

[54] HOISTING ROPE

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[58] Field of Search 174/103 R, 102 E, 174/113 R, 115, 116, 108, 110 FC, 126 R, 128, 130, 131 R, 131 A; 57/145, 146, 147, 148, 139

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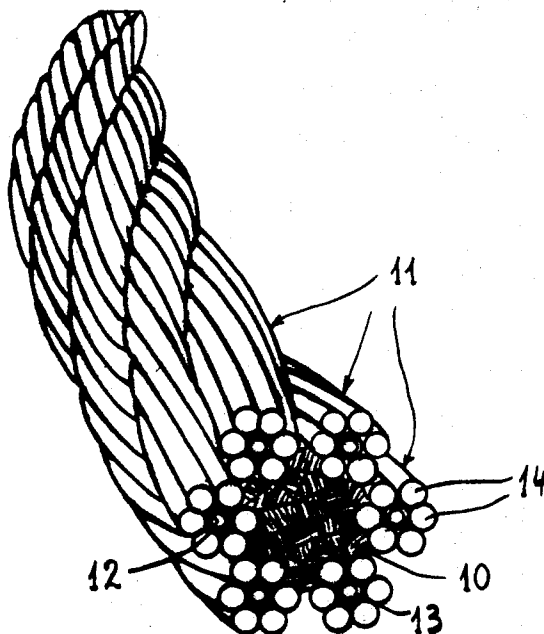
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[57] ABSTRACT

A hoisting rope is provided which has a core surrounded by strands having an insulated electrical conductor in their middle. The core can be a fibre core or a reinforcing steel core or any other type of core which may be found desirable. The resulting rope has a longer life and an improved overall performance.

8 Claims, 3 Drawing Figures



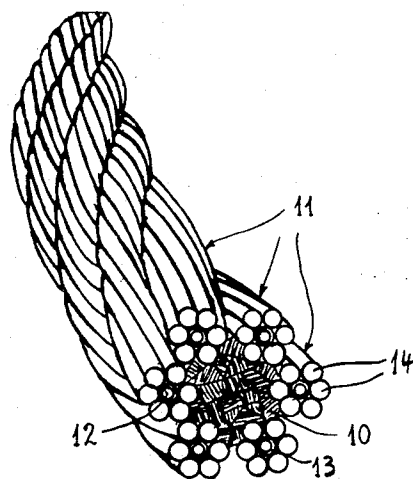


FIG. 1

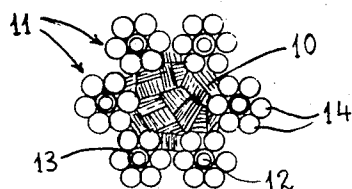


FIG. 2

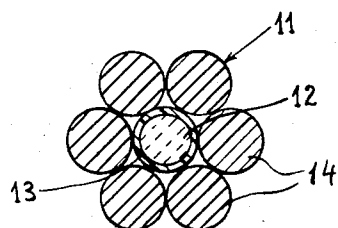


FIG. 3

HOISTING ROPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improved hoisting rope with capability of transmitting electric current there-through.

2. Description of the Prior Art

Generally speaking, hoisting ropes are used for many purposes such as elevators, mine shafts, scaffolds, e.g. window washing scaffolds for skyscrapers, and the like. Particularly in the case of this latter use, it was the practice of raising and lowering the window washing scaffolds by means of steel ropes, while the window washing equipment was provided with power by means of separate electric cables. This, however, presented many difficulties because the wind blew the electrical cables from the scaffolds or else these cables interfered with the movement of people on the scaffolds and presented a general hindrance and danger. For this reason, it was found necessary to incorporate the electrical conductors within the steel cables for such and similar operations.

