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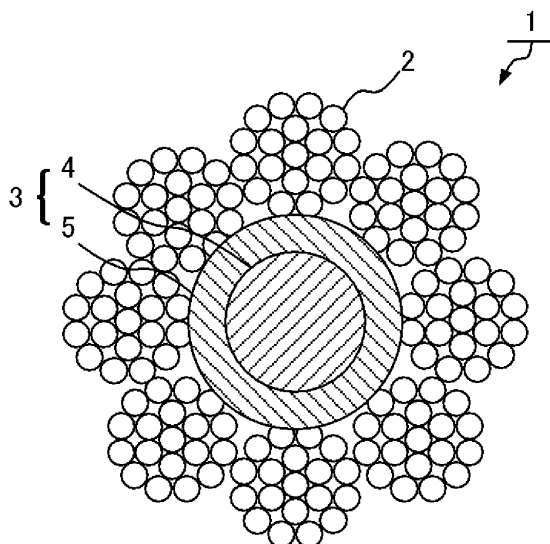
(54) **RUNNING WIRE ROPE**

(57) To provide a running wire rope having excellent performance and being capable of improve facilitating measurement of a state of a diameter of a rope to derive improvement of safety.

A running wire rope 1 is formed by twisting a plurality of strands 2 around a resin core 3 served as a resin core

member. The resin core 3 is formed by a plurality of resin layers of a first resin layer 4 and a second resin layer 5. Resin materials of the first resin layer 4 and the second resin layer 5 adjacent to each other are different, or alternatively colors of the layers adjacent to each other are different.

Fig. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a running wire rope used in running rigging for an elevator or the like.

BACKGROUND ART

[0002] A wire rope used in running rigging for an elevator is formed by twisting a strand around a core member, the strand being formed by twisting a plurality of wires. In a conventional running wire rope, a fiber core or a steel core is mainly used as the core member. Such a core member is worn gradually due to repeated bending or the like through a predetermined time period of use, and thereby the core member becomes thin. When the core member becomes thin, wear fractures are generated due to contact between the strands or the wire rope is stretched, and thereby the wire rope might be damaged or the strength of the wire rope might be deteriorated. Thus, a wire rope using a resin material such as polyethylene and polypropylene as the core member has been proposed (for example, see Patent Literature 1).

CITATIONS LIST

PATENT LITERATURE

[0003] Patent Literature 1: JP 2010-144305 A

SUMMARY OF INVENTION

TECHNICAL PROBLEMS

[0004] Replacement timing of a running wire rope is defined by respective standards, (for example, Ordinance on Industrial Safety and Health, Safety Ordinance for Cranes, Gondola Structure Standard, Inspection standard of elevator, escalator and dumbwaiter (JIS A 4302), or the like), and therefore when a diameter of the rope becomes lower than a predetermined diameter, the rope should be replaced. Thus, it is important to maintain and manage a diameter (thickness) of the running wire rope because the delay of the timing to measure a state of the diameter of the rope or the measurement error might lead a serious accident.

[0005] However, in the conventional running wire rope, it is not easy to check the diameter of the rope including the fiber core or the resin core. That is, in a case in which the diameter is measured by using a measurement jig (Vernier calipers) based on JIS G 3525, it is necessary that a machine (for example, lift) is stopped for the measurement and a plurality of portions of the wire should be measured, and such a work takes a lot of time and man-hour. At this time, when the number of the measured portions is made large, the detection accuracy of the state of the running wire rope can be improved. However, time

is limited because the machine should be stopped, and thereby the measured portions are also limited. Thus, the improvement of the detection accuracy of the state is limited.

[0006] Accordingly, an object of the present invention is, in consideration of the problem described above, to provide a running wire rope having excellent performance and being capable of facilitating measurement of a state of a diameter of a rope to derive improvement of safety.

SOLUTIONS TO PROBLEMS

[0007] In order to solve the problem described above, a running wire rope according to the present invention is formed by twisting a plurality of strands around a resin core served as a resin core member. The resin core is formed by a plurality of resin layers, and resin materials of the resin layers adjacent to each other are different and/or colors of the layers adjacent to each other are different.

