106-84 CROSS REFERENCE EXAMINER
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May 30, 1950 H. A. TOULMIN, JR., ET AL 2,509,894

WIRE ROPE AND PROCESS OF MANUFACTURING SAME

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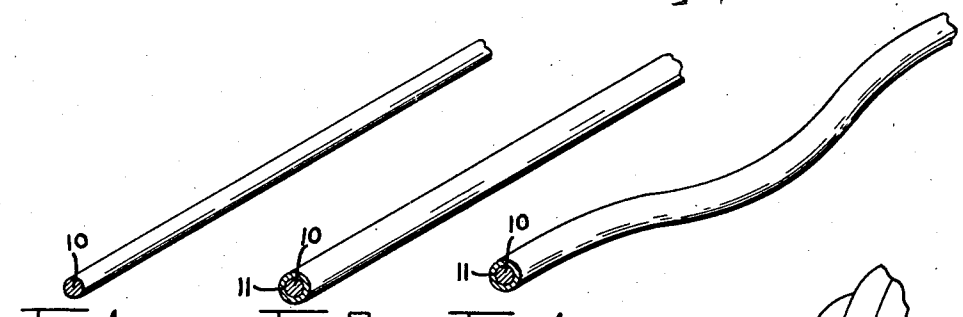


Fig. 1 Fig. 2 Fig. 4

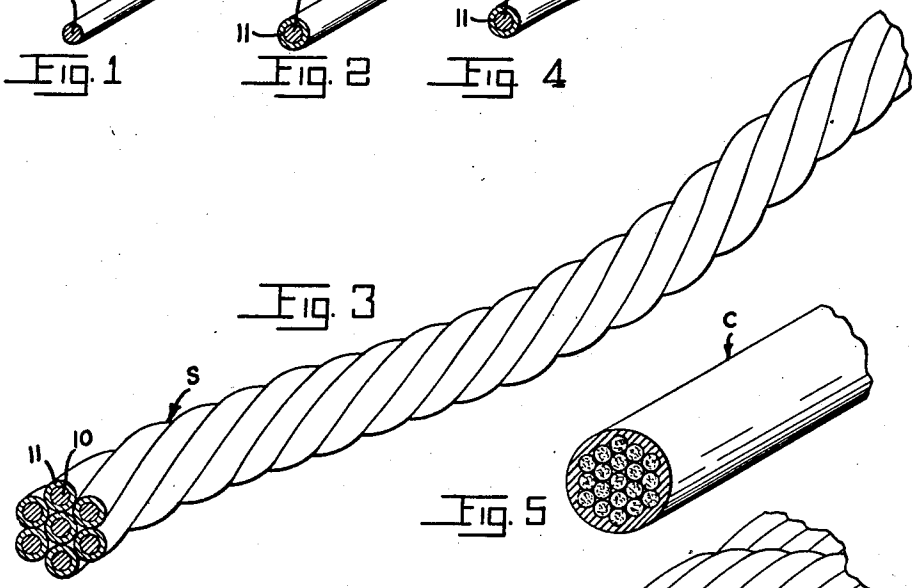


Fig. 3

Fig. 5

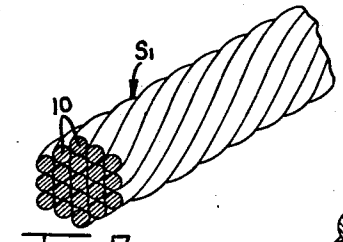


Fig. 7

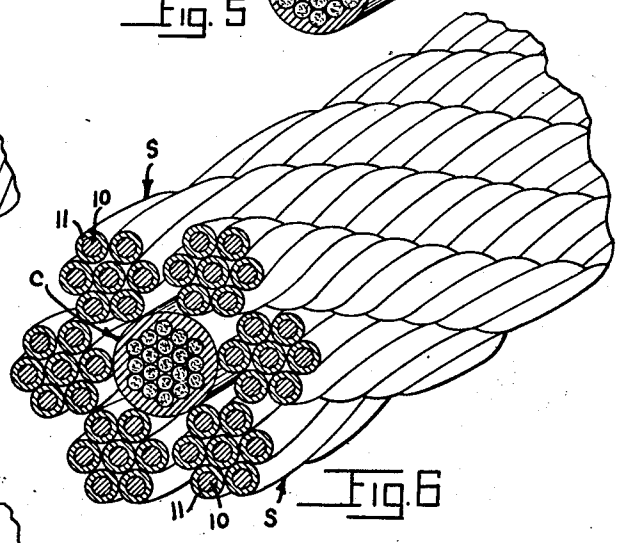


Fig. 6

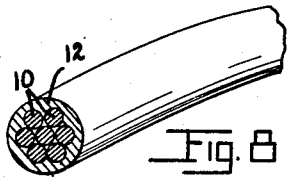


Fig. 8

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WIRE ROPE AND PROCESS OF MANUFACTURING SAME

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Application March 22, 1948, Serial No. 16,343

12 Claims. (Cl. 57—149) 47

1

The present invention deals with wire rope, and is concerned primarily with a wire rope of novel construction, together with a process of achieving this construction.

