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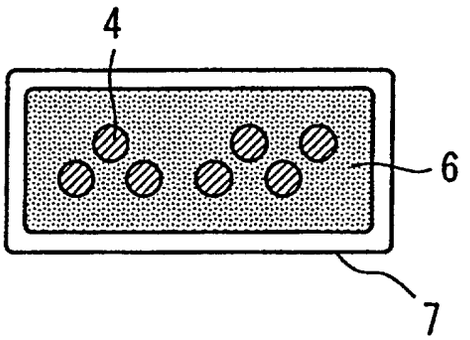
(54) SYNTHETIC RESIN ROPE, PRODUCTION METHOD THEREOF AND TERMINAL HANDLING METHOD

(57) In a synthetic resin rope formed from a strand of synthetic resin fibers and conductive fibers, the synthetic resin fibers are removed from an end portion, thereby exposing conductive resin. The conductive resin is integrated into a single body with a conductive adhesive, thereby ensuring electrical connection between hardware provided at the end portion and the conductive fibers.

Fig. 4 A



EP 1 350 886 A1

Description

Field of the Invention

[0001] The present invention relates to a synthetic resin rope formed by means of stranding synthetic resin fibers and conductive fibers, to a method of manufacturing the synthetic resin rope, and to a method of processing the end of the rope.

Background Art

[0002] Figs. 6 and 7 are diagrams for describing the structure of a related-art synthetic resin rope. Fig. 6 is a view showing the end portion of the synthetic resin rope which is not machined. Fig. 7 is a view showing the end portion of the synthetic resin rope shown in Fig. 6 when crimped by terminal hardware.

[0003] As shown Figs. 6 and 7, the related-art synthetic resin rope is formed by means of stranding synthetic resin fibers 3 and conductive fibers 4, and the end portion of the thus-stranded synthetic resin rope is crimped with terminal hardware 7 (a crimp terminal).

[0004] The synthetic resin fiber 3 having a high degree of electrical insulation and a coating agent 5 for insulation purpose are interposed between the conductive fibers 4 and the terminal hardware 7, thereby posing difficulty in ensuring electrically-stable connection.

[0005] The present invention has been conceived to solve such a related-art problem and provides a synthetic resin rope and a manufacturing method therefor which enable stable electrical connection in the end portion.

Disclosure of the Invention

[0006] A synthetic resin rope according to the present invention is formed from a strand of synthetic resin fibers and conductive fibers. The synthetic resin fibers are removed from an end portion of the rope, and the conductive fibers are integrated into a single body with a conductive adhesive, and terminal hardware is fitted around the conductive adhesive from the outside. As a result, electrical connection between the conductive fibers and terminal hardware can be improved.

[0007] Under a method of manufacturing a synthetic resin rope according to the present invention, synthetic resin fibers and conductive fibers are twisted, to thereby produce a strand. The synthetic resin fibers are removed from an end portion of the rope. The plurality of exposed conductive fibers are coated with a conductive adhesive, thus integrating the fibers into a single body. Terminal hardware is press-fitted onto the conductive adhesive from the outside. This method enables production of a synthetic resin rope involving superior electrical connection between conductive fibers and terminal hardware.

[0008] A method of processing an end portion of a synthetic resin rope according to the present invention, wherein the rope includes a strand formed from synthetic resin fibers and conductive fibers, comprises a first step of leaving only conductive fibers in the end portion; a second step of compressing the remaining conductive fibers; and a third step of press-fitting terminal hardware onto the compressed conductive fibers. The method enables production of a synthetic resin rope involving superior between conductive fibers and terminal hardware.

Brief Description of the Drawings

[0009]

Fig. 1 is a cross-sectional view of a synthetic resin rope according to the present invention;
Fig. 2 is a cross-sectional view of a stranded synthetic resin rope according to the present invention;
Fig. 3 is a cross-sectional view of a stranded synthetic resin rope whose end portion has been heated and coated with a conductive adhesive;
Figs. 4A and 4B are cross-sectional views showing the end of a rope after having been crimped with a terminal according to the present invention;
Fig. 5 is a flowchart of processes for processing the end portion of a synthetic resin rope according to the present invention;
Fig. 6 is a cross-sectional view of end portion of a known synthetic resin rope before the end portion is crimped with terminal hardware; and
Fig. 7 is a cross-sectional view of end portion of the known synthetic resin rope after the end portion has been crimped with the terminal hardware.

Best Modes for Implementing the Invention

[0010] A mode for implementing the present invention will be described hereinbelow by reference to the accompanying drawings. Throughout the drawings, like or corresponding elements are assigned the same reference numerals, and their repeated descriptions are simplified or omitted.

[0011] Figs. 1 through 5 are views for describing a mode for implementing the present invention. Fig. 1 is a cross-sectional view of a synthetic resin rope, and Fig. 2 is a cross-sectional view of a stranded synthetic resin rope.

