(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 012 369 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.04.2016 Bulletin 2016/17

(21) Application number: **13887418.5**

(22) Date of filing: **20.06.2013**

(51) Int Cl.:
D07B 5/00 *(2006.01)* ***D07B 1/00*** *(2006.01)*

(86) International application number:
PCT/CN2013/077546

(87) International publication number:
WO 2014/201653 (24.12.2014 Gazette 2014/52)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(54) HIGH-STRENGTH RIGGING AND PREPARATION METHOD THEREOF

(57) The invention provides a high-strength rope and a preparation method thereof The method at least comprises the following step: preparing a body of the high-strength rope from an ultra-high molecular weight polyethylene thin film or strip. The high-strength rope at least comprises the body prepared from the ultra-high molecular weight polyethylene thin film or strip. The invention replaces traditional ultra-high molecular weight polyethylene fibers with the UHMW-PE thin film or strip to prepare the rope, and the obtained rope has one or more of the advantages of good structural integrity, simple preparation process, high production efficiency, high strength, high strength utilization ratio, light weight, good flexibility, environmental friendliness and the like.

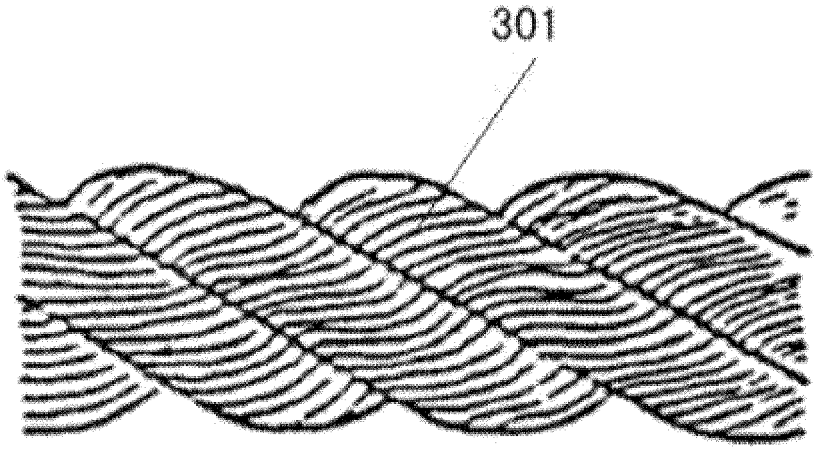


Fig. 4

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Description

Field of the Invention

[0001] The invention relates to the field of application of polymer materials and particularly relates to a high-strength rope and a preparation method thereof.

Background of the Invention

[0002] Ultra-high molecular weight polyethylene (UHMW-PE for short) is a thermoplastic engineering plastic with a linear structure and excellent comprehensive performances, and one of important uses of the material is to prepare a high-strength fiber on the basis of the material.

[0003] An ultra-high molecular weight polyethylene (UHMW-PE) fiber is a high-performance fiber, has the advantages of high strength, wear resistance, impact resistance, corrosion resistance, UV resistance and the like and is widely applied to preparation of hoisting ropes, hawsers, force-bearing ropes, heavy-duty ropes, salvaging ropes, drag ropes, sailboat ropes, fishing lines, mooring anchor ropes for ocean operation platforms and other various ropes. The breaking length of the rope prepared on the basis of ultra-high molecular weight polyethylene fibers under dead weight is about 8 times of that of a steel wire rope and is about 2 times of that of an aramid fiber rope, thereby having excellent performances.

[0004] The rope based on the ultra-high molecular weight polyethylene fibers is generally prepared by twisting, weaving or converging through an outer sleeve N ultra-high molecular weight polyethylene fiber. As the ultra-high molecular weight polyethylene fiber has a silk-like structure (the fiber number of the single yarn is about 2.5 deniers), so that in the process of preparing the various ropes based on the ultra-high molecular weight polyethylene fiber, multiple fibers with the silk-like structures need to be finished respectively, the process is complex, and the cost is high; and furthermore, in the preparation process of the product, the surfaces of the fibers are liable to production of burrs due to friction, and the fibers are liable to breaking, distortion, intertwining and other phenomena, thereby being not conductive to realizing integral uniform stress of the multiple fibers, resulting in that the integral strength of the prepared rope is often lower than the sum of the strength of N ultra-high molecular weight polyethylene fibers, and the strength utilization ratio is relatively low.

Summary of the Invention

[0005] A brief summary of the invention is given below to facilitate the basic understanding of some aspects of the invention. It should be understood that the summary is not an exhaustive summary of the invention. It is not intended to determine key or important parts of the invention or limit the scope of the invention. It only aims at presenting some concepts in a simplified form as a prelude to the more detailed description which will be discussed later.

[0006] The invention provides a high-strength rope with simple process and relatively low cost and a preparation method thereof.