Wire rope, such as is now meeting with present day usage, ordinarily includes a plurality of strands each of which is of a multiple wire construction. While there are some ropes which consist solely of the wire strands, the type of wire rope which is meeting with more widespread usage includes a hempen core with the multiple wire strands twisted thereabout. In any event and regardless of the particular type of wire rope, when a wire rope is subjected to the actual conditions of service usage it undergoes a certain amount of flexing. This means that adjacent wires and strands rub against one another with a resulting deterioration of the wire. Moreover, under many conditions of service usage, the rope is exposed to weather and other deleterious factors which have a tendency to attack and impair the rope structure.

With the foregoing conditions in mind, the present invention has in view as a highly important objective the provision of a new and improved rope structure, in which each component wire is provided with a coating which functions not only as a protective coating for the wire, but also as a lubricant to resist wear as an incident to movement between the adjacent wires.

There has recently become available to the public a coating material which consists essentially of a finely comminuted zinc that is suspended in sodium silicate. Such a coating composition is described in the application of Alexander McDonald, Serial No. 709,770, filed November 14, 1946, and entitled "Improvements in and relating to coating compositions."

Another highly improved object of the present invention is to provide a wire rope in which each wire is coated with the coating material of said patent application and which consists essentially of finely comminuted zinc suspended in sodium silicate.

In some instances it may be practical to coat each strand of a wire rope rather than each individual wire. Accordingly, a further object of the invention is to provide a wire rope including a plurality of strands each of which is covered by a protective coating of finely comminuted zinc suspended in sodium silicate.

While highly desired results may be achieved by coating only the wires or the wire strands, the invention also contemplates the covering of

2

the hempen core with the protective coating. It is evident that there is a certain amount of relative movement between the core and the adjacent strands which results in wear of the core. Hence another highly important object of the present invention is the provision of a wire rope including a core of hemp or other comparable fibrous material which is covered and impregnated with a protective coating of the character aforesaid.

Still another object of the present invention lies in the provision of a process of manufacturing wire rope, and which process includes the step of coating each individual wire before the wires have been twisted into a strand. A fibrous core is also treated with the protective coating, after which the core and the several strands are twisted into the final rope product.

In a slightly modified form of the invention a plurality of wires are first twisted into a strand. Each strand is then treated with the protective coating, after which the strand, together with a similarly treated fibrous core, is twisted into the final rope product.

In accordance with recent developments in the wire rope industry, the use of so-called "preformed" wire rope is becoming more and more widespread. In a pre-formed wire rope each strand is subject to a pre-forming operation which imparts to the strand and individual wires thereof, the shape or twist which it is to have in the final product. The present invention particularly lends itself to rope making operations which result in pre-formed wire rope, because the protective coating provided hereby particularly lends itself to the pre-forming operations.

Accordingly, a further object of the invention is the provision of a process for producing wire rope which includes the steps of first treating a plurality of individual wires with a coating composition consisting of finely comminuted zinc suspended in sodium silicate, setting the coating by heating, twisting a plurality of wires into a strand, pre-forming each strand to impart thereto the shape it is to assume in the final product, and then twisting several strands into the final rope construction.

Another object of the invention is the provision of a method of making wire rope of the character aforesaid which includes the step of thoroughly cleaning the wire prior to the application of the coating. This may be accomplished by subjecting the wire to an acid bath, washing, and sand blasting. Obviously, other cleaning methods could be employed.

Various other more detailed objects and advantages of the invention, such as arise in connection with carrying out the above noted ideas in practical embodiments will, in part, become apparent and, in part be hereinafter stated as the description of the invention proceeds.

The invention, therefore, comprises a wire rope made up of a fibrous core and a plurality of multiple wire strands, with each wire and the core treated with a protective coating consisting of finely divided zinc suspended in sodium silicate. The invention also includes a process of producing a wire rope having these structural characteristics.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings wherein:

Figure 1 is a perspective view of a wire prior to the application of the protective coating thereto,

Figure 2 is a view similar to Figure 1, showing the wire with the protective coating thereon,

Figure 3 shows several of the wires of Figure 2 twisted into a strand, and with the strand preformed,

Figure 4 shows the condition of one of the wires of the strand of Figure 3 if it is removed therefrom,

Figure 5 is a perspective view of a fibrous core as it has been impregnated and coated with the protective composition,

Figure 6 is an enlarged, detailed perspective of a wire rope made in accordance with the principles of this invention,

Figure 7 is a perspective view showing one step of a modification in which the wires are twisted into a strand before covering, and

Figure 8 shows the strand of Figure 7 as treated with the protective coating.