Up to now, such electrical conductors have usually been incorporated in the middle fibre or stranded core of the hoisting ropes. For example, Canadian Pat. No. 364,203 issued Feb. 16, 1937 to The Technicraft Engineering Corporation and entitled "Conductor Core Wire Rope" describes and claims one such design wherein the conductor is within the middle core of the rope. This type of design presents, however, certain important disadvantages because when the surrounding steel strands of the rope squeeze under tension or load upon the middle core containing the conductor or conductors, these surrounding strands have a tendency to damage or break such conductor with consequent interruption in power transmission. This is particularly so because hoisting wire ropes are usually subjected not only to load and tension but also to constant bending and flexing and consequently the middle core of such ropes must withstand considerable abuse. Thus, the life of such hoisting ropes having the electrical conductors in the middle core thereof has proved to be insufficient and they have not resulted in great popularity. Attempts have been made to obviate the disadvantage mentioned above by reinforcing the middle core and by encasing the conductors within metallic tubular members. For example, Canadian Pat. No. 390,258 of July 30, 1940 to William Kerr Auchinvole, entitled "Hoisting Rope" illustrates such construction. However, such ropes with inside tubular members were found to be insufficiently flexible and also much more difficult to manufacture and therefore more expensive.

Some recent designs of such ropes, for instance, a wire towing rope described and claimed in U.S. Pat. No. 3,482,034 of Dec. 2, 1969 of L.A. Rhoades et al., entitled "Conductive Tow Cable," involve a rather complex construction wherein helically wound crushing resistant metal armor wires are used to provide an armor covering for the electrically conductive wires.

SUMMARY OF THE INVENTION

It is an object of the present invention to obviate the above disadvantages and to provide a hoisting or similar rope of high strength and flexibility and of simple and inexpensive construction.

This is achieved by providing a hoisting rope which comprises a core and a plurality of strands surrounding said core, said strands consisting of a middle insulated electrical conductor surrounded by steel wires. The core may be any desired type of fiber, synthetic or metal core suitable for hoisting ropes, however, a fibre core or a steel core, when further overall reinforcement of the rope is desired, are preferred. The insulated electrical conductor is a copper, aluminum or similar wire having a surrounding insulation of Teflon (trade mark for polytetrafluoroethylene), neoprene, polypropylene, polyethylene, wrapping insulating tape, or the like. The insulation on the conductor of each strand of the rope may be of different color so as to provide desired identification for connection to various electrical units. The insulated electrical conductor of each strand may be surrounded by one or a plurality of superimposed rows of steel wires depending on the desired strength, thickness and flexibility of the final rope.

According to a preferred embodiment of this invention, a six stranded hoisting rope is provided wherein the fibre core is surrounded by six strands, each of these strands consisting of a middle insulated electrical conductor surrounded by steel wires.

According to another preferred embodiment of this invention, a seven stranded hoisting rope is provided wherein six strands surround the seventh core strand. The core strand is a reinforcing steel strand which may be an independent wire rope core having no electrical conductor therewithin and each of the six surrounding strands has a middle insulated electrical conductor surrounded by steel wires as already described above.

Of course, many other designs and constructions can be made in accordance with the present invention which is essentially characterized by providing the electrical conductors in the middle of the strands that surround the core of the final hoisting rope.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now further be described with reference to the appended drawings in which:

FIG. 1 is an illustration of a piece of rope in accordance with one embodiment of the present invention; FIG. 2 is an end view of the rope shown in FIG. 1; and FIG. 3 is a section view of a strand used in the rope construction of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The rope of the present invention comprises a core 10 surrounded by a plurality of strands 11. Each strand 11 has an insulated electrical conductor 12 in its middle. This conductor may consist of a copper wire, aluminum wire or the like, which is surrounded by insulation 13 of Teflon, neoprene, polypropylene, polyethylene, insulating tape wrapping or the like. Wires 14 surrounding the insulated conductor are preferably of steel of desired strength and other properties; galvanized steel is particularly suitable. It should be noted that instead of one row of wires 14 surrounding the insulated conductor, as illustrated in the drawings, there may be two or more superimposed rows of such wires depending on the required thickness and strength of the final rope and its ultimate use.

Furthermore, fibre core 10 shown in the drawings can easily be replaced by a steel or other suitable core

(not shown), if, for example, additional strengthening of the rope is desired.

