March 15, 1966 J. J. GRIMES, JR., ET AL 3,240,570

STRANDED WIRE STRUCTURES AND METHOD OF MAKING THE SAME

Filed July 18, 1963 2 Sheets-Sheet 1

FIG. 1.

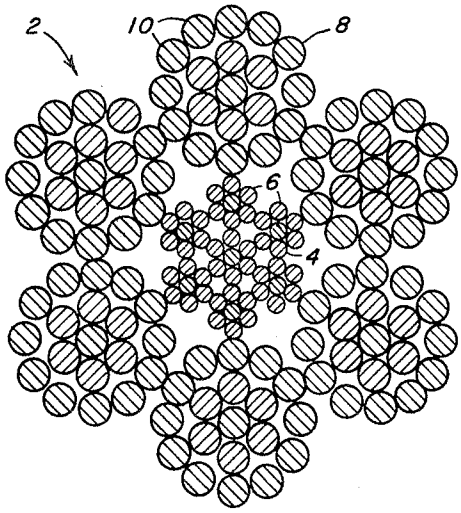


FIG. 2.

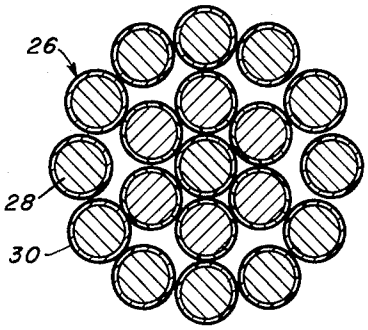
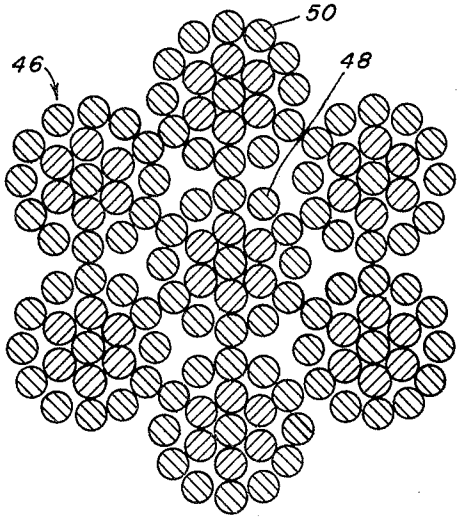


FIG. 3.



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Filed July 18, 1963 2 Sheets-Sheet 2

FIG. 4.

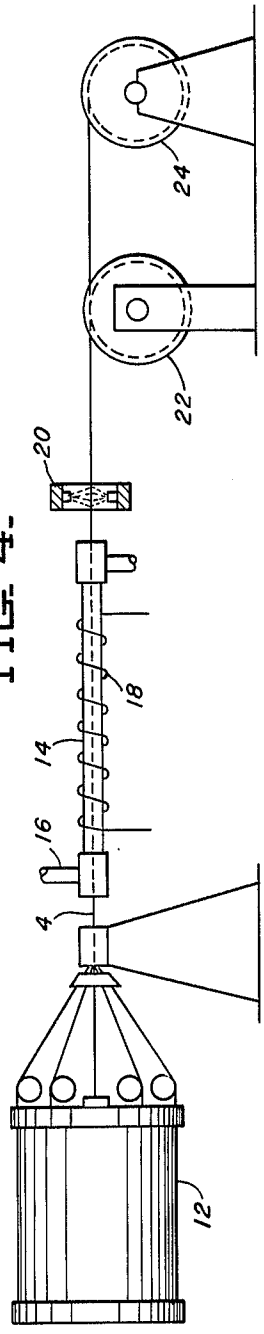


FIG. 5.