Before describing the steps constituting the methods which may be employed to produce wire rope in accordance with the precepts of this invention, attention is first called to the exact nature of the coating material which is to be employed.

Such a coating composition consists essentially of a finely divided or comminuted material, such as zinc, lead, aluminum, magnesium, cadmium, or alloys thereof. This finely divided material is combined with sodium silicate, in which the ratio of sodium oxide to silica is approximately 1:2.6. This composition is essentially a suspension.

If desired, certain lead compounds may be added to this basic composition to incorporate desirable properties thereinto. Thus, if red lead be added, the attack of zinc by the alkali is delayed. Other lead compounds which may be added are lead chromate, litharge and white lead. In all cases the metallic dust which is employed in the basic composition must be finely comminuted, the average particle size should be no greater than three microns. This feature of the fine nature of the particles is highly important, as it is believed that many of the desirable properties of the coating are derived from this factor. The following are given as a few examples of a coating material which is suitable to the method and products of the present invention:

EXAMPLE I

Sodium silicate of ratio $Na_2O:SiO_2$ of 1:2.6	milliliters 30
Zinc dust	grammes 100

EXAMPLE II

Red lead	ozs 8
Lead chromate	ozs 4
Sodium silicate of ratio $Na_2O:SiO_2$ of 1:2.6	pts 6
Mix thoroughly and add: Superfine zinc powder	lbs 21

EXAMPLE III

Red lead	grammes 7
Lead chromate	do 5
Zinc dust	do 163
Sodium silicate having the ratio of $Na_2O:SiO_2$ of from 1:2.3 to 1:3.0	milliliters 31

Assuming that an appropriate coating material of the above described is available, certain novel methods of producing wire rope will now be described.

It will be assumed that an adequate supply of steel wire of the type found suitable, as used in the wire rope industry, is available. Such a steel wire is shown at 10 in Figure 1. Before the wire 10 is coated by any of the compositions above described it is subjected to a thorough cleansing operation. This coating may be carried out either by dipping, spraying, or the use of an implement such as a brush. After it has been applied it must be set and this invention contemplates setting by heating for a required length of time at a prescribed temperature. Both the temperature and the time may vary within fairly wide limits, however, it is noted that a time period ranging from a few minutes to one hour may be employed with a temperature of about 250° F. The coating is shown in a somewhat exaggerated manner at 11 in Figure 2.

A plurality of the coated wires are now twisted into a strand which is identified at "S" in Figure 3. Obviously, each complete rope will include a plurality of these strands "S," the number varying with the specification of each particular rope.

In the preferred form of the invention, each strand is now subjected to a pre-forming operation which will cause it to assume the formation depicted in Figure 3 and which is the same shape it will have in the final rope product. It will be noted that if, after this pre-forming step is carried out, and a wire is removed from the strand "S," this wire will have the shape illustrated in Figure 4.

A fibrous core is referred to in its entirety by the reference character "C." Such a core is shown in Figure 5 and this core will preferably be made from hemp or other appropriate fibrous material. The core "C" is also treated with any of the coating compositions above described, and this composition will impregnate and cover the hempen fibers. After the core "C" has been covered by the coated composition the latter is set by heating in the manner above described.

The core "C," together with the plurality of the strands "S," are now twisted into the ultimate rope product, which is shown in Figure 6. In this form of the invention, six strands "S" are illustrated. Obviously, this particular number is intended as no limitation on the invention as it may be varied as the occasion demands.

Following well accepted principles in the rope making industry, the several strands "S" will be twisted in the direction that is opposite or reverse to the twisting of each wire in the individual strand. This affords stability in the final product.

CROSS REFERENCE EXAMINER

Modification

In a modified form of the invention, a plurality of the wires 10 in their uncoated condition may be first twisted into a strand such as shown in Figure 7. This strand is identified by the reference character "S_1". The strand "S_1" is now covered by the coating composition as above described and which is shown at 12 in Figure 8. The coating is then set by heating at a proper temperature and for a prescribed period as above indicated.

A required number of the strand S_1, together with a coated core "C" are then twisted into the final product.

Second modification

In another modification of the invention, each wire 10 is first covered with a protective coating 11, as above described. After this coating has been applied, each wire may then be pre-formed into the shape shown in Figure 4. The several pre-formed wires are then twisted into a strand which will have the characteristics of pre-formed strands as shown in Figure 3. Several of these pre-formed strands are then twisted about core C to achieve the final rope construction.