[0007] The invention provides a preparation method of a high-strength rope, at least comprising the following step: preparing a body of the high-strength rope from an ultra-high molecular weight polyethylene thin film or strip.

[0008] Optionally, preparing the body from the ultra-high molecular weight polyethylene thin film or strip comprises: converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip into a single yarn to obtain the body

[0009] Optionally, preparing the body from the ultra-high molecular weight polyethylene thin film or strip comprises: integrally arranging multiple single yarns to form the body, wherein each single yarn is prepared by converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

[0010] Optionally, integrally arranging the multiple single yarns comprises: converging, twisting or weaving the multiple single yarns into a whole.

[0011] Optionally, the body is prepared by plying multiple yarn strands, wherein each yarn strand comprises multiple single yarns, and each single yarn is prepared by converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

[0012] Optionally, all the single yarns in each yarn strand are converged, twisted or woven into a whole.

[0013] Optionally, plying the multiple yarn strands comprises: converging, twisting or weaving the multiple yarn strands into a whole.

[0014] Optionally, the ultra-high molecular weight polyethylene thin film or strip is converged along the straightening direction of a molecular chain thereof.

[0015] Optionally, the single yarn is converged along the straightening direction of a molecular chain of the ultra-high molecular weight polyethylene thin film or strip.

[0016] Optionally, the yarn strands are converged along the straightening direction of a molecular chain of the ultra-high molecular weight polyethylene thin film or strip.

[0017] Optionally, the related parameters of the ultra-high molecular weight polyethylene thin film at least meet one or more of the following conditions:

the linear density is above 5000 deniers;
the width is above 100 mm;
the thickness is below 0.2 mm;
the breaking strength is above 10 grams/denier;
the tensile modulus is above 800 grams/denier; and
the elongation at break is below 6%.

[0018] Optionally, the related parameters of the ultra-high molecular weight polyethylene strip at least meet one or more of the following conditions:

the linear density is above 100 deniers;
the width is 1-100 mm;
the thickness is below 0.2 mm;
the breaking strength is above 10 grams/denier;
the tensile modulus is above 800 grams/denier; and
the elongation at break is below 6%.

[0019] The invention further provides a high-strength rope, prepared by adopting the preparation method of the high-strength rope.

[0020] The body of the high-strength rope provided in each embodiment of the invention is prepared on the basis of the ultra-high molecular weight polyethylene thin film or strip. In the preparation process of the body, the ultra-high molecular weight polyethylene thin film or strip is treated as a whole, thereby having good structural integrity, being simple in preparation process, eliminating a complex process for respectively finishing multiple fiber silks, obviously reducing the probability of producing burrs on the surface of the thin film or strip and also obviously reducing the probability of breaking, distortion, intertwining and other phenomena in the thin film or strip. When the rope including the body bears a load, the ultra-high molecular weight polyethylene thin film or strip is stressed as a whole, so that the strength of the rope is relatively high and the strength utilization ratio is effectively improved. Thus, the strength of the rope prepared on the basis of the ultra-high molecular weight polyethylene thin film or strip is higher than that of a product prepared by adopting the ultra-high molecular weight polyethylene fiber with the same denier number, the cost of the former is obviously lower than that of the latter, and the rope has the advantages of good structural integrity, high strength, high strength utilization ratio, high production efficiency, low processing cost, light weight, small surface density, good flexibility and the like.

[0021] These and other advantages of the invention will be more evident through the following detailed description of optional embodiments of the invention in conjunction with the accompanying drawings.

Brief Description of the Drawings

[0022] The invention can be better understood through the following description given below in conjunction with the accompanying drawings, in which same or similar reference symbols are used throughout the drawings to represent same or similar parts. The accompanying drawings, together with the detailed description below, are included in the specification and form part of the specification, and are used for further illustrating the optional embodiments of the invention by way of examples and explaining the principle and advantages of the invention. In the drawings:

Fig. 1 is a structural schematic diagram of an embodiment of an ultra-high molecular weight polyethylene thin film in a high-strength rope provided by the invention.

Fig. 2 is a structural schematic diagram of an embodiment of an ultra-high molecular weight polyethylene strip in the high-strength rope provided by the invention.

Fig. 3 is a flow diagram of an embodiment of a preparation method of the high-strength rope provided by the invention.

Fig. 4 is a structural schematic diagram of an embodiment of the high-strength rope provided by the invention.

Fig. 5 is a structural schematic diagram of a second embodiment of the high-strength rope provided by the invention.

Fig. 6 is a structural schematic diagram of a third embodiment of the high-strength rope provided by the invention.

[0023] Those skilled in the art should understand that elements in the accompanying drawings are only illustrated for simplicity and clarity, and are not necessarily drawn to scale. For example, the sizes of some elements in the accompanying drawings may be exaggerated relative to other elements so as to assist in improvement of the understanding of the embodiments of the invention.