[0008] According to this, the resin core is formed as a multilayer structure in which the layers are formed by different resin materials or formed in different colors, and therefore measurement of a state of a diameter of the rope can be facilitated. That is, the running wire rope is changed due to wear with the elapse of time and therefore the resin material that forms each layer is turned into powder sequentially from an outer side layer. Accordingly, the state of the diameter of the rope can be presumed based on an amount of the generated powder, and thereby the timing of the replacement of the rope can be recognized.

[0009] Here, it is preferable that a resistance against wear of the resin layer arranged at an outer side of the resin core is higher than that of the resin layer arranged at a center side of resin core.

[0010] According to this, a multilayer structure using the resin material having excellent resistance against the wear at an outer side where the wear is facilitated and using the resin material available at a relatively low cost at an inner side where the wear is not facilitated can be obtained. Consequently, the running wire rope having high performance can be obtained at a low cost.

[0011] Further, it is also preferable that a color of the resin layer arranged at an outer side of the resin core is lighter than that of the resin layer arranged at a center side of resin core.

[0012] According to this, the powder generated due to the wear is changed from a light color to a dark color, and thereby the state of the diameter of the rope can be recognized at a first sight.

ADVANTAGEOUS EFFECTS OF INVENTION

[0013] As described above, according to the running wire rope according to the present invention, since the multilayer structure in which the resin core is formed of

different materials is adopted, the state of the diameter of the rope can be recognized based on the powder generated from the resin material due to the wear thereof. Consequently, the timing of the replacement of the rope can be recognized, and improvement of safety is derived.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

Fig. 1 is a cross-sectional view of a running wire rope.
Fig. 2 is a view for describing a ratio of a resin core.
Fig. 3 is a cross-sectional view illustrating another example of a resin core.

DESCRIPTION OF EMBODIMENTS

[0015] Hereinafter, an embodiment of the present invention is described with reference to drawings.

[0016] Fig. 1 is a cross-sectional view of a running wire rope according to the present embodiment.

[0017] A running wire rope 1 is formed by twisting a plurality of strands 2 around a core member. The running wire rope 1 is served as a wire rope used in running rigging for an elevator or the like. In this embodiment, a configuration in which eight strands 2 are twisted is exemplary illustrated, however a configuration in which six strands are twisted may be adopted.

[0018] The running wire rope 1 is provided with a resin core 3 as a core member. The resin core 3 has a multilayer structure formed by a first resin layer 4 and a second resin layer 5. Each of the first resin layer 4 and the second resin layer 5 that forms the resin core 3 is formed of a thermoplastic resin material such as polyethylene, polypropylene, and polyester.

[0019] A resin material that forms the first resin layer 4 is different from a resin material that forms the second resin layer. For example, in a case in which the first resin layer 4 served as a center portion is formed of a resin material available at a relatively low cost such as polyethylene and polypropylene and the second resin layer 5 arranged around the center portion is formed of a resin material having high resistance such as high density polyethylene and polyester, the resin core 3 having excellent performance can be obtained at a low cost.

[0020] In this way, since the resin core has a multilayer structure including the materials forming the respective layers different from each other, a diameter of the rope changed with the elapse of time can be recognized by powder generated from the resin material due to the wear thereof. When the powder of the resin material is generated due to the wear, some part of the corresponding layer is exposed. In particular, the rope is worn across a longitudinal direction, and thereby a certain amount of the powder of the resin material is generated. Consequently, a forecast of the replacement timing of the rope can be obtained. Further, it is preferable that a thickness of each layer is set to 1 mm or more in order to generate

a certain amount of the powder to such an extent in which a measurer can visually recognize the generation of the powder.

[0021] Fig. 2 is a view for describing a ratio of the resin core.

[0022] In the running wire rope 1 formed by twisting the eight strands 2, it is preferable that a diameter B of the resin core 3 before the strands are twisted is set in a range between 55% and 65% of a diameter A of the rope. In a case in which the diameter B is lower than 55% of the diameter A, it might be late to find a decrease of the diameter of the rope. On the other hand, in a case in which the diameter B is larger than 65% of the diameter A, the replacement of the rope is urged by the decrease of the diameter of the rope, at the timing earlier than the right timing, and therefore a lifetime of the rope might be shortened.

[0023] Further, in the running wire rope formed by twisting the six strands, it is preferable that a diameter B of the resin core is set in a range between 35% and 45% of a diameter A of the rope. The reason thereof is similar to that described above.

