July 29, 1969 J. C. OTTO ET AL 3,457,718

SWAGED ROPE

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Fig. 1.

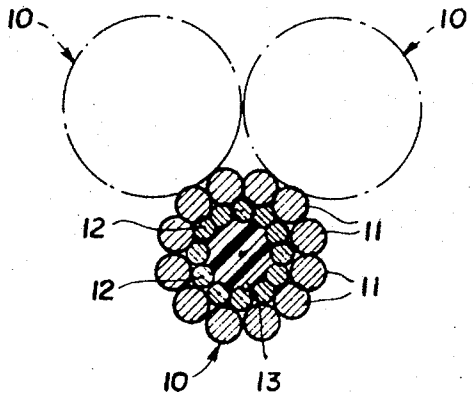
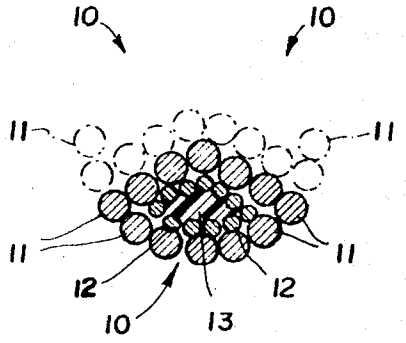


Fig. 2.



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SWAGED ROPE

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ABSTRACT OF THE DISCLOSURE

A method of manufacturing high density wire rope by forming the strands thereof with soft, pliant centers, laying the strands together to form a rope structure and compacting the structure by applying an inwardly directed radial force thereto.

This invention relates generally to wire rope and more particularly to high density wire rope of improved efficiency, strength and ductility.

In fabricating high density wire rope having a high strength to diameter ratio, the rope typically is compacted by swaging. Swaging results in substantial deformation of the individual metal wires which make up the rope to the extent that the wires, originally of circular cross-section, become polygonal in cross-section. This deformation and associated nicking and damaging of the wires are inherent in a swaging operation and adversely affect the tensile strength and ductility of the rope.

We have found that the undesirable effects of swaging can be minimized by forming the rope strands with soft, pliant cores and by swaging the rope in a manner so as to rearrange the wires into a closely packed configuration by displacement and deformation of the pliant cores with minimum deformation and damage to the wires.

It is an object of the invention to provide high density wire rope. It is another object of the invention to provide high density wire rope of improved efficiency, strength and ductility. It is a further object of the invention to provide such rope by compacting the rope with minimum deformation and damage to the individual wires. It is yet another object of the invention to provide such rope through the use of strands having soft, pliant cores of plastic and the like.

These and other objects and advantages of the invention will be more apparent from the following description of an embodiment of the invention with reference to the accompanying drawing in which:

FIGURE 1 is a cross-section of an embodiment of a wire rope structure according to the present invention with only one strand thereof being shown for ease of illustration.

FIGURE 2 is a cross-section of a high density wire rope compacted according to the present invention from the rope structure of FIGURE 1, again with only one strand thereof being shown.

In fabricating the rope structure of FIGURE 1, the three strands **10—10**, only one being illustrated since they are essentially alike, are first made by stranding the outer layer of wires **11—11** and inner layer of wires **12—12** uniformly about a central soft, pliant core element **13** of plastic rope such as polypropylene, nylon, polyvinyl or polyurethane or any material which can be readily deformed and displaced from the center of the strand upon compaction of the rope structure. The strands are then closed about one another. The rope is compacted to produce the high density structure of FIGURE 2 by a rotary swager which delivers a large number of quick, raidal, light blows spaced around the periphery of the rope as it is fed through the swager.

Because the centers **13** of the strands **10—10** are readily deformable and displaceable, compaction of the rope

into a high density structure can occur primarily by rearrangement of the wires **11—11** and **12—12** into a close-packed configuration through deformation and displacement of the plastic core material **13** and with minimum deformation and damage to the wires themselves. Thus the action of the swager reduces the diameter of the rope structure of FIGURE 1 to the diameter of the rope structure of FIGURE 2 by a rearrangement of the wires from the circular strand configuration of the former to the triangular strand configuration of the latter; and this occurs primarily by means of deformation and displacement of plastic material **13** with minimum deformation and damage to the individual wires. For ease of illustration, the wires of FIGURE 2 are shown as having undergone no deformation, but in fact they will deform somewhat. However, their deformation is substantially less than that which typically occurs in a swaging operation, and they essentially maintain their circular configuration.

As exemplary of the improved high density wire rope produced by the present invention, a ⅝" norminal diameter wire rope having three 21 wire strands with plastic cores and having an aggregate wire tensile strength of 51,354 pounds upon swaging to a metallic cross-sectional area of .2173 square inch has a tensile strength of 45,000 pounds for an efficiency of 87.8%. The ductility of the outer and inner wires after swaging as measured by the average torsions per 100 diameters is 15.3 turns and 24.5 turns, respectively. A similar ⅝", 3 x 21 wire rope having strands with wire cores rather than plastic cores and having an aggregate wire tensile strength of 55,422 pounds has a tensile strength of 43,400 pounds and a metallic cross-sectional area of .2557 square inch after swaging for an efficiency of 79.3%. The ductility of the outer and inner wires after swaging is 7.7 turns per 100 diameters and 17.0 turns per 100 diameters, respectively.

We claim:

1. A method of manufacturing wire rope comprising stranding a plurality of wires about a soft, pliant core element to form a strand, closing a plurality of such strands about one another to form a rope structure and compacting said rope strucure by applying an inwardly directed radial force thereto so as to rearrange the wires into a closely packed configuration with minimum deformation and damage to the wires.

2. The method of claim **1** wherein said compacting of said rope structure is accomplished by passing the rope through a rotary swager.

3. The method of claim **2** wherein said soft, pliant core element comprises a plastic selected from the group consisting of polypropylene, nylon, polyvinyl and polyurethane.

4. The method of claim **2** wherein said soft, pliant core element comprises a polypropylene rope.

5. The method of claim **4** wherein said rope structure is formed by closing three strands about one another.

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