Detailed Description of the Embodiments

[0024] The exemplary embodiments of the invention will be described in detail below in conjunction with the accompanying drawings. For clarity and brevity, not all the characteristics of the actual implementation ways are described in the description.

[0025] However, it should be understood that, in the process of developing any of these actual embodiments, many decisions which are specific to the implementation ways must be made to facilitate achieving specific objectives of development persons, such as meeting those system and business related limitation conditions, and these limitation conditions may vary between different implementation ways. In addition, it should also be understood that, although the development work may be very complex and time-consuming, such development work is just a routine task for those skilled in the art benefiting from the disclosure of the invention.

[0026] Here, it still needs to be noted that, in order to prevent unnecessary details from obscuring the invention, only the device structure and/or the treatment steps which are closely related to the solutions of the invention are described in the accompanying drawings and the description, and the expressions and the descriptions of the parts and the treatments which are not closely related to the invention and are known to those of ordinary skill in the art are omitted.

[0027] Ultra-high molecular weight polyethylene is polyethylene with molecular weight of above 1 million. The traditional technologies of ultra-high molecular weight polyethylene application take ultra-high molecular weight

polyethylene fibers as the basis to prepare various products. The technical solutions provided by the various embodiments of the invention are essentially different from the traditional technologies of ultra-high molecular weight polyethylene application and are revolutionary innovations against the traditional technologies, and the core concept mainly comprises: the various ropes are prepared by using the ultra-high molecular weight polyethylene thin film or strip to replace the traditional ultra-high molecular weight polyethylene fibers.

[0028] In this case, as shown in Fig. 1, the ultra-high molecular weight polyethylene thin film is a thin slice which is prepared from ultra-high molecular weight polyethylene and has a certain width and thickness, wherein the width is much greater than the thickness. As shown in Fig. 2, the strip is a strip-like thin slice which can be prepared independently or be formed by performing slitting process step before and after stretching the thin film, wherein the width of the strip is less than the width of the thin film, and the thickness thereof is equivalent to that of the thin film or greater than the thickness of the thin film.

[0029] The ultra-high molecular weight polyethylene thin film or strip provided by the invention is different from the ultra-high molecular weight polyethylene fibers and also different from a plane formed by bonding multiple ultra-high molecular weight polyethylene fibers, and the significant difference is that the ultra-high molecular weight polyethylene thin film or strip provided by the invention has a certain width and thickness and has an integral structure without integration points or trim lines.

[0030] The body of the high-strength rope provided in each embodiment of the invention is prepared on the basis of the ultra-high molecular weight polyethylene thin film or strip. In the preparation process of the body, the ultra-high molecular weight polyethylene thin film or strip is treated as a whole, thereby having good structural integrity, being simple in preparation process, eliminating a complex process for respectively finishing multiple fiber silks, obviously reducing the probability of producing burrs on the surface of the thin film or strip and also obviously reducing the probability of breaking, distortion, intertwining and other phenomena in the thin film or strip. When the rope including the body bears a load, the ultra-high molecular weight polyethylene thin film or strip is stressed as a whole, so that the strength of the rope is relatively high and the strength utilization ratio is effectively improved. Thus, the strength of the rope prepared on the basis of the ultra-high molecular weight polyethylene thin film or strip is higher than that of a product prepared by adopting the ultra-high molecular weight polyethylene fiber with the same denier number, the cost of the former is obviously lower than the latter, and the rope has the advantages of good structural integrity, high strength, high strength utilization ratio, high production efficiency, low processing cost, light weight, small surface density, good flexibility and the like.

[0031] The technical solutions of the invention are further described below by taking the optional structures of the rope and the preparation method thereof as examples in conjunction with the accompanying drawings.

Embodiment 1

[0032] As shown in Fig. 3, the embodiment provides a preparation method of a high-strength rope, at least comprising the following step:

step S101: preparing a body of the high-strength rope from an ultra-high molecular weight polyethylene thin film or strip.

[0033] In addition to the body, the high-strength rope provided in each embodiment of the invention may comprises a sheath and other structures, and the body is a main part for bearing force.

[0034] Preparing the body of the high-strength rope from the ultra-high molecular weight polyethylene thin film or strip specifically comprises: converging the ultra-high molecular weight polyethylene thin film or strip to prepare a single yarn and using the prepared single yarns to replace traditional ultra-high molecular weight polyethylene fibers to prepare the rope, for example, various wires, ropes, strips and the like.

[0035] In addition, the ultra-high molecular weight polyethylene thin film or strip can also be used for directly replacing the traditional ultra-high molecular weight polyethylene fibers to prepare the rope, for example, multiple ultra-high molecular weight polyethylene strips are laminated to obtain a strip-like rope.

