments, the second plurality of links 200' may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 220'b and directly adjacent to the groove 300'b. In various embodiments, the second plurality of links 200' may further comprise additional facets that lie on a surface of additional links such that the additional facets are adjacent to facet 220'c and directly adjacent to the groove 300'c. Consequently, the reflected light shining on the facets 220' and additional facets would also be aligned substantially along the internal track of the rope chain 1000' and in the direction S₂ when rotated about the longitudinal centre L of the rope chain 1000'. Advantageously, the presence of additional facets enhances the shiny effect (sparkle or brilliance) of the rope chain 1000'.

In various embodiments, the rope chain 1000' is a true spiral cut rope chain because the facets 120', 220' and additional facets faithfully follow the grooves of the rope chain 1000', such that each facet is directly adjacent to a groove. In contrast, the facets of prior art rope chains such as rope chain P1000' are formed on the outer periphery of the rope chain P1000', such that each facet is a distinct

reflecting surface aligned in a manner corresponding to one of the eight faces of an octagon (Fig. 1D and 1E).

In various embodiments, the facets 120', 220' and additional facets located directly adjacent to the grooves 300' are facing inwards and towards the longitudinal centre L of the rope chain 1000'. This advantageously leads to increased safety for the wearer and increased lifespan of the sparkle compared to prior art diamond cut rope chains. In particular, the rope chain 1000' has increased lifespan of the sparkle because it is not easy or not possible for the facets 120', 220' and additional facets to get tarnished by abrasion on the surface of the wearer's skin, clothes and/or hair. As illustrated in Fig. 4A to 4C, the facets 120'b and 220'b are located directly adjacent to the groove 300'b and facing inwards and towards the longitudinal centre L of the rope chain 1000'. In a preferred embodiment, the facets 120', 220' and additional facets are located at an angle of about 35 degrees from the longitudinal centre L of the rope chain 1000'. In another preferred embodiment and as illustrated in Fig. 4B and 4C, the shape of the facet is leaf-like.

In a preferred embodiment, each of the links making up the first plurality of links 100' and each of the links making up the second plurality of links 200' comprises a facet that lies on a surface of the link, such that each facet is located directly adjacent to the plurality of grooves 300'. As such, all the links of the rope chain 1000' is faceted, thereby enhancing the shiny effect (sparkle or brilliance) of the rope chain 1000'.

Fig. 2D illustrates a true spiral diamond cut rope chain 1000' (or spiral rope chain 1000' or rope chain 1000'), preferably with a right twist as shown. It should be understood that the embodiments of the rope chain 1000' of Fig. 2B may be present in the rope chain 1000' of Fig. 2D and vice versa. It should also be understood that equivalent or similar technical features of the rope chain 1000' of Fig. 2B have been labelled likewise in the rope chain 1000' of Fig. 2D.

In various embodiments, the size (or surface area) of the facets of the rope chain 1000' of Fig. 2D, such as facets 120', facets 220', differs from the size of the facets of the rope chain 1000' of Fig. 2B. As will be explained in various embodiments, with reference to Figs. 9A to 9H, the size of the facets can be varied by a diamond tool 2000. In various embodiments, the number of facets on the rope chain 1000' of Fig. 2D is the same as the number of facets on the rope chain 1000' of Fig. 2B.

Exemplary, non-limiting embodiments of a method of forming a diamond cut rope chain 1000' will now be disclosed.

In accordance with an embodiment, the method of forming a diamond cut rope chain comprises making a raw (or uncut) rope chain C1000' using a machine, such as an automatic chain making machine, or by hand. In a preferred embodiment, the rope chain C1000' is made using an automatic chain making machine capable of laser welding. The automatic chain making machine is capable of compressing a wire to form semi-open links, preferably C-shaped. Each link has a small gap formed so as to enable a link to pass through the gap of another link. Two links are then welded together to form a closed loop. This action is repeated by putting a link through the welded pair, and forming a new pair by welding them together again. The action is repeated and assembled to form a rope chain C1000' that can be diamond cut into a rope chain 1000'. At this stage, the rope chain C1000' is raw and has not been diamond cut yet.

