Oct. 5, 1965 C. M. ZERR 3,209,528

FLEXIBLE WIRE ROPE CORE

Filed April 26, 1963 3 Sheets-Sheet 1

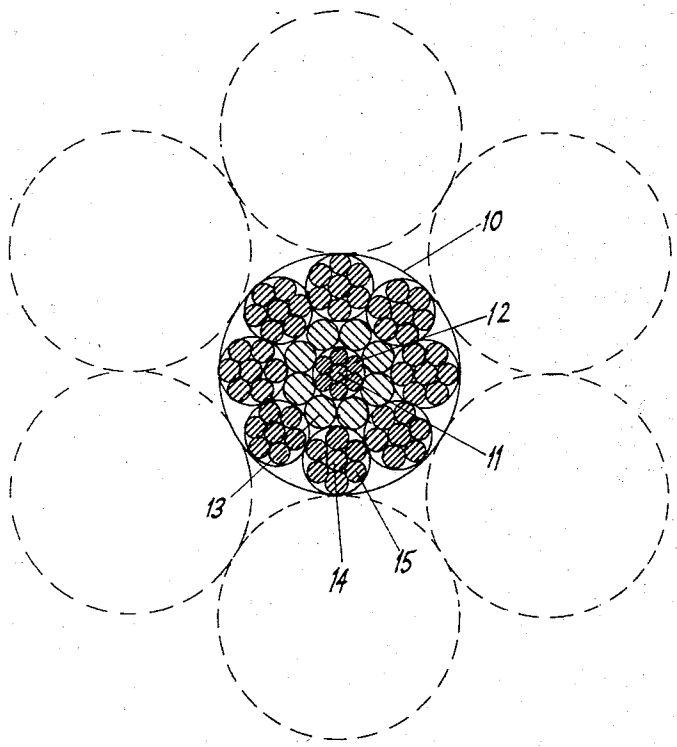


Fig.1

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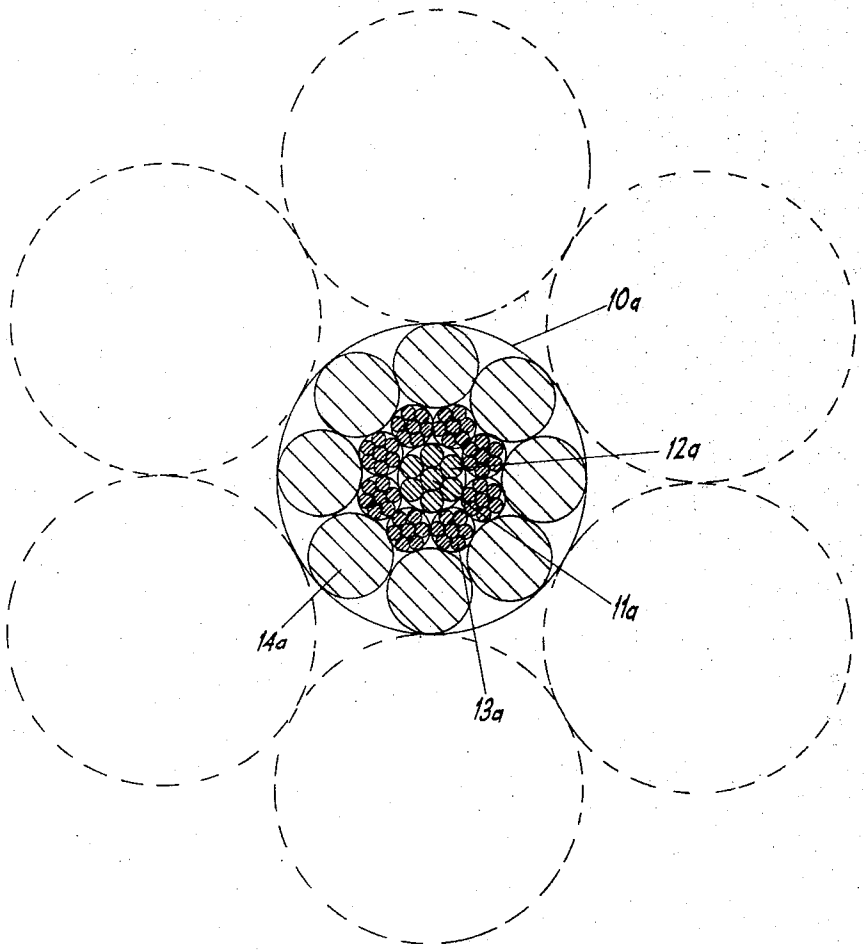