[0012] In Figs. 1 and 2, reference numeral 1 designates a stranded synthetic resin rope; 2 designates an outer sheath of the synthetic resin rope; 3 designates synthetic resin fibers such as aramid fibers; 4 designates conductive fibers such as carbon fibers; and 5 designates an insulation coating agent. As shown in Fig. 2, a stranded synthetic resin rope 1 is formed by means of stranding the synthetic resin fibers 3 and the conductive fibers 4 and coating the thus-stranded fibers with the insulation coating agent 5.

[0013] Fig. 3 is a cross-sectional view of the strand

after the synthetic resin fibers 3 and the insulation coating agent 5 have been removed from the end portion and the end portion has been coated with the conductive adhesive. Reference numeral 6 provided in Fig. 3 designates a conductive adhesive. As shown in Fig. 3, after the end portion of the strand has been heated and coated with the conductive adhesive, the synthetic resin fibers 3 and the insulation coating agent 5 have been fired. Hence, the strand is formed from only the conductive fibers 4 and the conductive adhesive 6.

[0014] Figs. 4A and 4B show the end portion after having been crimped with a terminal. Fig. 4A is a cross-sectional view of the end portion, and Fig. 4B is a side view of the same. As shown in Figs. 4A and 4B, reference numeral 7 designates terminal hardware. As shown in Fig. 4A, the end portion of the synthetic resin rope after having been coated with the conductive adhesive 6 and crimped with the terminal hardware 7 corresponds to a strand which consists of only the conductive fibers 4 and the conductive adhesive 6 and has been crimped with the terminal hardware 7. As shown in Fig. 4B, the terminal hardware 7 covers the end portion so as to become continuous from the outer sheath 2 covering the main body of the rope.

[0015] The structure of the synthetic resin rope according to the embodiment can also be described in the following manner.

[0016] The synthetic resin rope according to the embodiment has a main body portion and an end portion continuously connected to the main body portion. As shown in Fig. 4A, the end portion has a structure in which the terminal hardware, which has the shape of a quadrangle ring, is filled with the conductive adhesive 6, and the plurality of conductive fibers 4 are embedded in the conductive adhesive 6. As shown in Figs. 1 and 2, the strand 1 is produced by means of stranding a plurality of synthetic fibers and conductive fibers extending from a plurality of conductive fibers of the end portion, and the strand 1 is covered with the outer sheath 2.

[0017] A method of manufacturing the synthetic resin rope will now described.

[0018] Fig. 5 is a flowchart showing a method of manufacturing the synthetic resin rope according to the embodiment (i.e., a process for processing an end portion).

[0019] As can be seen from the cross-sectional views shown in Figs. 1 and 2, the synthetic resin fibers 3, such as aramid fibers, and the conductive fibers 4, such as carbon fibers, are stranded, and the resultant strand is coated with the insulation coating agent 5. The thus-coated strand is further coated with the outer sheath 2, thus producing a synthetic resin rope. In this way, a synthetic resin rope that has already been produced may be used as a starting material to be subjected to terminal processing.

[0020] The end portion of the thus-produced synthetic resin rope is heated in a flame. As a result, the synthetic resin fibers 3 and the insulation coating agent 5, which have low heat-resistant temperatures, are burnt away, whereby the conductive fibers 4 having a high heat-resistant temperature can be selectively left and exposed (step S1 shown in Fig. 5).

[0021] The thus-exposed conductive fibers 4 are coated with the conductive adhesive 6, and the conductive fibers 4 are integrated into a single conductor (step S2 shown in Fig. 5). Further, as a result of the conductive adhesive 6 setting, the mechanical strength of the conductive fibers 4 can be enhanced.

[0022] As shown in Figs. 4A and 4B, the terminal hardware 7 is squeezed onto (or fitted onto) the end portion of the synthetic resin rope so as to cover the thus-integrated conductive resin 6 from the outside, thereby producing a synthetic resin rope whose end portion has been processed (step S3 shown in Fig. 5). As a result, electrical connection between the terminal hardware 7 and the conductive fibers 4 is made stable.

[0023] As has been described, in the present embodiment, the conductive fibers 4 having a high heat-resistance temperature can be left and exposed by means of heating the end portion of the synthetic resin rope in a flame. By means of coating the thus-exposed conductive fibers 4 with the conductive adhesive 6, the plurality of conductive fibers can be integrated into a single conductor. Further, as a result of the conductive adhesive 6 setting, the mechanical strength of the conductive fibers 4 can be enhanced, and making electrical connection between the terminal hardware 7 and the conductive fibers 4 stable.