Irrespective of which method is employed to produce the final product, it will be noted that a wire rope which is made in accordance with the principles of this invention will have the ability to withstand wear over long periods of service usage, because the protective coating for the wires and core performs two distinct functions. It protects the wire against corrosion and attack by weather or other elements to which the rope may be subjected, and it also acts as a lubricant to minimize friction between the adjacent parts due to flexing of the rope. Moreover, wire rope may be used in places where it is subjected to the action of corrosive materials and still exhibit a long service life.

While preferred specific embodiments of the invention are hereinbefore set forth, it is to be clearly understood that the invention is not to be limited to the exact construction, materials, and steps illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

What is claimed is:

1. In the production of wire rope a method comprising the steps of first covering each of a plurality of wires with a composition of finely comminuted zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating at a prescribed temperature for a predetermined length of time, twisting said coated wires into a strand, preforming a plurality of said strands, and then twisting a plurality of said strands into a rope.

2. In the production of wire rope, a method comprising the steps of first preparing a fibrous core by impregnating and covering it with a composition of finely comminuted zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said covering by heating, coating each of a plurality of wires with a composition of finely comminuted zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating, twisting a plurality of said wires to form a required number of strands, and then twisting said strands about said core.

3. In the production of wire rope, a method

comprising the steps of coating a wire with a composition of finely divided zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating, twisting a plurality of said coated wires into a strand, preforming a plurality of said strands, and then twisting a plurality of pre-formed strands into a rope.

4. In the production of wire rope, a method comprising the steps of twisting a plurality of wires into a strand, covering said strand with a composition of finely divided zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating, preforming a plurality of said strands and then twisting a plurality of said strands into a rope.

5. In the production of wire rope, a method comprising the steps of first preparing a fibrous core by impregnating and covering said core with a composition of finely divided zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating, twisting a plurality of wires into a strand, coating said strand with a composition of finely divided zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating, and then twisting a plurality of said coated strands about said coated core.

6. In the production of wire rope, a method comprising the steps of first preparing a hempen core by impregnating and covering with a composition of finely comminuted zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating at 250° F., coating of each of a plurality of wires with a composition of finely divided zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating on the wire by heating to a temperature of about 250° F., twisting a plurality of said wires into a strand, pre-forming a plurality of such strands, and then twisting a plurality of said pre-formed strands about said coated core.

7. In the production of wire rope, a method including the steps of first cleaning each of a plurality of wires, coating each of said plurality of wires with a protective coating of finely divided zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating, twisting said wires into a strand, and then twisting a plurality of said strands into a rope.

8. In the production of wire rope a method comprising the steps of first cleaning each of a plurality of wires, covering each of said cleaned wires with a composition of finely comminuted zinc of an average particle size of 3 microns or less suspended in sodium silicate, setting said coating by heating at a prescribed temperature for a predetermined length of time, twisting said coated wires into a strand, and then twisting a plurality of said strands into a rope.

9. In a wire rope, having a self-hardening anti-corrosion coating, the combination of a plurality of wires covered by a protective and lubricating coating comprising a mixture of super fine zinc dust of an average particle size of three microns or less and sodium silicate having a ratio of $Na_2O:SiO_2$ of 1:2.3 to 1:3.0 whereby the rope has a self-drying stable, non-porous film protecting the wires of the wire rope.

10. In a wire rope, having a self-hardening anti-corrosion coating, the combination of a plu-

rality of stranded steel wires covered by a protective and lubricating coating comprising a mixture of super fine zinc dust of an average particle size of three microns or less and sodium silicate having a ratio of $Na_2O:SiO_2$ of 1:2.3 to 1:3.0 and lead chromate whereby the rope has a self-drying stable, non-porous film protecting the wires of the wire rope.

11. In a wire rope, having a self-hardening anti-corrosion coating, the combination of a twisted fibrous core and a plurality of twisted strands surrounding said core, each of said strands being composed of a plurality of wires covered by a protective and lubricating coating comprising a mixture of super fine zinc dust of an average particle size of three microns or less and sodium silicate having a ratio of $Na_2O:SiO_2$ of 1:2.3 to 1:3.0 and lead chromate whereby the rope has a self-drying stable, non-porous film protecting the wires of the wire rope.

12. In a wire rope, having a self-hardening anti-corrosion coating, a combination of a fibrous core composed of fibrous material impregnated with a coating composition, a plurality of wires surrounding said core, said wires being covered by a protective and lubricating coating comprising a mixture of super fine zinc dust of an average particle size of three microns or less and sodium silicate having a ratio of $Na_2O:SiO_2$ of 1:2.3 to 1:3.0 and lead chromate whereby the rope has a self-drying stable, non-porous film protecting the wires of the wire rope.

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