The method of forming a diamond cut rope chain further comprises using a faceting structure 3000. In various embodiments and as illustrated in Figs. 6, 7B and 8, the rope chain C1000' is fed into a faceting structure 3000 comprising a motorized stage 720. As illustrated in Fig. 6, the motorized stage 720 is attached to an anvil 620 via an attachment means 600. The anvil 620 comprises a channel and a gripping mechanism so as to stabilize the rope chain C1000' during diamond cutting. Advantageously, this facilitates minimal movement of the rope chain C1000' during diamond cutting so as to ensure that it is a smooth and vibration-free cut. The motorized stage 720 further comprises a diamond cutting tool holder 550

that is mounted on the motorized stage 720, and a plurality of sensors 500 and 500' connected to the motorized stage 720 via an arm A500.

In various embodiments and as illustrated in Fig. 9A, the diamond cutting tool holder 550 comprises a motor 560 attached to a diamond cutting tool 2000 via a connecting means 555, wherein the motor 560 is capable of spinning the diamond cutting tool 2000 during diamond cutting, thereby creating a mirror surface. As used herein, the term "mirror surface" refers to a substantially smooth and reflective surface formed by diamond cutting which resembles the reflective surface of a mirror. The diamond cutting tool holder 550 may further comprise a sliding means 570, preferably an air actuated sliding means, attached to the motor 560, so that the diamond cutting tool 2000 capable of spinning in the direction W_1 , can be aligned with the rope chain C1000' (Fig. 7B). The sliding means 570 may comprise a sliding platform 565 positioned above a stationary base 567. The sliding means 570 allows the diamond cutting tool 2000 to move in the direction of arrow D via a sliding motion. The diamond cutting tool 2000 may be a single point diamond cutting tool.

In various embodiments and as illustrated in Fig. 6, the faceting structure 3000 further comprises bobbins 800 and 800' for winding of the rope chain C1000', wherein the bobbins 800 and 800' are arranged in a vertical direction such that bobbin 800 is positioned directly above bobbin 800'. As such, the faceting structure 3000 works in the vertical position i.e. along the Y-axis and Z-axis. Advantageously, the force of gravity is utilized to straighten and orientate the rope chain C1000', such that it is suitable for faceting.

In various embodiments and as illustrated in Fig. 6, the faceting structure 3000 further comprises air cylinder holders 700 and 700' comprising clamps, which are connected adjacently to bobbins 800 and 800' respectively. Movement of the rope chain C1000' is controlled by the bobbins 800 and 800' and the rope chain C1000' is held firmly in position via the clamps attached to the air cylinder holders 700 and 700'. Clamp tension is adjusted, preferably automatically, by the air cylinders (not

illustrated) attached to the air cylinder holders 700 and 700'. Air is used to open and close the air cylinders for the main purpose of gripping the rope chain C1000'.

Advantageously, the faceting structure 3000, particularly, anvil 620 and air cylinder holders 700 and 700' comprising clamps, allows the holding and mounting of the rope chain C1000' so that the rope chain C1000' is tightly held to minimize vibrations during diamond cutting (or faceting). As vibrations will cause the cut (or facet) to be blur, if the rope chain C1000' is loosely held, it may break during cutting and hit the diamond cutting tool 2000, thereby causing damage to the diamond cutting tool 2000.

- 10 The positioning of the diamond cutter 2000 to a groove of the rope chain C1000' is controlled by a plurality of sensors, preferably laser sensors, via an alignment procedure. In various embodiments and as illustrated in Fig. 6, the faceting structure 3000 further comprises sensors 500 and 500', preferably laser sensors, disposed at one end of the motorized stage 720 via the arm A500. The sensors 500 and 500' are adapted such that they move along the direction of arrow Z and are capable of providing feedback so that they advantageously assist in adjusting and aligning the position of the diamond cutting tool 2000.

- 20 In various embodiments, the plurality of sensors 500 and 500' detects and aligns the diamond cutting tool 2000 such that it is at the optimal position, position 1, which is the deepest part of a groove of the rope chain C1000'. An example of position 1 is illustrated in Fig. 8, which indicates position 1 of the groove 300'b superimposed on the rope chain 1000' (Fig. 2B). It should be understood that the groove 300'b of the rope chain 1000' is similar to groove 300'b of the rope chain C1000'.