The rope is manufactured in a simple and inexpensive manner. First, the steel wires are stranded around the insulated conductors to form the strands which are then stranded around the core to form the final hoisting rope.

The rope in accordance with the present invention has exceptionally long life and a better overall performance. Due to the fact that there are no electrical conductors in its middle core, the life of this rope insofar as its electrical service is concerned, is considerably prolonged, without removing any of its flexibility or making it more expensive or more difficult to manufacture. In addition, this type of rope is extremely well balanced because each surrounding strand will have the same type of conductor in its middle and will be of substantially the same weight, thereby providing an excellent overall balancing of the rope. Each conductor may be insulated in an insulation of different color thereby providing easy identification at each end.

Moreover, in a six stranded rope, which is particularly preferred in accordance with the present invention, the number of electrical conductors actually used for transmitting the power will usually be only three or four and consequently the remaining two or three will serve as spares. Thus, even if for some unexpected reason one of such conductors becomes damaged or broken, the power can easily be switched to the spare one without any interruption in work and without any difficulty, especially when the conductors are easily identified due to insulation of different color for each conductor.

It should be noted that fatigue simulation tests of accepted reliability made on a six stranded rope of the present invention have shown extremely satisfactory results.

Two basic tests were carried out. The first involved multiple reverse bending over sheaves of different diameters with a tension load of 500 lbs and the second involved a tension load of 2,000 lbs which is the expected maximum load in actual service. The first test was operated for a total of 75 hours and the second test for 168 hours. In each case, 7 cycles per minute were performed by the test unit. The testing equipment drive motor was controlled by relays operated through the electrical conductors in series, so a break, or a ground in any conductor would at once stop the test. These are conventional testing procedures and it is believed unnecessary to describe them further.

In evaluating the tests, it has been estimated that in normal service, a power scaffold would make 15 trips per day and be used about 260 days per year or a total of 3,900 trips per year. Each cycle on the test machine represents one trip, and the total cycles operated by

both tests were 102,000 without any break in electric power transmission or damage to the ropes. This means that the ropes would last in excess of 26 years. Even allowing for some reduction in this figure, due to temperature and weather differences and the general differences between test and service conditions, this represents nonetheless a great improvement over hoisting ropes of similar type and size now being used.

I claim:

1. In a rope for hoisting heavy equipment such as elevators, scaffolds, and the like, which comprises a central core and a plurality of strands helically surrounding the central core, the improvement being that each of the plurality of strands consists of a unitary solid middle electrical conductor, a single layer of insulating material covering the middle electrical conductor, and a plurality of steel wires helically wound about and insulated from the middle electrical conductor.
2. The rope according to claim 1, wherein said central core is a fibre core.
3. The rope according to claim 1, wherein said central core is a steel core.
4. The rope according to claim 1, wherein said middle electrical conductor is surrounded by a single row of steel wires.
5. The rope according to claim 1, wherein said middle electrical conductor is surrounded by a plurality of superimposed rows of steel wires.
6. The rope according to claim 1, wherein said middle electrical conductor is a copper wire, and wherein said layer of insulating material is selected from the group consisting of polytetrafluoroethylene, neoprene, polypropylene, polyethylene and wrapping insulating tape.
7. In a six stranded rope for hoisting heavy equipment such as elevators, scaffolds and the like, which comprises a central fibre core and six strands helically surrounding the central fibre core, the improvement being that each of the six strands consists of a unitary solid middle electrical conductor, a single layer of insulating material covering the middle electrical conductor, and a plurality of steel wires helically wound about and insulated from the middle electrical conductor.
8. In a seven stranded rope for hoisting heavy equipment such as elevators, scaffolds, and the like, which comprises a stranded reinforcing steel core and six strands helically wound about and surrounding the reinforcing steel core, the improvement being that each of the six strands comprises a unitary solid middle electrical conductor, a single layer of insulating material covering the middle electrical conductor, and a plurality of steel wires helically wound about and insulated from the middle electrical conductor.

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