Fig. 2

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FLEXIBLE WIRE ROPE CORE

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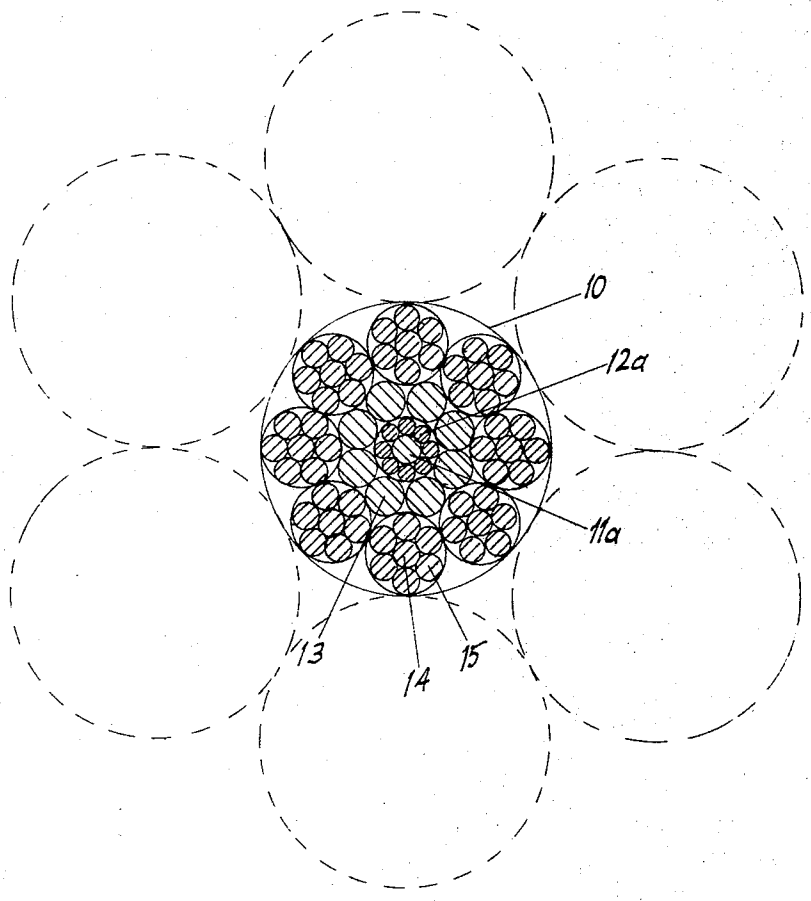


Fig.3

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FLEXIBLE WIRE ROPE CORE

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10 Claims. (Cl. 57—145)

This invention relates to a flexible wire rope core.

In wire rope such as is used in connection with hoists, derricks, cranes, and similar hoisting equipment and also in earth moving equipment such as drag lines and for a great variety of purposes, it is conventional practice to provide a core for the wire rope or cable, which core is in itself made up of one or more wires. The present invention relates to the construction of the core itself and not particularly to the wire rope as a whole.

It is a principal object of the invention to provide a wire rope core which is considerably more flexible than wire rope cores used heretofore, whereby to provide for greater resistance to fatigue breaking. It is another object of the invention to provide a wire rope core which will be firm enough so that it will not distort, collapse or break and thereby contribute to the failure of the wire rope as a whole.

A still further object of the invention is to provide a wire rope core having the above outlined advantageous characteristics which is capable of being closed in a single operation.

These and other objects of the invention which will be described in greater detail hereinafter or which will be apparent to one skilled in the art upon reading these specifications, are accomplished by that construction and arrangement of parts of which several embodiments will be described hereinafter.

Reference is made to the drawings forming a part hereof and in which:

FIG. 1 is a diagrammatic cross-sectional view through a wire rope and a core according to the present invention.

FIG. 2 is a view similar to FIG. 1 but of a modification.

FIG. 3 is a view similar to FIG. 1, but of a modification.

Briefly, in the practice of the invention there is provided a core which is composed of three elements. There is a central element which is preferably a multi-wire strand; around this there is an intermediate layer of eight wires or strands and around the intermediate layer is a covering layer of eight multi-wire strands. In small wire rope, say up to about 2¾ inches in diameter, the intermediate layer is preferably constituted of eight solid wires. Where the wire rope is of an outside diameter of 2¾ inches and up, the intermediate layer may be composed of multi-wire strands, as, for example, seven wire strands.

A wire rope core must be a compromise between two apparently mutually inconsistent qualities. First, it must be flexible enough so as to resist breaking as a result of fatigue either from impact or bending. Secondly, it has to be firm enough so that it will not collapse or break and contribute to the ultimate failure of the wire rope. The reason that these qualities are apparently mutually inconsistent is that optimum flexibility requires a multiplicity of strands or wires and of course the more strands or wires used, the smaller the diameter of the wires or strands will be. Generally speaking, however, the smaller wires or strands are more likely to break than heavier wires or strands. On the other hand, firmness of the core suggests a minimum number of strands of relatively heavier wire. Such a strand will be much less flexible.

The present invention solves the above outlined dilemma by a particular arrangement of wires and strands in the core and gives a core which provides better support for the main strands of the wire rope which is at the same time more flexible than conventional wire rope cores and which provides an increased metallic area for the total rope cross-section.

Referring now more particularly to FIG. 1 and FIG. 3, the core is that portion in the center of the figure within the circle **10**. The central element of this core may be a seven wire strand, as shown in FIG. 1, having the formula (1–6). This means that there is a central wire **11** surrounded by six wires **12**. It may also be a nine wire strand as shown in FIG. 3, having the formula (1–8). This means that there is a central wire **11***a* surrounded by eight wires **12***a*.