- 25 In various embodiments, the faceting structure 3000 further comprises motors, preferably a hollow shaft motor 640 (B axis), a linear drive stepper motor 730 (Z axis) and a motor 560 that spins the diamond cutting tool 2000 (Fig. 6). The hollow shaft motor 640 is capable of driving the motorised stage 720 which is resting on pivot bearings 660 and 660', thereby resulting in the movement of the motorised

stage 720 along the B axis. The linear drive stepper motor 730 controls the up and down movement of the motorised stage 720 via a drive shaft 740 and a Z axis arm 750 attached to the hollow shaft motor 640. The pivot bearings 660 and 660' advantageously provides the stiff radial and axial support. The area indicated by the dotted lines (Fig. 6) illustrates how the diamond cutting tool holder 550 is mounted on the motorised stage 720 that is driven by the hollow shaft motor 640. In various embodiments, the Z axis arm 750 is attached to the pivot bearing 660', which supports the motorised stage 720. Consequently, when in operation, the hollow shaft motor 640 and the linear drive stepper motor 730 drive the motorised stage 720 along the B axis and Z axis, respectively. Subsequently, the motorised stage 720 comprising the anvil 620, the diamond cutting tool 2000 that is resting on the sliding means 570 of the diamond cutting tool holder 550 and the laser sensors 500 and 500' follows the rope chain C1000' in a helicoidal, spiral movement in the direction of arrow Y. The direction indicated by the arrow Y is the combination of movement in the direction indicated by the arrow B (B axis) and the direction indicated by the arrow Z (Z axis), which is controlled by the movement of the hollow shaft motor 640 in the direction of arrow B and the linear drive stepper motor 730 in the direction of arrow Z, respectively. The movement of the various motors is controlled by a programmable logic controller (PLC) with a command signal that can be transmitted to the motor. Advantageously, the diamond cutting tool 2000 is moved in the direction of arrow Y so that the diamond cutting tool 2000 is aligned to a groove of the rope chain C1000' and positioned directly below clamp 700 and in between clamp 700 and clamp 700'. Sensors 500 and 500' detects once the alignment is achieved. Once the diamond cutting tool 2000 is aligned and verified by the sensors 500 and 500', the anvil 620 which is positioned directly opposite the diamond cutting tool 2000 is activated and firmly holds the rope chain C1000'. Subsequently, the spinning diamond cutting tool 2000 is moved into position by the sliding means 570 via a sliding motion in the direction indicated by the arrow D to facet the rope chain C1000'.

As illustrated in Fig. 7B, when in operation, the diamond cutting tool 2000 spins in the direction indicated by the arrow W_1 and cuts a surface of a link that is directly

adjacent to the groove 300'b of the rope chain C1000' to form a facet 120'b (shown in Fig. 2B). In various embodiments, the depth of the facet 120'b is limited by screw stops (not illustrated) because the depth of each facet is important. Advantageously, the rotation of the diamond cutting tool 2000 is controlled and carefully coordinated to avoid over cutting or under cutting of each facet. In other words, all the facets are uniformly cut. The sliding means 570 of the diamond cutting tool holder 550 controls the in and out movement of the diamond cutting tool 2000 in the direction indicated by the arrow D. Once the diamond cutting tool 2000 goes in, it will cut the rope chain C1000'.

In various embodiments and as illustrated in Fig. 6 and Fig. 7B, the diamond cutting tool 2000 is built on a diamond cutting tool holder 550 that is capable of allowing the diamond cutting tool 2000 to follow a spiralling path (as indicated by the arrow Y) needed to complete faceting of a portion of the rope chain C1000' having a length C_L of (but not limited to) 100 mm. The spiralling path brings the diamond cutting tool 2000 upwards off the end of 100 mm (towards the direction of bobbin 800). Subsequently, the motorised stage 720 and partially faceted rope chain C1000' is lowered to a distance of 100 mm to re-start the whole process of diamond cutting.

In various embodiments, once the facet 120'b is completed, the diamond cutting tool 2000 is retracted via a sliding motion in the direction of arrow D and the anvil 620 is released. This provides the signal for activation of the linear drive stepper motor 730 and subsequent rotation in the direction of arrow B to align the diamond cutting tool 2000 for the faceting of the next link directly adjacent to the groove 300'b of the rope chain C1000'. In various embodiments and as illustrated in Fig. 8, the motorised stage 720 is lifted to the new position 2 which is superimposed on the rope chain 1000' (Fig. 2B). This causes the sensors 500 and 500' to be sensing position 2, which is not along the groove 300'b. Consequently, this error sensing gives a signal to rotate the motorised stage 720 so that the sensors 500 and 500' will be in the optimal position, position 3, and faceting can then proceed. The sequence is repeated until the motorised stage 720 has moved upwards in the direction of the arrow Z for a distance of 100 mm i.e. the length C_L .