[0036] The related parameters of the ultra-high molecular weight polyethylene thin film in each embodiment of the invention at least meet one or more of the following conditions: the linear density is above 5000 deniers; the width is above 100 mm; the thickness is below 0.2 mm; the breaking strength is above 10 grams/denier; the tensile modulus is above 800 grams/denier; and the elongation at break is below 6%. By preparing the rope on the basis of the ultra-high molecular weight polyethylene thin film with one or more of the properties described above, the rope has higher integral strength and can meet the preparation requirements of high-strength load, bulletproof and other products.

[0037] The related parameters of the ultra-high molecular weight polyethylene strip provided in each embodiment of the invention at least meet one or more of the following conditions: the linear density is above 100 deniers; the width is 1-100 mm; the thickness is below 0.2 mm; the breaking strength is above 10 grams/denier; the tensile modulus is above 800 grams/denier; and the elongation at break is below 6%. By preparing the rope on the basis of the ultra-high molecular weight polyethylene strip with one or more of the properties described above, the rope has higher integral strength and can meet the preparation requirements of high-strength load, bulletproof and other products.

[0038] According to the high-strength rope in the em-

bodiment, the ultra-high molecular weight polyethylene thin film or strip is adopted to prepare the body, and the ultra-high molecular weight polyethylene thin film or strip has an integral structure without integration points or trim lines and is different from the silk-like structure of the ultra-high molecular weight polyethylene fiber in the prior art, so that in the preparation process of the rope, the ultra-high molecular weight polyethylene thin film or strip is treated as a whole, a complex process for respectively finishing multiple fiber silks is eliminated, and the probability of breaking, distortion, intertwining and other phenomena in the thin film or strip is obviously reduced.

[0039] When the rope prepared on the basis of the ultra-high molecular weight polyethylene thin film or strip bears a load, the ultra-high molecular weight polyethylene thin film or strip is stressed as a whole, so that the strength of the rope is relatively high and the strength utilization ratio is effectively improved. Thus, the strength of the rope adopting the ultra-high molecular weight polyethylene thin film or strip is higher than that of the rope prepared by adopting the ultra-high molecular weight polyethylene fiber with the same denier number, and the cost of the former is obviously lower than the latter.

Embodiment 2

[0040] The embodiment provides a preparation method of a high-strength rope, comprising the step of converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip into a single yarn to obtain a body.

[0041] The body of the high-strength rope in the embodiment is the single yarn formed by converging the ultra-high molecular weight polyethylene thin film or strip, or the single yarn formed by converging and twisting the ultra-high molecular weight polyethylene thin film or strip, thereby having a linear structure.

[0042] The ultra-high molecular weight polyethylene thin film or strip is converged along the straightening direction of a molecular chain thereof.

[0043] Preparing the body by converging the ultra-high molecular weight polyethylene thin film or strip specifically comprises: placing the ultra-high molecular weight polyethylene thin film or strip on a reeling and unreeling device for converging to obtain the single yarn, as the stress direction of the ultra-high molecular weight polyethylene thin film or strip is along the straightening direction of the molecular chain when it bears a load, the strength utilization ratio can be improved to the greatest extent.

[0044] The method for preparing the body by converging and twisting the ultra-high molecular weight polyethylene thin film or strip comprises: placing the ultra-high molecular weight polyethylene thin film or strip on the reeling and unreeling device for converging, and then placing the converged ultra-high molecular weight polyethylene thin film or strip on a double-twisting machine for twisting, wherein the twist is 1-50, the twisting direction is left twisting or right twisting, and the single yarn obtained by converging and twisting has an appropriate thickness and a high cohesion, can effectively prevent the body from fluffing due to friction and thus is more wear-resistant.

[0045] The single yarn prepared by converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip can be applied to preparation of fishing lines, deep water net cages, net pieces, drag nets and the like.

Embodiment 3

[0046] The embodiment provides a preparation method of a high-strength rope, comprising integrally arranging multiple single yarns to form the body, wherein each single yarn is prepared by converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

[0047] The high-strength rope in the embodiment at least comprises the body prepared by the ultra-high molecular weight polyethylene thin film or strip, the body comprises multiple single yarns, each single yarn is prepared by converging the ultra-high molecular weight polyethylene thin film or strip, or each single yarn is prepared by converging and twisting the ultra-high molecular weight polyethylene thin film or strip, and the high-strength rope in the embodiment has a rope-like structure.

[0048] Each single yarn is converted along the straightening direction of a molecular chain of the ultra-high molecular weight polyethylene thin film or strip.

[0049] Using the multiple single yarns, the body with a higher strength can be obtained.

[0050] Optionally, the multiple single yarns are converged into a whole, specifically comprising: placing the multiple single yarns on a reeling and unreeling device for converging, and the body prepared in this way can be applied to electric traction ropes, optical cable reinforcing cores and the like.