Around this central strand is an intermediate layer comprising eight solid wires **13** and around the intermediate layer is a covering layer of eight seven wire strands, each comprising a central wire **14** surrounded by six wires **15**. Thus the strands in the covering layer again have the formula (1–6). The formula for the core may thus be expressed as follows:

1(1–6)–8–8(1–6) *or* 1(1–8)–8–8(1–6)

It should be noted that the eight strands of the covering layer **15** can be seated in the valleys between the adjacent wires **13** of the intermediate layer and therefore they have the same pitch or lay and the entire core can be closed or assembled in one operation. This is highly advantageous in order to develop flexibility, resist fatigue and impact loading, and to provide a firmness to properly support the strands of the rope.

Comparing a standard 7 by 7 core with the core of the present invention, is should be noted that there is an additional strand in the intermediate layer composed of the strands **13**, and an additional strand in the covering layer composed of the strands **14–15**. These two additional strands give added support to the outer strands of the rope.

The construction of the present invention, and the additional strands, also make the core considerably more flexible than the standard 7 by 7 core now in general use. This results from the fact that the core is made up of more wires and more strands, laid in the same direction, rather than cross laid.

There have been special cores, some of which have been patented, which are made up in what is known as a two operation construction. Such cores are made in such a manner that the various elements are cross laid. When the elements are cross laid, areas of stress concentration are set up, and these cause fatigue failures of the wires at points of intersection. The present invention eliminates cross-laying of wires and thus overcomes the problem just described. The resulting wire rope has a greater strength for a given size and is much more flexible. There is also obtained the added advantage that the core may be made up in one operation.

Cores such as those described above in connection with FIG. 1 are excellent in wire rope up to about 2¾ inch outside diameter. In a larger diameter wire rope it may be desirable to substitute for the eight single wire elements of the intermediate layer eight seven wire strands having the formula (1–6) and the covering layer strands, instead of being seven wire strands, may be provided in the form of nineteen wire strands No matter what the composition of the strands, the core may still be closed or assembled in a single operation.

In FIG. 2 a typical wire rope of large diameter is shown wherein the central element **11***a* is a seven wire (1 x 6) strand and where the intermediate layer comprises eight seven wire strands having the formula (1–6)

and indicated generally at 13*a* and wherein the strands of the covering layer indicated generally by the circles 14*a* are nineteen wire strands of any desirable formula.

By comparing a core according to the present invention with conventional independent wire rope core, it will be found that the cross-sectional area of steel in the present core will be 6% to 10% greater, and it has been found that a core according to the present invention has, due to design and fabrication, about a 15% greater tensile strength than a conventional core.

A core according to the present invention is also considerably more flexible than a conventional core. A flexibility test generally used comprises leading the wire rope in a sinuous path over pulleys and running it back and forth in a sinuous path. A core according to the present invention will go from 20% to 30% more cycles than a conventional core.

A reduction in the tendency of the core to collapse and be crushed by the radially inward pressure of the wire rope strands is shown by the fact that the ropes will not show what is known as "adjacent strand notching" but will wear on the outside of the rope where the wear should take place and where the wear can be observed. "Adjacent strand notching" is not so readily apparent upon inspection but nevertheless weakens the rope and this problem is substantially eliminated with a core according to the present invention.

It will be clear that various modifications may be made without departing from the spirit of the invention and there is no intention therefore to limit the claims otherwise than as specifically set forth.

What is claimed is:

1. A wire rope core comprising a central multi-wire strand, and intermediate layer comprising eight elements closed around said central strand, and a covering layer of eight multi-wire strands closed around said intermediate layer, said intermediate and covering layers being closed around said central strand simultaneously, whereby the strands of the covering layer nestle in the valleys between the strands of the intermediate layer for maximum support.

2. A wire rope core according to claim **1**, wherein said central multi-wire strand has a central wire surrounded by six wires.

3. A wire rope core according to claim **1**, wherein said central multi-wire strand has a central wire surrounded by eight wires.

4. A wire rope core according to claim **1**, wherein said eight elements of intermediate layer are solid wires.

5. A wire rope core according to claim **1**, wherein each of the multi-wire strands of said covering layer has a central wire surrounded by six wires.

6. A wire rope core according to claim **1** wherein said central strand has a central wire surrounded by six wires, said intermediate layer consists of eight single wires, and said covering layer consists of eight strands, each having a central wire surrounded by six wires.

7. A wire rope core according to claim **1** wherein said central strand has a central wire surrounded by eight wires, said intermediate layer consists of eight single wires, and said covering layer consists of eight strands, each having a central wire surrounded by six wires.

8. A wire rope core according to claim **1** for wire rope of large diameter, wherein each of said eight elements of the intermediate layer has a central wire surrounded by six wires.

9. A wire rope core according to claim **1** for wire rope of large diameter, wherein each of the eight multi-wire strands of said covering layer comprises a nineteen wire strand.

10. A wire core according to claim **1** for wire rope of large diameter, wherein each of said eight elements of the intermediate layer has a central wire surrounded by six wires and each of the eight multi-wire strands of said covering layer comprises a nineteen wire strand.

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