In various embodiments, one or more of the motors may comprise a built-in encoder, wherein the built-in encoder is capable of detecting 100 mm of rope chain C1000' i.e. the length C_L . The built-in encoder is a device used to "count pulse" and verify that the signal commands given to the motor are carried out accordingly. This ability to count "signal pulse" is made use of to control accurately the 100 mm upward spiral movement in the direction of arrow Y. Once the pre-determined number of pulse count for 100 mm movement is reached, a signal is obtained for PLC to send a signal for clamps 700 and 700' to release partially faceted rope chain C1000' from bobbin 800. Simultaneously, the motorised stage 720 is also lowered by a distance of 100 mm along the Z axis, stopping exactly after 100 mm of rope chain C1000' has been released from bobbin 800 and when the encoder in the linear drive stepper motor 730 detects the 100 mm pulse count. Subsequently, the diamond cutting tool 2000 is re-aligned to the new optimal position to begin the faceting procedure. As such, once the signal is received by a PLC, the clamps at the air cylinder holders 700 and 700' is released and bobbin 800' pulls another 100 mm of the partially faceted rope chain C1000' downwards and in the direction of the arrow Z. Subsequently, the alignment procedure of the diamond cutting tool 2000 with another groove of the rope chain C1000' is repeated and the faceting procedure is repeated.

In a preferred embodiment, the method of the present invention is carefully calibrated. This is because once a groove of the rope chain C1000' is missed by a small margin of (but not limited to) 0.1 mm, an overcut on the internal track of the rope chain C1000' would be likely, thereby causing uneven cutting on one side. In other words, the shape of the facet, such as the leaf shape illustrated in Fig. 4B, would be bigger on one side and smaller on the other side of the groove 300'.

In various embodiments, when the rope chain C1000' has moved by 100 mm during faceting, the rope chain C1000' is retracted and re-spoiled onto bobbin 800. The alignment procedure is activated to begin faceting of another groove of the rope chain C1000'. The faceting and alignment procedures are repeated until the links directly adjacent to another groove is completely faceted.

In various embodiments and as illustrated in Figs. 9A to 9H, the diamond cutting tool 2000 may be a single point diamond cutter tool that comprises a diamond tip 2200 and an elongated portion 2400 connected to the diamond tip, preferably by soldering. Preferably, the elongated portion 2400 is a stiff tool shank, preferably a carbide shank, which allows the diamond of the diamond tip 2200 to be rigidly attached to an end of the elongated portion so that vibration during faceting is avoided or minimized. In various embodiments, the elongated portion 2400 comprises a protruding portion and a hole. As illustrated by the dotted lines of Fig. 9C, the hole is located approximately in the middle of the elongated portion 2400.

In a preferred embodiment, the diamond tip 2200 of the diamond cutting tool 2000 is a solid, flawless diamond that has a sharp cutting edge that is capable of forming a facet on a surface of a link of the rope chain C1000' that is directly adjacent to a groove.

The profile of the diamond cutting tool 2000 is crucial and important in determining the shine of each facet. Accordingly, the diamond tip 2200 is designed such that it follows the cutting angle and the profile of the groove of the raw rope chain. In a preferred embodiment, the diamond tip 2200 is a natural or synthetic diamond that is sharpened or adapted to a particular desired profile by mechanical grinding and optionally but preferably, polishing. As illustrated in Fig. 9D, the diamond tip 2200 has an angle α that is in the range of about 90° to about 100° .

In various embodiments, the size (or surface area) of each facet of the rope chain can be varied by the diamond tool 2000 because the size of each facet differs when a diamond tip 2200 having a different tip angle α is used. For example, if the diamond tip angle is α_1 , wherein α_1 is 90° , each facet, such as facet 120, that is formed will be relatively smaller and slimmer in size because the profile of the diamond cutting tool 2000 is sharp and pointed (Figure 9E). This can lead to the formation of a rope chain (1000 or 1000') such as that illustrated in Figs. 2A and 2B. In contrast, if the diamond tip 2200 angle is α_2 , wherein α_2 is 100° , more material (or portion of the rope chain) will be cut away during faceting, thereby resulting in the formation of facets having a relatively larger size because the profile of the diamond cutting tool 2000 is less sharp (Figure 9F). As such, the diamond

cutting tool 2000 can cover a larger surface area and each facet, such as facet 120, that is formed will be relatively larger in size. For comparison purposes, the outline of the facet formed by the diamond tip 2200 having the angle α_1 is superimposed on Fig. 9F via dotted lines, which clearly illustrates that the facet 120 formed is larger in size when the diamond tool 2000 comprising the diamond tip 2200 having the angle α_2 is used. In various embodiments, the use of the diamond tool 2000 comprising the diamond tip 2200 having the angle α_2 can lead to the formation of a rope chain (1000 or 1000') such as that illustrated in Figs. 2C and 2D.

