

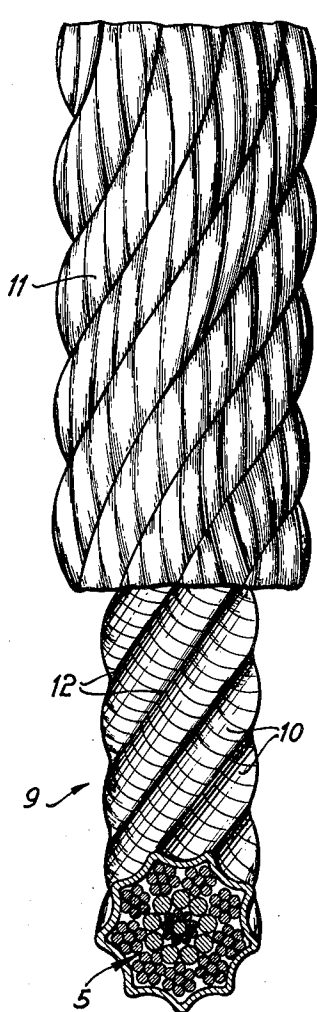
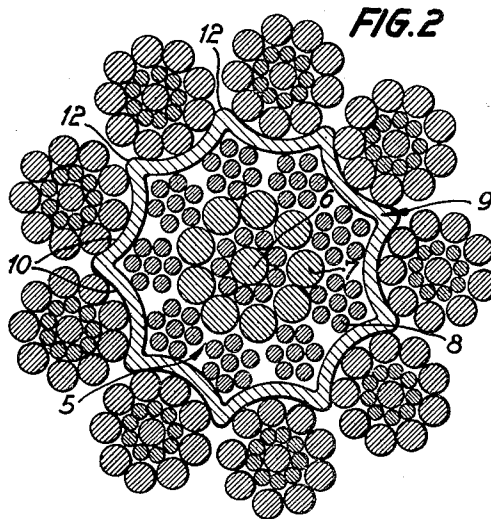
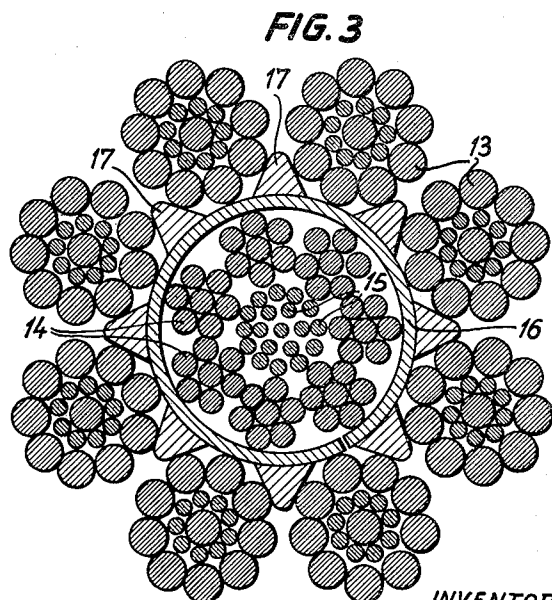
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WIRE ROPES

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3,018,607 WIRE ROPES

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This invention relates to wire ropes, at least the outer covers of which are of stranded form. As a rule, such ropes have a hemp or steel core which may be separated from the outer strands by an intermediate layer of strands.

Wire ropes must comply with two main requirements in addition to having sufficient mechanical strength. Firstly, there should be no crossing of wires, for the stresses occurring when the rope is in use then rapidly lead to notching of the wires and therefore to early wear. Secondly, the rope must not become unlaidd when loaded without being guided, for instance, when used on a rotary tower crane. The rope elements or strands extend helically and therefore tend when in tension to straighten—i.e., to increasingly reduce the radius of their spiral. In other words, the strands tend to move towards the rope axis and to come closer to one another. Since the design of the rope makes it almost impossible for the strands to shift in this way, the rope tends to become unlaidd.

Many methods have been tried to reduce wire crossings and rope twist but they have usually conflicted with other requirements. For instance, it may well be desirable for the pitch of the inner stranded layers to be greater than the pitch of the outer layer, to ensure satisfactory stretching, but wire crossings then become almost inevitable. Wire crossings occur to a very considerable extent in the case of stranded spiral ropes devoid of load twist, for the inner and outer stranded layers of such ropes must be laid in opposite directions to one another.

A known proposal to obviate these difficulties is to wind a protective layer of flat wire around the inner stranded layer or around the rope core, whereafter the protective layer may or may not be provided with special spiral ridges adapted to engage between the various strands of the outer stranded layer to prevent lateral contact between the last-mentioned strands. Since the flat wire covering is relatively soft, however, the forces applied to the rope deform the same and may, of course, impair the spiral ridges.