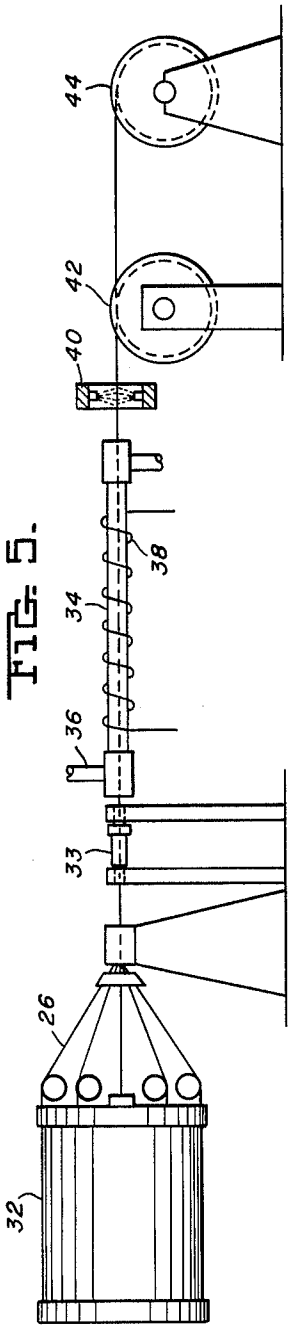
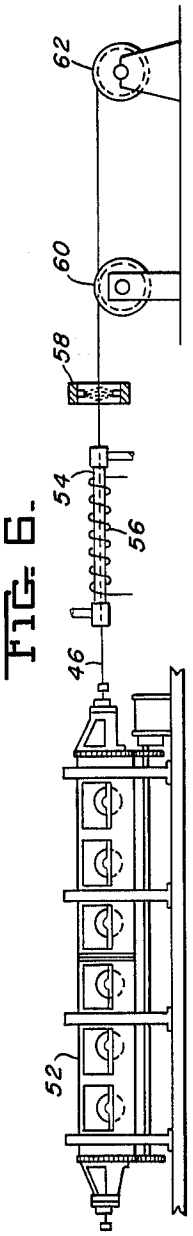


FIG. 6.



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United States Patent Office 3,240,570 Patented Mar. 15, 1966

3,240,570

STRANDED WIRE STRUCTURES AND METHOD OF MAKING THE SAME

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Filed July 18, 1963, Ser. No. 296,043
14 Claims. (Cl. 29—191.6)

This invention relates to stranded wire structure and to a method of making the same. The invention is particularly directed to stranded wire structures made of steel wires. In one type of stranded wire structure which has an independent wire rope core with strands surrounding it, the core is made of lower strength and more ductile wires such as mild plow steel whereas the outer strands are made of higher strength less ductile wires such as plow steel. This increases the cost of the wire rope because more types of wire and billets must be provided and stored. The foregoing is also true of stranded wire structures having a strand core and individual wires surrounding the core. The core is also normally difficult to straighten and we have determined how to straighten the core and at the same time obtain the desired physical characteristics thereof with the same material as used in the outer wires or strands. In making the stranded wire structure having a strand core and individual wires surrounding the core the steel wires may be coated with zinc or aluminum. This creates an additional problem in that the tension required to straighten the strand caused the wires to pull down through the coating metal and reduce the diameter of the strand.

In making wire rope in which the strands are made in a conventional strander a residual twist is created in the wires making up the strand. This residual twist causes the strands to unwind or untwist when not restrained. The magnitude of the residual twist in the strand varies with the type, size and speed of the strander as well as the amount of back tension on the spools. The back tension will vary as the wire is paid off. Starting and stopping the strander for spool changes also has an effect on the strand. Since the rope maker cannot compensate continually for all these variables, the final stranded structure has variable twist properties. When the rope is laid, the magnitude of the twist in the strands affects the setting required for preforming and since the twist is variable the uniformity of preforming is affected. When making Lang Lay ropes there is a tendency for the rope strands to unwind. Making Lang Lay rope is ordinarily done on a planetary strander on which the spools of wire are placed in cradles at the periphery of the rotor of the strander and rotate with it. Since the cradles rotate about their own axis they impart a twist to the individual wires which provides a tightening twist in the individual wires tending to offset the loosening of the wires in the laying operation. Basically this consists of twisting the strand a fixed amount in the direction of stranding. However, since the residual twist in the strand is not uniform the foreturned product is also not uniform.

It is therefore an object of our invention to provide stranded wire structures having a straight core with the desired physical characteristics in which the same steel analysis is used for the outer wires as for the core wires.

Another object is to provide such a stranded wire structure in which the wires are coated with zinc or aluminum.