[0024] Although an example method of manufacturing a synthetic resin rope according to the present invention has been described, the method is not limited to this example; another method falling within the scope of the invention may also be employed. For instance, synthetic fibers and an insulation coating agent may be removed from the end portion by use of a chemical or an organic solvent. Further, bundling of the conductive fibers still remaining in the end portion is implemented by a method of winding a conductive tape around the still-remaining conductive fibers, and other methods falling within the scope of the invention may also be employed.

[0025] The invention is conceived in the manner as has been described, and hence the following effects are provided.

[0026] According to the present invention, only conductive fibers are exposed in the end portion of the rope, and the thus-exposed portions are integrated. Terminal hardware is fitted around the thus-integrated portion of the rope. Hence, electrical connection existing between the conductive fibers and the terminal hardware can be improved.

[0027] According to the present invention, the conductive fibers still remaining on and exposed on the end portion of the rope are coated with a conductive adhesive and integrated into a single conductive line. Hence, mechanical strength of the conductive fibers can be enhanced.

[0028] The end portion of the synthetic resin rope is heated, thereby removing from the end portion synthetic resin fibers and an insulation coating agent, both having low high heat resistance temperatures. Thus, conductive fibers having a high heat resistance temperature can be left and exposed. Hence, synthetic fibers and an insulation coating agent, which are interposed between the terminal hardware and the conductive fibers and have a high degree of electrical insulation, can be removed, thus enabling stable electrical connection.

[0029] By means of the thus-remaining and exposed conductive fibers being coated with a conductive adhesive, the conductive fibers are integrated into a single conductor, and the terminal hardware is press-fitted onto the conductor. Hence, electrical connection between the conductive fibers and the terminal hardware can be made stable.

Industrial Applicability

[0030] As has been described, a synthetic resin rope according to the present invention provides sufficient electrical connection between terminal hardware provided at the end portion of the rope and internal conductive fibers while ensuring sufficient mechanical strength for, for example, an elevator rope. Thus, there is provided a rope capable of smoothly transmitting an electrical signal.

Claims

1. A synthetic resin rope formed from a strand of synthetic resin fibers and conductive fibers, wherein the synthetic resin fibers are removed from an end portion of the rope, the remaining conductive resin is integrated into a single body with a conductive adhesive, and terminal hardware is fitted around the conductive adhesive from the outside.

2. A synthetic resin rope having a main body portion and an end portion continuously connected to the main body portion, wherein

   the end portion comprises ring-shaped terminal hardware, a conductive adhesive filled into the terminal hardware, and a plurality of conductive fibers embedded in the conductive adhesive; and

   a plurality of synthetic resin fibers and conductive fibers extending from a plurality of conductive fibers of the end portion are twisted into a strand in the main body portion.

3. A method of manufacturing a synthetic resin rope comprising the steps of:

   twisting synthetic resin fibers and conductive fibers, to thereby produce a strand;
   removing the synthetic resin fibers from an end portion of the rope;
   coating the plurality of exposed conductive fibers with a conductive adhesive, thus integrating the fibers into a single body; and
   press-fitting terminal hardware onto the conductive adhesive from the outside.

4. The method of manufacturing a synthetic resin rope according to claim 3, wherein removal of synthetic resin fibers from the end portion is performed by means of heating the end portion.

5. A method of processing an end portion of a synthetic resin rope including a strand formed from synthetic resin fibers and conductive fibers, the method comprising:

   a first step of leaving only conductive fibers in the end portion;
   a second step of compressing the remaining conductive fibers; and
   a third step of press-fitting terminal hardware onto the compressed conductive fibers.

6. The method of processing an end portion of a synthetic resin rope according to claim 5, wherein the first step is for heating the end portion of the synthetic resin rope, thereby selectively leaving and exposing conductive fibers having a higher heat-resistance temperature.

7. The method of processing an end portion of a synthetic resin rope according to claim 5 or 6, wherein the second step is for coating and compressing the remaining conductive fibers with a conductive adhesive.