The wire rope according to this invention is devised with the same object of obviating wire crossings but also ensures that the unguided rope will not become unlaidd when loaded. To achieve this purpose, the invention starts from a known rope construction comprising a core, an inner stranded layer, a protective layer thereabout and an outer stranded layer with spiral ridges engaging between the outer strands. In the improved rope construction according to the invention, the spiral ridges are peripherally connected unyieldingly to a non-distorting protective layer surrounding the inner stranded layer.

By proceeding in the manner according to the invention, not only is a satisfactory solution provided for the problem of wire crossings but also a completely non-twisting rope is provided, for the outer strands which exert a thrust on the core when the rope is loaded can neither deform the protective layer nor move beyond the firm spiral ridges in the manner required for the rope to become unlaidd.

The invention can be embodied in a variety of ways. For instance, a firm protective layer of flat wire can be wound around the inner stranded layer or rope core and formed with grooves corresponding in number, helix and pitch to the outer strands. The pressing of the grooves into the flat wire cover leads to the production between the grooves of the required spiral ridges which extend between the outer strands. Depending upon requirements,

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the flat wire can be wound around the rope core either with the same twist as the grooves or with an opposite twist. In another very useful embodiment of the invention, the spiral ridges are placed in separable manner upon the protective layer of the rope core but are non-releasably connected thereto.

Moreover, although the protective layer is usually placed between an inner and an outer stranded layer, the protective layer could be laid directly around the rope core. In such a case, as in the other embodiments of the invention, a plastic protective layer with the spiral ridges formed on it directly could be used instead of a metal protective layer.

Reference will now be made to the drawings wherein: FIGURE 1 diagrammatically illustrates a rope according to the invention with some of the outer stranded layer omitted;

FIGURE 2 is a diagrammatic cross-section through the two-layer stranded spiral rope shown in FIGURE 1, and

FIGURE 3 is a diagrammatic cross-section through another embodiment of the invention.

In FIGURE 1, the reference 5 applies to the whole of a rope core which, in the example illustrated in FIGURE 2, comprises a core strand 6 (1+9 wires), a protective layer 7 and an inner stranded layer 8. A flat wire 9 is wound around the complete structure with a relatively reduced pitch so that the whole rope core is inside a covering wound around it.

The cover 9 is formed, independently of the lay and pitch of the inner strands 8, with grooves 10 which, in the example illustrated in FIGURE 1, have an opposite lay to the lay of the strip 9 and correspond in number, pitch and lay to the outer strands 11 stranded on the core. The actual design of the outer layers is of no importance for the invention and they could be individual wires, for instance, round wires or shaped wires. The outer strands 11 lie in the grooves 10 which are with advantage given a radius of curvature adapted to the radius of curvature of the outer strands 11.

A ridge 12 is left between adjacent grooves 10 and is so designed that two adjacent outer strands 11 cannot engage with one another laterally or at least cannot notch one another when subjected to pressure.

Of course, a flat wire layer, as 9, could be provided elsewhere, for instance, between the inner stranded layer 8 and the wires 7. Conveniently, the flat wire layer will always be applied to the rope core or the like during the complete stranding operation and will be simultaneously formed with the grooves 10.

The example shown in FIGURE 3 is a Seale's rope in which the outer strands 13 are laid in the same direction as the inner strands 14. The same co-operate with a wire insert 15 to form a rope core surrounded externally by a flat wire cover 16. Rigidly secured thereto are spiral ridges of dimensions and arrangement such as to engage between the outer strands 13. When such a rope is pulled without being guided, the outer strands 13 tend to press concentrically inwards, but since the core 14, 15 cannot yield, the rope would become unlaidd if it were not that the outer strands, as they try to unwind from the core, abut with the spiral ridges 17.

If the protective layer of the rope according to the invention consists of a flat wire cover 17, the wire used could be, for instance, about 1.0-1.2 mm. thick and about 2.0-2.5 mm. wide. As already mentioned, instead of a flat wire cover a protective plastic layer can be used which is sprayed on to the core directly and on which the required spiral ridges are formed.

If required, this idea could be carried further and the inner stranded layer omitted entirely; instead, the rope

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core and spiral ridges could be formed in unitary manner of plastic.