[0051] Optionally, the multiple single yarns are twisted into a whole, and the method comprises: placing the multiple single yarns on a double-twisting machine for twisting, wherein the twist is 1-50, one part of the multiple single yarns is twisted in a left twisting direction, and the other part is twisted in a right twisting direction, it is also possible for all the multiple single yarns to be twisted in a left twisting or right twisting direction, and the body prepared in this way has a high strength and strong wear resistance, and can be applied to net pieces, deep water net cages, ocean-going drag nets, brake ropes, airfreight nets, guide ropes of helicopters, suspension ropes on deceleration parachutes and aircrafts, electric traction ropes and the like.

[0052] Optionally, the multiple single yarns are woven into a whole, and the method comprises: placing the multiple single yarns on a weaving machine for weaving into a rope, wherein the number of the single yarns can be

set according to need, and the body prepared in this way can be applied to guide ropes of helicopters, suspension ropes on deceleration parachutes and aircrafts, electric traction ropes, ship mooring ropes, cable ropes, anchoring ropes, tank drag ropes, mooring anchoring ropes, crashproof poles, cable reinforcing cores and the like.

Embodiment 4

[0053] The embodiment provides a preparation method of a high-strength rope, comprising: plying multiple yarn strands to obtain a body, wherein each yarn strand comprises multiple single yarns, and each single yarn is prepared by converging or converging and twisting an ultra-high molecular weight polyethylene thin film or strip.

[0054] The body of the high-strength rope in the embodiment is formed by plying the multiple yarn strands, wherein each yarn strand comprises multiple single yarns, each single yarn is prepared by converging the ultra-high molecular weight polyethylene thin film or strip, or each single yarn is prepared by converging and twisting the ultra-high molecular weight polyethylene thin film or strip; and the body of the high-strength rope in the embodiment has a rope-like structure.

[0055] Optionally, the multiple single yarns included in each yarn strand are converged into a whole, and the yarn strands prepared in this way can be applied to electric traction ropes, cable reinforcing cores and the like.

[0056] Optionally, the multiple single yarns included in each yarn strand are twisted into a whole, and the yarn strands prepared in this way can be applied to net pieces, deep water net cages, ocean-going drag nets, brake ropes, airfreight nets, guide ropes of helicopters, suspension ropes on deceleration parachutes and aircrafts, electric traction ropes and the like.

[0057] Optionally, the multiple single yarns included in each yarn strand are woven into a whole, and the yarn strands prepared in this way can be applied to guide ropes of helicopters, suspension ropes on deceleration parachutes and aircrafts, electric traction ropes, ship mooring ropes, cable ropes, anchoring ropes, tank drag ropes, mooring anchoring ropes, crashproof poles, cable reinforcing cores and the like.

[0058] Optionally, the multiple yarn strands are converged into a whole, and the method specifically comprises: placing the multiple yarn strands on a reeling and unreeling device for converging, wherein the multiple yarn strands are converged along the straightening direction of a molecular chain of the ultra-high molecular weight polyethylene thin film or strip, and the body prepared in this way can be applied to electric traction ropes, crashproof poles and optical cable reinforcing cores.

[0059] Optionally, as shown in Fig. 4, the multiple single yarns 301 are twisted into a whole, and the method specifically comprises: placing the multiple single yarns on a double-twisting machine for twisting, wherein one part of the multiple single yarns is twisted in a left twisting direction, and the other part is twisted in a right twisting direction, or it is also possible for all the multiple single yarns to be twisted in a left twisting or right twisting direction, and the body prepared in this way can be applied to net pieces, deep water net cages, ocean-going drag nets, brake ropes, airfreight nets, guide ropes of helicopters, suspension ropes on deceleration parachutes and aircrafts, electric traction ropes and the like.

[0060] Optionally, as shown in Fig. 5, the multiple single yarns 401 are woven into a whole, and the method specifically comprises: placing the multiple single yarns on a weaving machine for weaving, wherein the number of the single yarns can be set according to need, and the body prepared in this way can be applied to guide ropes of helicopters, suspension ropes on deceleration parachutes and aircrafts, electric traction ropes, ship mooring ropes, cable ropes, anchoring ropes, tank drag ropes, mooring anchoring ropes, crashproof poles, cable reinforcing cores and the like.

[0061] After testing, when the body prepared from the ultra-high molecular weight polyethylene thin film or strip has a diameter of about 10 mm, the breaking load (the load at break) can be above 8.5 tons, the production cost is low, and in addition, the body has the advantages of light weight, corrosion resistance, wear resistance, ultraviolet resistance, long service life, portability and the like.