A further object is to provide a wire rope which is more uniform along its length than previous ropes.

A still further object is to provide methods of making such stranded wire structures.

These and other objects will be more apparent after

referring to the following specifications and attached drawings, in which:

FIGURE 1 is a cross sectional view of a wire rope having an independent wire rope core;

FIGURE 2 is a cross sectional view of a stranded wire structure having a strand core and individual wires surrounding the core;

FIGURE 3 is a cross sectional view of a rope having a strand core;

FIGURE 4 is a schematic view of apparatus used in the practice of our invention;

FIGURE 5 is a view similar to FIGURE 4 showing other apparatus used in the practice of our invention; and

FIGURE 6 is a view similar to FIGURE 4 showing still another apparatus used in the practice of our invention.

Referring more particularly to FIGURE 1 of the drawings, reference numeral 2 indicates a wire rope having an independent wire rope core 4 made of steel wires 6. Six strands 8 surround the core 4 and are made of steel wires 10 which preferably have the same composition as the wires 6. In making up the wire rope 2 the strands of the independent wire rope core 4 are formed in the usual manner. The independent wire rope core is then made in the apparatus of FIGURE 4. This includes a standard strander 12 which supports the strands of the independent wire rope core and strands them together to form the core 4. The core 4 is then threaded through a conduit 14 which has an inlet 16 for nitrogen or other gas. The core 4 is heated by means of an induction coil 18 which surrounds the conduit 14. Depending upon the type of steel used the temperature to which the core is heated may vary from 650 to 1150° F. when using carbon steel to temperatures as high as 1300° F. when using stainless steel. Immediately after leaving the conduit 14 the core 4 is quenched by passing it through a water spray 20. The core then passes around a capstan 22 to a reel 24. A temperature of 750° F. has proved to be suitable when using Monitor steel. Strands 8 which have been made in the usual manner are then stranded around the core 4, also in apparatus such as shown in FIGURE 4. However, in stress relieving the entire rope 2 it is heated to a temperature between 50 and 300° F. less than the temperature at which the core was heated. A temperature of 650° F. has proved satisfactory in making the Monitor rope described above. Regardless of whether the rope is made from one or more grades of steel the stress relieving of the core at a higher temperature than that of the entire rope increases the ductility and elongation of the core. We have also found that this increased ductility and elongation increases the overall strength of the core although the strength of the individual wires is decreased. The overall strength of the rope is also increased. We believe this to be due to the greater elongation property of the core and also because the strength of the outer strands 8 is greater due to the lower temperature used in stress relieving them. The core will also be straighter than if not stress relieved.

In the embodiment of our invention shown in FIGURE 2 a nineteen wire strand 26 is made up of steel wires 28 coated with a zinc or aluminum coating 30, the thickness of the coating 30 being exaggerated for the purpose of illustration. In making up the strand, seven central wires 28 are stranded together in the strander 32 of FIGURE 5. The strand so formed is passed through a standard rotary straightener 33 which may be of the type shown in Greiner Patent No. 1,032,823 dated July 16, 1912 or Sleeper Patent No. 1,594,570 dated August 3, 1926. The strand is then fed through a conduit 34 which has an inlet 36 for the inert gas where it is heated by means of an induction coil 38. The stress relieving temperature will

be the same as that described above for the independent wire rope core of FIGURE 1. Immediately after leaving the conduit 34 the core is quenched by passing it through a water spray 40. The strand then passes around a capstan 42 to a reel 44. This results in a very straight seven wire core which has the residual twist removed therefrom and an elastic limit higher than without the stress relieving. Twelve cover wires are then stranded about the core in apparatus such as shown in FIGURE 4 with the resultant strand being stress relieved at a temperature between 50 and 300° F. less than the stress relieving temperature of the seven wire core. This produces a straight strand with good control of size and a minimum of mechanical abuse to the coating.