It is immaterial for the invention how the rope core and outer stranded layer are disposed. The strands of the core and of the outer layer can be stranded in the same direction using, for instance, a parallel lay for the inner strands and a cross-lay for the outer strands. Alternatively, the inner and outer strands could be stranded in opposite directions to one another, in which case it is advantageous if the flat wire protective layer between the inner strands and outer strands is given a short length of lay independently of the pitch of the rope elements contiguous with the protective layer, since the elasticity of the cover is increased and therefore the cover remains closed even when the rope is bent considerably.

Of course, using the inventive idea ropes free from a load twist can be provided which have relatively few outer strands and can therefore have wires of any required thickness; this step ensures that the ropes always have an appropriate outer strength.

In the drawings the spiral ridges are shown as being of roughly triangular cross-section, but other cross-sections can be used provided that the ridges can engage appropriately between the outer strands and serve as a fixed abutment therefor to prevent the rope from becoming unlaidd.

What we claim is:

1. A helical stranded wire rope comprising a core section, a protective layer covering and confining said core section, and an outer layer of wire strands helically laid on said protective layer, said protective layer being non-deformable by strains on the rope and being formed peripherally with a series of rigid helical ridges respectively lying between and holding separate the adjacent strands of said outer layer so that no notching contact can occur between said wire strands and the rope cannot untwist under strain.

2. A helical stranded wire rope comprising a core section, a protective layer covering and confining said core section, and an outer layer of wire strands helically laid on said protective layer, said protective layer being non-deformable by strains on the rope and being formed peripherally with a series of rigid helical ridges respectively lying between and holding separate the adjacent strands of said outer layer so that no notching contact can occur between said wire strands and the rope cannot twist under strain, said protective layer defining between said ridges helical grooves conforming in cross-section to the curvature of said wire strands, said wire strands being laid in said grooves.

3. A helical stranded wire rope comprising a core section, a protective layer covering and confining said core section, and an outer layer of wire strands helically laid on said protective layer, said protective layer being non-deformable by strains on the rope and being formed peripherally with a series of rigid helical ridges respectively lying between and holding separate the adjacent strands of said outer layer so that no notching contact can occur between said wire strands and the rope cannot untwist under strain, said protective layer being formed by a flat wire wound helically on said core section and provided with integral rigid projections which form said ridges, said flat wire forming between said ridges helical grooves corresponding in number, pitch and lay to and receiving said wire strands.

4. A wire rope as claimed in claim 3, said flat wire being wound with a pitch sufficiently small that said protective layer remains closed when the rope is bent.

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5. A wire rope as claimed in claim 3, said flat wire being a wire of uniform transverse dimensions precrimped to form said projections and to provide between said projections concavities which form said grooves.

6. A wire rope as claimed in claim 3, said flat wire being wound in the direction of the twist of said ridges.

7. A wire rope as claimed in claim 3, said flat wire being wound in a direction opposite to the direction of the twist of said ridges.

8. A helical stranded wire rope comprising a rope core, an inner layer of strands helically laid on said core, a protective layer covering and confining said inner layer of strands, and an outer layer of wire strands helically laid on said protective layer, said protective layer being non-deformable by strains on the rope and being formed peripherally with a series of rigid helical ridges respectively lying between and holding separate the adjacent strands of said outer layer so that no notching contact can occur between said wire strands and the rope cannot untwist under strain.

9. A helical stranded wire rope comprising a rope core, an inner layer of strands helically laid on said core, a protective layer covering and confining said inner layer of strands, and an outer layer of wire strands helically laid on said protective layer, said protective layer being non-deformable by strains on the rope and being formed peripherally with a series of rigid helical ridges respectively lying between and holding separate the adjacent strands of said outer layer so that no notching contact can occur between said wire strands and the rope cannot untwist under strain, said protective layer being formed by a flat wire of uniform transverse dimensions wound helically on said inner layer of strands, said wire being precrimped to provide projections forming said ridges and, between said projections, concavities forming between said ridges helical grooves receiving said wire strands, the strands of said inner layer lying respectively in helical channels at the inner side of said protective layer opposite said ridges.

10. A wire rope as claimed in claim 9, said flat wire being wound in a direction opposite to the direction of the twist of said ridges and with a pitch sufficiently small that said protective layer remains closed when the rope is bent.

11. A helical stranded wire rope comprising a rope core, an inner layer of strands helically laid on said core, a protective layer covering and confining said inner layer of strands, and an outer layer of wire strands helically laid on said protective layer, said protective layer being non-deformable by strains on the rope and being formed peripherally with a series of rigid helical ridges respectively lying between and holding separate the adjacent strands of said outer layer so that no notching contact can occur between said wire strands and the rope cannot untwist under strain, said protective layer being formed by a flat wire helically wound on said inner layer of strands, said flat wire having rigidly secured to its outer side rigid projections which form said ridges.

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