Fig. 1

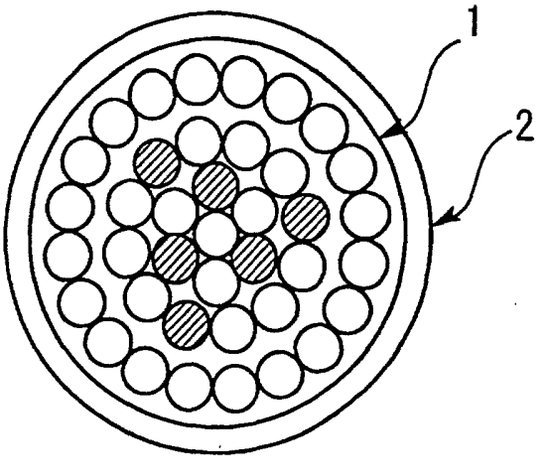


Fig. 2

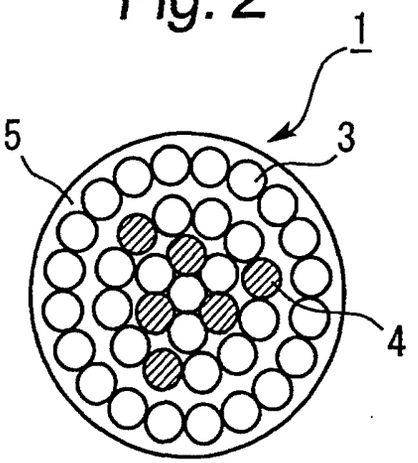


Fig. 3

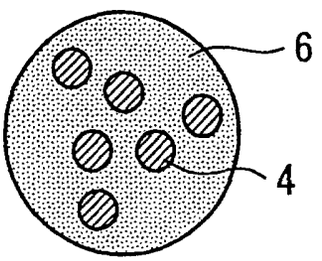


Fig. 4 A

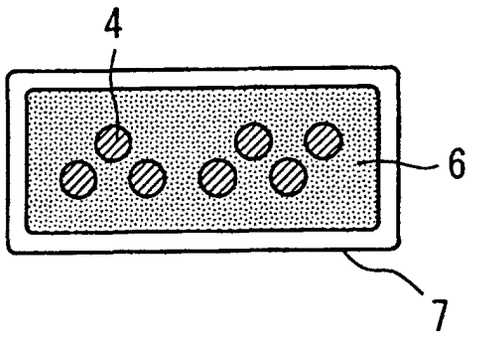


Fig. 4 B

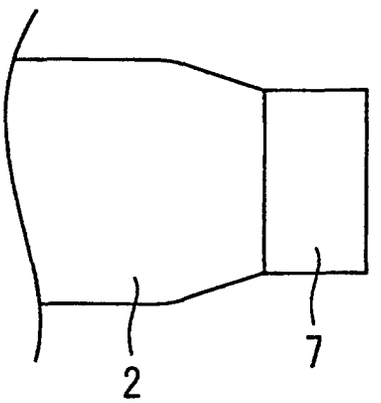


Fig. 5

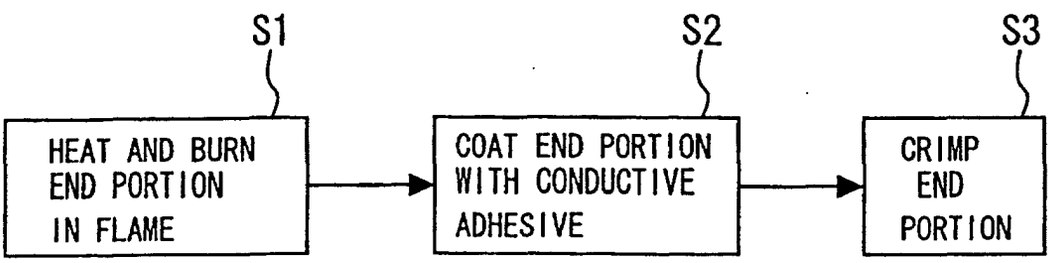


Fig. 6

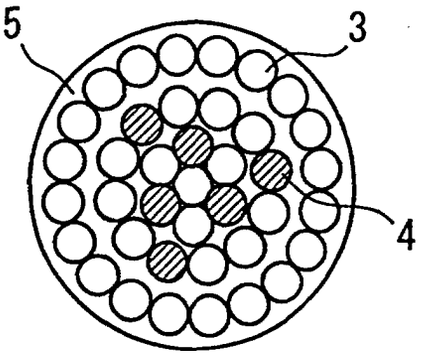
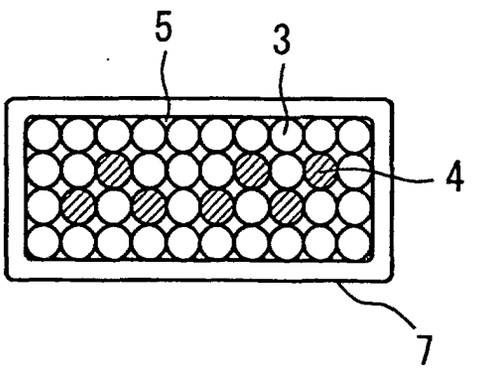


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/07923

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] D07B9/00

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)
Int.Cl[7] D07B1/00-9/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Toroku Jitsuyo Shinan Koho 1994-2001

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, 10-195787, A (Tokyo Seiko Co., Ltd.), 28 July, 1998 (28.07.98) (Family: none)	1-7
A	JP, 1-168224, A (Mitsubishi Heavy Industries, Ltd.), 03 July, 1989 (03.07.89) (Family: none)	1-7

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Date of the actual completion of the international search	Date of mailing of the international search report
05 February, 2001 (05.02.01)	13 February, 2001 (13.02.01)
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