FIGURE 3 shows an embodiment of our invention in which a rope 46 is made up of a core strand 48 and six outer strands 50. In making up this rope the strands 48 and 50 are formed in apparatus such as shown in FIGURE 4 and are stress relieved at a temperature between 600 and 850° F. when made of carbon steel and a temperature between 800 and 1150° F. when made of stainless steel. The strands 48 and 50 are then laid up in the usual manner in a conventional strander such as a Larmuth strander shown in Larmuth Patent No. 1,870,290 dated August 9, 1932, or in a planetary strander such as shown in Rairden Patent No. 1,892,632 dated December 27, 1932, or Reardon Patent No. 2,319,827 dated May 25, 1943. A Larmuth strander 52 is shown in FIGURE 6. It will be understood that the strands are mechanically formed in the strander in the usual manner prior to being stranded together. The completed rope passes from the strander 52 through a conduit 54 surrounded by an induction coil 56 and hence through a water spray 58 and around a capstan 60 to a reel 62. The core strand 48 is preferably stress relieved at a higher temperature than the outer strands 50 and the entire rope stress relieved at a lower temperature than the center strand as in the embodiment of FIGURE 1. We have found that this method provides strands which are inert or free of residual twist throughout their length and that the fixed mechanical forming applied thereto by preforming, foreturning or backturning will be much more uniform than when using the ordinary strands. The entire rope is also more uniform in lay than a conventionally formed rope.

While several embodiments of our invention have been shown and described it will be apparent that other modifications and adaptations may be made without departing from the scope of the following claims.

We claim:

1. The method of making a stranded steel wire structure which comprises making an independent steel wire rope core, stress relieving said core at a temperature between 650 and 1150° F., then stranding additional steel wires around the core to form the stranded wire structure, and then stress relieving the entire stranded wire structure at a temperature between 50 and 300° less than the core.

2. The method of making a stranded steel wire structure according to claim 1 in which the additional wires are a plurality of strands.

3. The method of making a stranded wire structure which comprises providing steel wires coated with a metal of the class consisting of zinc and aluminum, stranding a plurality of said wires together to form a center core, straightening said center core by subjecting it to a stress relieving temperature between 650 and 750° F. under tension, then stranding a plurality of said wires around said center core to form said stranded wire structure, and then stress relieving said stranded wire structure at a temperature between 50 and 300° less than the first stress relieving temperature.

4. The method of making a stranded wire structure which comprises providing steel wires coated with a metal of the class consisting of zinc and aluminum, stranding seven of said wires together to form a center core, straightening said center core by subjecting it to a stress relieving temperature between 650 and 750° F. under tension, then stranding twelve of said wires around said center core to form said stranded wire structure, and then stress relieving said stranded wire structure at a temperature between 50 and 300° less than the first stress relieving temperature.

5. The method of making a wire rope which comprises making a plurality of steel wire strands, stress relieving said wire strands at a temperature between 650 and 1150° F., mechanical forming said stress relieved strands, and stranding said mechanically formed strands around a core.

6. The method of making a wire rope which comprises making a plurality of steel wire strands, stress relieving said wire strands with one of said strands being stress relieved at a temperature between 650 and 1150° F. and the remaining strands being stress relieved at a temperature between 50 and 300° less than the said one strand, and then stranding the said remaining strands around said one strand to form said rope.

7. A stress relieved stranded steel wire structure comprising a stranded wire core, and a plurality of wires stranded around said core, said core having greater ductility and strength than said plurality of wires.

8. A stress relieved stranded steel wire structure according to claim 7 in which the plurality of wires are a number of strands.

9. A stress relieved stranded steel wire structure according to claim 7 in which all of the wires have substantially the same analysis.

10. A stress relieved stranded wire structure according to claim 7 in which the wires are coated with a metal of the class consisting of zinc and aluminum.

11. A stress relieved stranded steel wire structure comprising an independent wire rope core, and a plurality of strands stranded around said core, said core having greater ductility and strength than said strands.

12. A stress relieved stranded steel wire structure according to claim 11 in which core and strands have substantially the same analysis.

13. A rope comprising a stranded wire core, and a plurality of stress relieved steel strands stranded around said core, said strands being mechanically formed.

14. The method of making a stranded wire structure which comprises providing a core of steel wires, stress relieving said core at a temperature between 650 and 1150° F., then stranding additional steel wires around the core to form the stranded wire structure, and then stress relieving the entire stranded wire structure at a temperature between 50 and 300° less than the core.

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