Embodiment 5

[0062] The embodiment provides a high-strength rope, which at least comprises a body prepared from an ultra-high molecular weight polyethylene thin film or strip, the body comprises multiple single yarns, each single yarn is prepared by converging the ultra-high molecular weight polyethylene thin film or strip, or each single yarn is prepared by converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

[0063] Optionally, as shown in Fig. 6, a hoisting strip comprises a sheath 501 and a bearing core 502, the body is the bearing core of the hoisting strip, the body has a strip-like structure, the multiple single yarns are woven into a whole to obtain the body, and the method comprises: placing the multiple single yarns on a weaving machine for weaving, and the number of the single yarns can be set according to need.

[0064] When the hoisting strip prepared from the ultra-high molecular weight polyethylene thin film or strip bears the load, the ultra-high molecular weight polyethylene thin film or strip is stressed as a whole, so that the strength of the hoisting strip is relatively high, and the strength utilization ratio is effectively improved. Thus, the strength of the hoisting strip prepared from the ultra-high molecular weight polyethylene thin film or strip is much higher than that of the hoisting strip prepared from ultra-high molecular weight polyethylene fibers with the same denier number, and the cost of the former is obviously lower than the latter.

Embodiment 6

[0065] The embodiment provides a high-strength rope, which at least comprises a body prepared from an ultra-high molecular weight polyethylene thin film or strip, the body comprises multiple yarn strands, each yarn strand comprises multiple single yarns, each single yarn is prepared by converging an ultra-high molecular weight polyethylene thin film or strip, or each single yarn is prepared by converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

[0066] As an optional implementation way, the body is a bearing core of a hoisting strip, and the body has a strip-like structure.

[0067] Optionally, the multiple single yarns included in each yarn strand are converged into a whole.

[0068] Optionally, the multiple single yarns included in each yarn strand are twisted into a whole.

[0069] Optionally, the multiple single yarns included in each yarn strand are woven into a whole.

[0070] Optionally, the multiple yarn strands are woven into a whole to obtain the body, and the method specifically comprises: placing the multiple yarn strands on a weaving machine for weaving, and the number of the yarn strands can be set according to actual requirements.

[0071] When the hoisting strip prepared from the ultra-high molecular weight polyethylene thin film or strip bears the load, the ultra-high molecular weight polyethylene thin film or strip is stressed as a whole, so that the strength of the hoisting strip is relatively high, and the strength utilization ratio is effectively improved. Thus, the strength of the hoisting strip prepared from the ultra-high molecular weight polyethylene thin film or strip is much higher than that of the hoisting strip prepared from ultra-high molecular weight polyethylene fibers with the same denier number, and the cost of the former is obviously lower than the latter.

[0072] Although the invention and the advantages thereof have been described in detail, it should be understood that various changes, substitutions and modifications can be made without exceeding the spirit and the scope of the invention defined by the appended claims.

[0073] Finally, it need to be noted that the relation terms, such as first, second and the like herein are only used to differentiate one entity or operation from another entity or operation, and do not necessarily require or imply that these entities or operations have any actual relation or sequence. Furthermore, terms 'including', 'comprising' or any other variations thereof are intended to cover non-exclusive inclusion, so that a process, method, article or equipment including a series of elements comprises not only those elements, but also other elements which are not listed clearly, or further comprise inherent elements of the process, method, article or equipment. Without more limitations, an element limited by the wording 'including one...' does not exclude that the process, method, article or equipment including the element further has other identical elements.

[0074] Although the embodiments of the invention have been described in detail in conjunction with the accompanying drawings, it should be understood that the implementation ways described above are only used for describing the invention rather than limiting the invention. For those skilled in the art, various modifications and changes can be made to the above implementation ways without deviating from the spirit and the scope of the invention. Thus, the scope of the invention is only defined by the appended claims and equivalents thereof.

Claims

1. A preparation method of a high-strength rope, at least comprising the following step: preparing a body of the high-strength rope from an ultra-high molecular weight polyethylene thin film or strip.

2. The preparation method of the high-strength rope according to claim 1, **characterized in that** preparing the body from the ultra-high molecular weight polyethylene thin film or strip comprises:

   converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip into a single yarn to obtain the body.

3. The preparation method of the high-strength rope according to claim 1, **characterized in that** preparing the body from the ultra-high molecular weight polyethylene thin film or strip comprises:

   integrally arranging multiple single yarns to form the body, wherein each single yarn is prepared by converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

4. The preparation method of the high-strength rope according to claim 1, **characterized in that** integrally arranging the multiple single yarns comprises: converging, twisting or weaving the multiple single yarns into a whole.

5. The preparation method of the high-strength rope according to claim 1, **characterized in that**
   the body is prepared by plying multiple yarn strands, wherein each yarn strand comprises multiple single yarns, and each single yarn is prepared by converging or converging and twisting the ultra-high molecular weight polyethylene thin film or strip.