[0024] Fig. 3 is a cross-sectional view illustrating another example of a resin core.

[0025] A resin core 3a shown in Fig. 3 is formed by layers of a first resin layer 4, a second resin layer 5, and a third resin layer 6. In addition or instead of forming the layers by different resin materials, the layers may be formed in different colors from each other. For example, in a case in which the layers are formed in respective colors closer to three primary colors of cyan (C), magenta (M), and yellow (Y) of color materials, a state of a diameter or the rope can be recognized easily based on powder generated from the resin material due to the wear thereof. The colors may be set to be different in shades in the same color system. In such a case, for example, it is preferable that the colors are set to be lighter from an inner side of the center of the core toward an outer side of the core. When the resin material is turned into the powder due to the wear of the rope, it can be recognized that the wear of the rope is advanced to which layer based on the color of the powder. Further, since the rope is worn across the longitudinal direction, in a case in which a layer having different color is exposed in some part, the wear can be recognized by a visual inspection.

[0026] Further, in addition to the differences of the resin materials of the layers and the differences of the colors of the layers, the thicknesses of the layers may be set to be different. For example, the layer may be made thicker by using a resin material having excellent resistance from an inner side of the center of the core toward an outer side of the core and further the layers may be formed in different colors from each other. Or alternatively, a resin material having excellent resistance and a resin material available at a low cost may be alternately arranged, or the thicknesses of the layers may be changed from each other, so that a resin core adapted to an apparatus for using the running wire rope is obtained. At least by using

different resin materials or by setting different colors in the layers adjacent to each other in the multilayer structure, the state of the diameter of the rope can be recognized by the powder generated from the resin material due to the wear of the rope. Consequently, many patterns of the resin cores having the multilayer structure suitable to the usage thereof or the like can be considered.

[0027] As described above, the running wire rope according to the present invention is described based on each embodiment, however the present invention is not limited to the embodiments described above. Various design modifications can be adopted within a subject matter of the present invention as long as the object of the present invention is achieved, and those modifications are also encompassed in the present invention.

INDUSTRIAL APPLICABILITY

[0028] The present invention is applied as a running wire rope used in running rigging for an elevator.

REFERENCE SIGNS LIST

[0029]

1:	running wire rope	25
2:	strand	
3, 3a:	resin core	
4:	first resin layer	
5:	second resin layer	30
6:	third resin layer	

Claims

1. A running wire rope formed by twisting a plurality of strands around a resin core served as a resin core member, wherein the resin core is formed by a plurality of resin layers, and resin materials of the resin layers adjacent to each other are different and/or colors of the resin layers adjacent to each other are different.
2. The running wire rope according to claim 1, wherein a resistance against wear of the resin layer arranged at an outer side in the resin core is higher than that of the resin layer arranged at a center side in the resin core.
3. The running wire rope according to claim 1 or 2, wherein a color of the resin layer arranged at an outer side in the resin core is lighter than that of the resin layer arranged at a center side in the resin core.