In various embodiments, the cutting depth using the diamond tip 2200 having an angle α_1 or an angle α_2 is the same i.e. remains constant. This is because if the cut is too deep, the rope chain will break. Conversely, if the cut is too shallow, there will not be enough sparkle. In various embodiments, the depth of the facet is limited by screw stops (not illustrated) because the depth of each facet is important to achieve balance between brightness of the resulting facet and strength of the rope chain. Advantageously, the rotation of the diamond cutting tool 2000 is controlled and carefully coordinated to avoid over cutting or under cutting of each facet. In other words, all the facets are uniformly cut.

In another preferred embodiment, the diamond tip 2200 has a width of about 3 mm to about 5 mm. When a rope chain having a bigger diameter is cut, the width of the diamond tip 2200 is preferably bigger, such as 5 mm. The rope chain having a bigger diameter may have a diameter of about wire size 0.85 mm to about 1.2 mm. When a rope chain having a smaller diameter is cut, the width of the diamond tip 2200 is preferably smaller, such as 3 mm. The rope chain having a smaller diameter may have a diameter of about wire size 0.3 mm to about 0.8 mm. Consequently, the diamond cutting tool 2000 can advantageously create a shiny surface on the internal track of the rope chain C1000' to form a diamond cut rope chain 1000' having a spiralling shiny effect.

It should be understood that a rope chain C1000 having a left twist can be used in place of the rope chain C1000'. As illustrated in Fig. 7A, the rope chain C1000 can be placed on the anvil 620 so that a diamond cutting tool 2000 can be aligned with

the rope chain C1000. In various embodiments, when in operation, the diamond cutting tool 2000 spins in the direction indicated by the arrow W_1 and cuts a surface of a link that is directly adjacent to the groove 300b of the rope chain C1000 to form a facet. Accordingly, the aligning and faceting procedure outlined above can be
5 similarly applied to the rope chain C1000 to form a diamond cut rope chain 1000.

Exemplary, non-limiting embodiments of a faceting structure 3000 for creating at least one facet on a plurality of links for forming a diamond cut rope chain 1000 will now be disclosed. Advantageously, the faceting structure 3000 creates facets
10 located directly adjacent to the plurality of grooves 300 of the diamond cut rope chain 1000, preferably in a uniform manner.

In various embodiments, the faceting structure 3000 comprises two bobbins 800 and 800' arranged in a vertical direction such that bobbin 800 is positioned directly
15 above bobbin 800'. The faceting structure 3000 further comprises air cylinder holders 700 and 700' comprising clamps, wherein the air cylinder holders are connected adjacently to the bobbins 800 and 800'.

In various embodiments, the faceting structure 3000 further comprises a diamond
20 cutting tool holder 550 comprising a single point diamond cutting tool 2000. Preferably, the single point diamond tool 2000 comprises a diamond tip 2200 and a carbide shank 2400 attached to the diamond tip 2200. The diamond cutting tool holder 550 may further comprise a sliding means 570, preferably an air actuated sliding means, attached to a motor 560. The sliding means 570 of the diamond
25 cutting tool holder 550 controls the in and out movement of the diamond cutting tool 2000 in the direction indicated by the arrow D. The motor 560 is capable of spinning the diamond cutting tool 2000 during diamond cutting, thereby creating a mirror surface.

30 In various embodiments, the faceting structure 3000 further comprises sensors 500 and 500' disposed at one end of the faceting structure 3000, wherein the sensors 500 and 500' are capable of positioning the single point diamond cutting tool 2000.

The faceting structure 3000 further comprises a motor capable of rotating the single point diamond cutting tool 2000.

5 It will be apparent that various other modifications and adaptations of the invention will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the invention. It is intended that all such modifications and adaptations come within the scope of the appended claims.

Further, it is to be appreciated that features from various embodiment(s), may be combined to form one or more additional embodiments.