6. The preparation method of the high-strength rope according to claim 5, **characterized in that** all the single yarns in each yarn strand are converged, twisted or woven into a whole.

7. The preparation method of the high-strength rope according to claim 6, **characterized in that** plying the multiple yarn strands comprises: converging, twisting or weaving the multiple yarn strands into a whole.

8. The preparation method of the high-strength rope according to any of claims 1-6, **characterized in that** the ultra-high molecular weight polyethylene thin film or strip is converged along the straightening direction of a molecular chain thereof.

9. The preparation method of the high-strength rope according to claim 4 or 6, **characterized in that** the single yarn is converged along the straightening direction of a molecular chain of the ultra-high molecular weight polyethylene thin film or strip.

10. The preparation method of the high-strength rope according to claim 7, **characterized in that** the yarn strands are converged along the straightening direction of a molecular chain of the ultra-high molecular weight polyethylene thin film or strip.

11. The preparation method of the high-strength rope according to any of claims 1-7, **characterized in that** the related parameters of the ultra-high molecular weight polyethylene thin film at least meet one or more of the following conditions:

the linear density is above 5000 deniers;
the width is above 100 mm;
the thickness is below 0.2 mm;
the breaking strength is above 10 grams/denier;
the tensile modulus is above 800 grams/denier; and
the elongation at break is below 6%.

12. The preparation method of the high-strength rope according to any of claims 1-7, **characterized in that** the related parameters of the ultra-high molecular weight polyethylene strip at least meet one or more of the following conditions:

the linear density is above 100 deniers;
the width is 1-100 mm;
the thickness is below 0.2 mm;
the breaking strength is above 10 grams/denier;
the tensile modulus is above 800 grams/denier; and
the elongation at break is below 6%.

13. A high-strength rope, prepared by adopting the preparation method of the high-strength rope according to any of claims 1-12.