Fig. 1

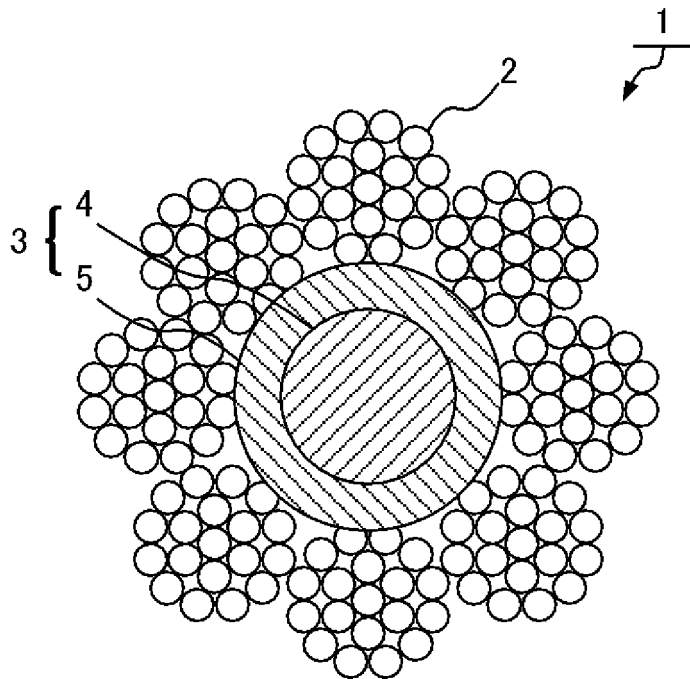


Fig. 2

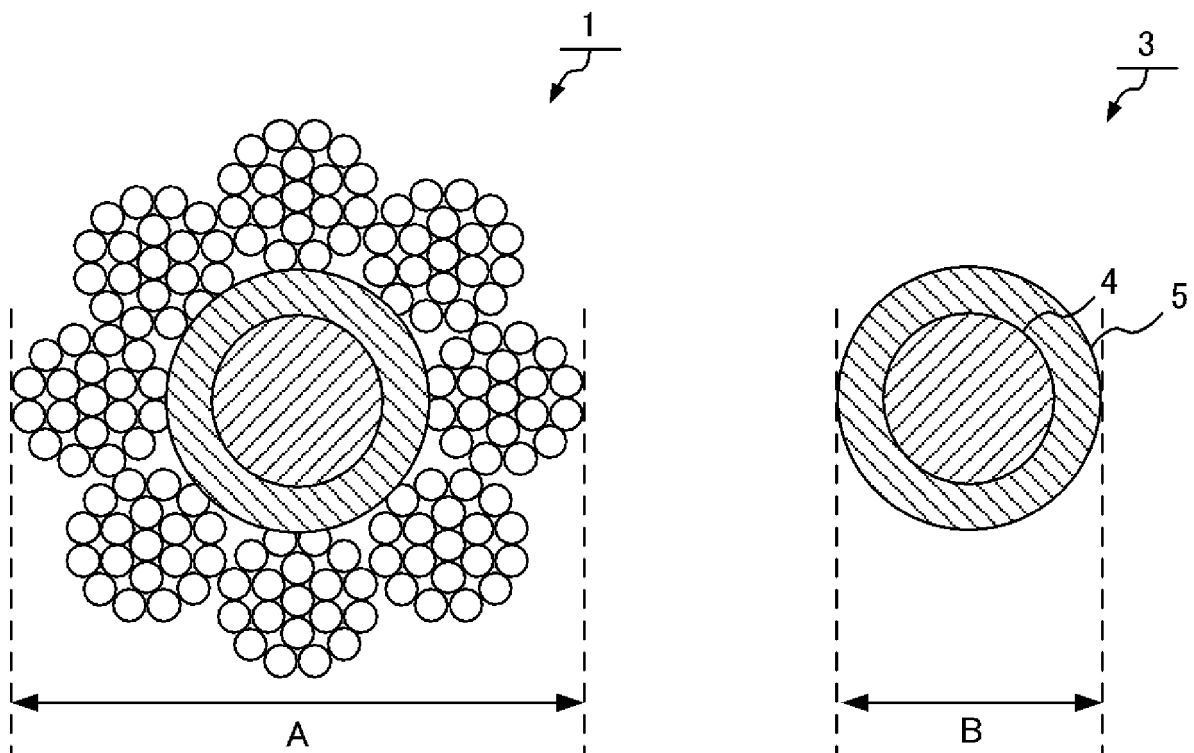
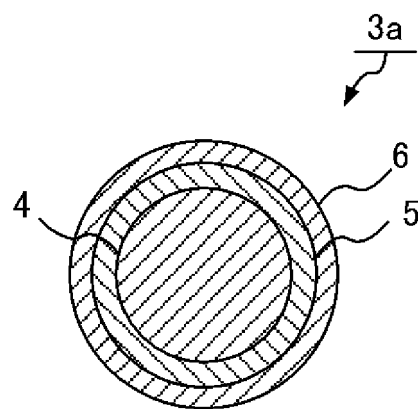


Fig. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/068966

A. CLASSIFICATION OF SUBJECT MATTER

D07B1/16(2006.01) i

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)

D07B1/16

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2010-202404 A (Tokyo Rope Mfg. Co., Ltd.), 16 September 2010 (16.09.2010), (Family: none)	1-3
A	WO 2002/016249 A1 (Mitsubishi Electric Corp.), 28 February 2002 (28.02.2002), & EP 1312574 A1	1-3

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

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"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

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Name and mailing address of the ISA/

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010144305 A [0003]