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Claims

1. A rope chain comprising:

5 a double helix structure comprising a first plurality of links intertwined with a second plurality of links to form a plurality of grooves;
wherein the first plurality of links comprises at least one facet; and
wherein each facet is located directly adjacent to the plurality of grooves.

2. The rope chain according to claim 1, wherein the double helix structure
10 has a substantially curved peripheral surface.

3. The rope chain according to claim 2, wherein the substantially curved
peripheral surface comprises a portion of the first plurality of links that does
not have a facet and a portion of the second plurality of links that does not
have a facet.

4. The rope chain according to any one of the preceding claims, wherein the
15 second plurality of links comprises at least one facet, and wherein each facet
is located directly adjacent to the plurality of grooves.

5. The rope chain according to claim 4, wherein the at least one facet on the
20 first plurality of links are on a different plane from the at least one facet on
the second plurality of links.

6. The rope chain according to claim 4 or 5, wherein the at least one facet on
the first plurality of links and the at least one facet on the second plurality of
links are facing inwards and towards a longitudinal centre of the rope chain.

25 7. The rope chain according to claim 6, wherein the at least one facet on the
first plurality of links and the at least one facet on the second plurality of links
are at an angle of about 35 degrees from the longitudinal centre of the rope
chain.

8. The rope chain according to any one of the preceding claims, wherein the at least one facet on the first plurality of links and the at least one facet on the second plurality of links is shaped like a leaf.
- 5 9. The rope chain according to any one of the preceding claims, wherein the first plurality of links is made up of a hollow wire or a solid wire.
10. The rope chain according to claim 9, wherein the second plurality of links is made up of a hollow wire or a solid wire.
- 10 11. The rope chain according to any one of the preceding claims, wherein the first plurality of links and the second plurality of links have a substantially circular cross-section.
12. The rope chain according to any one of the preceding claims, wherein each facet directly adjacent to the plurality of grooves has a uniform surface area.
- 15 13. The rope chain according to any one of the preceding claims, further comprising an engaging means capable of attaching a first end of the double helix structure to a second end of the double helix structure.
14. The rope chain according to claim 13, wherein the engaging means is a clasp.
15. A method of manufacturing a rope chain, comprising:
- 20 providing a double helix structure comprising a first plurality of links intertwined with a second plurality of links to form a plurality of grooves;
- creating at least one facet on the first plurality of links;
- wherein each facet is located directly adjacent to the plurality of grooves.

16. The method of claim 15, further comprising creating at least one facet on the second plurality of links, wherein each facet is located directly adjacent to the plurality of grooves.
- 5 17. The method of claim 15 or 16, wherein the step of creating the at least one facet on the first plurality of links and/or the second plurality of links makes use of a faceting structure capable of holding and mounting the rope chain.
18. A faceting structure for creating at least one facet on a plurality of links, wherein the faceting structure is capable of being used in a method of claim 17.
- 10 19. The faceting structure of claim 18, wherein the faceting structure comprises two bobbins arranged in a vertical direction such that one bobbin is positioned directly above the other bobbin.
- 15 20. The faceting structure of claim 19, wherein the faceting structure further comprises air cylinder holders comprising clamps, wherein the air cylinder holders are connected adjacently to the bobbins.
21. The faceting structure of any one of claims 18 to 21, wherein the faceting structure further comprises a diamond cutting tool holder comprising a single point diamond cutting tool.
- 20 22. The faceting structure of claim 21, wherein the single point diamond tool comprises a diamond tip and a carbide shank attached to the diamond tip.
23. The faceting structure of claim 21, wherein the diamond cutting tool holder further comprises a sliding means capable of controlling the movement of the single point diamond cutting tool.
- 25 24. The faceting structure of any one of claims 21 to 23, wherein the faceting structure further comprises sensors disposed at one end of the faceting structure, wherein the sensors are capable of positioning the single point diamond cutting tool.

25. The faceting structure of any one of claims 21 to 24, wherein the faceting structure further comprises at least one or more motors, wherein the at least one or more motors is selected from the group comprising of a hollow shaft motor, a linear drive stepper motor and a motor capable of rotating the single point diamond cutting tool.
26. The faceting structure of claim 25, wherein each motor comprises a built-in encoder capable of detecting a length of a rope chain.
27. The faceting structure of any one of claims 21 to 26, wherein the faceting structure further comprises a motorized stage, wherein the diamond cutting tool holder is mounted on the motorized stage.
28. The faceting structure of claim 27, wherein the sensors are connected to the motorized stage via an arm.