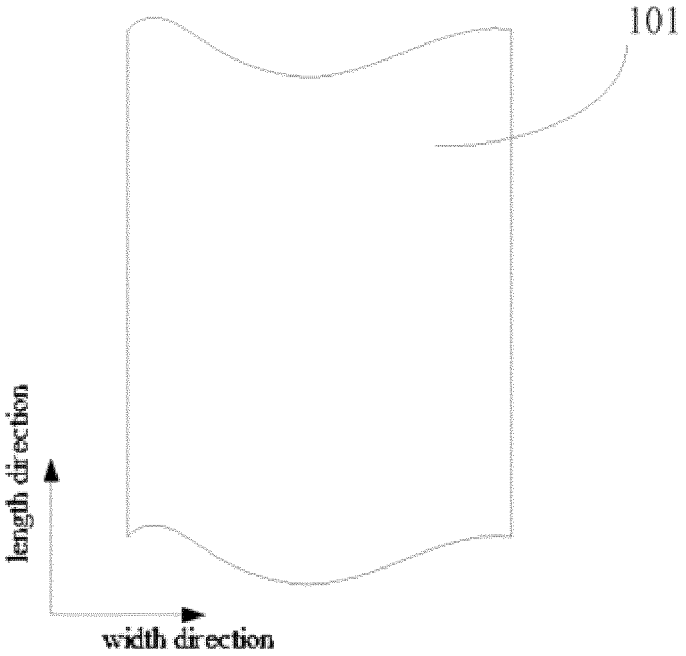

101
length direction
width direction

Fig. 1

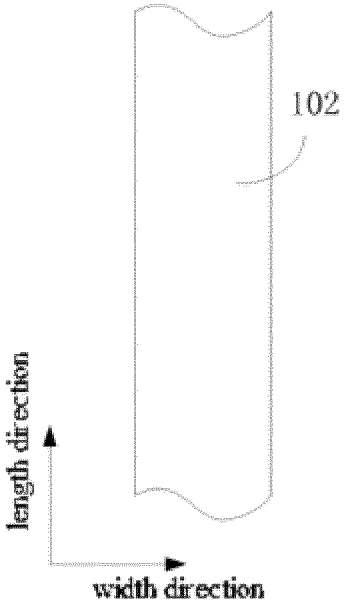

102
length direction
width direction

Fig. 2

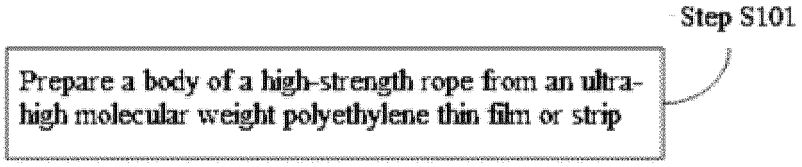


Fig. 3

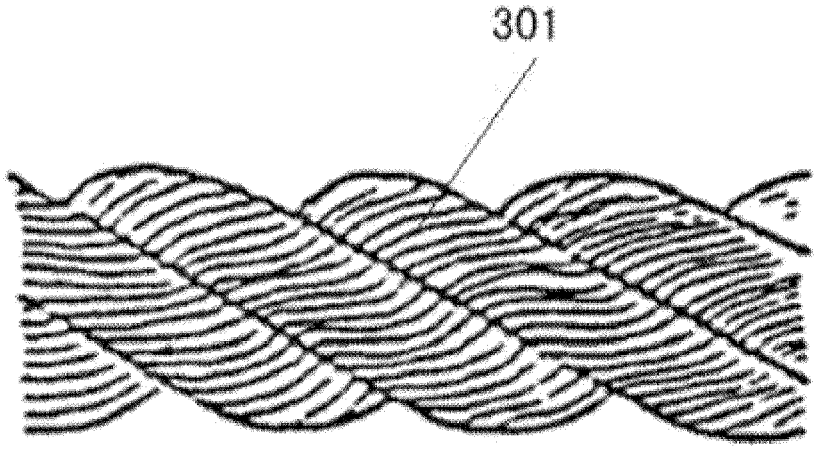


Fig. 4

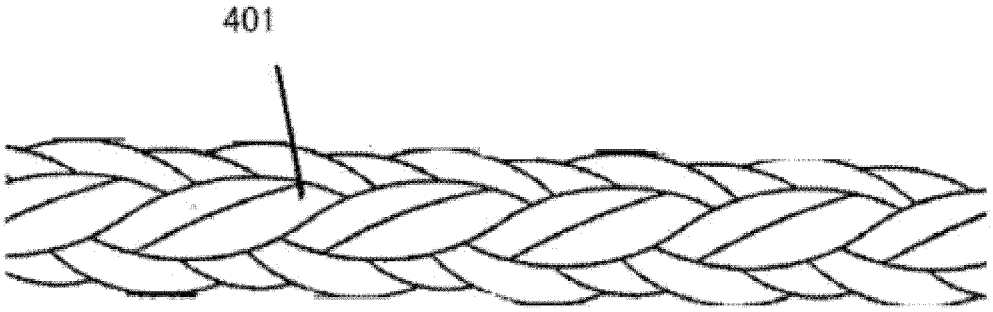


Fig. 5

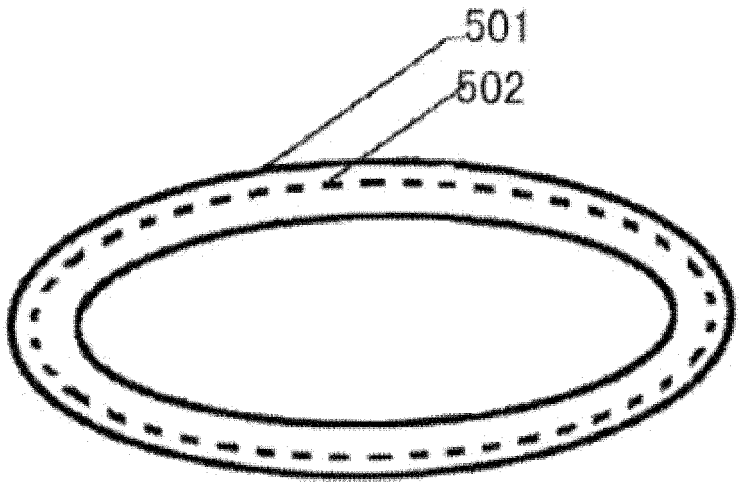


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/077546

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: D07B 5/-, D07B 1/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI; EPODOC; CNABS; CNPAT: yarn, twist+, film?, rope, polyethylene

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 101914234 A (REN, Yi), 15 December 2010 (15.12.2010), description, paragraphs [0003], [0008]-[0011], [0029] and [0030]	1, 11-13
Y		2-10
X	CN 101891912 A (REN, Yi), 24 November 2010 (24.11.2010), embodiments 1-5	1, 11-13
Y		2-10
Y	CN 2309353 Y (CHEN, Dejiang), 03 March 1999 (03.03.1999), description, page 1	2-10
A	JP S5593891 A (TOKUYAMA SODA KK et al.), 16 July 1980 (16.07.1980), embodiment 1	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 February 2014 (27.02.2014)	**27 March 2014 (27.03.2014)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **PANG, Mingjuan** Telephone No.: (86-10) **82245211**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/077546

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 101914234 A	15.12.2010	None	
CN 101891912 A	24.11.2010	None	
CN 2309353 Y	03.03.1999	None	
JPS 5593891 A	16.07.1980	JPS 5730435 B2	29.06.1982

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/077546

CONTINUATION: A. CLASSIFICATION OF SUBJECT MATTER

D07B 5/00 (2006.01) i

D07B 1/00 (2006.01) i

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