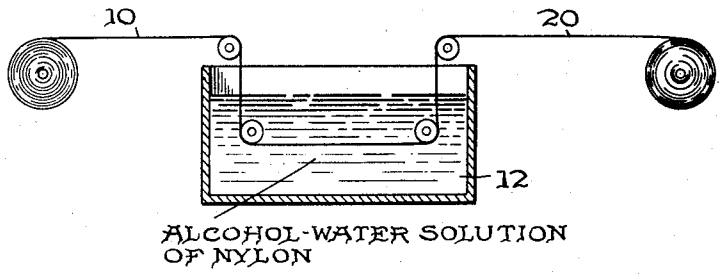
Dec. 22, 1959 S. M. MURDOCK 2,917,891

SYNTHETIC ROPE STRUCTURE AND METHOD OF MAKING SAME

Filed Sept. 1, 1953

FIG. 1.



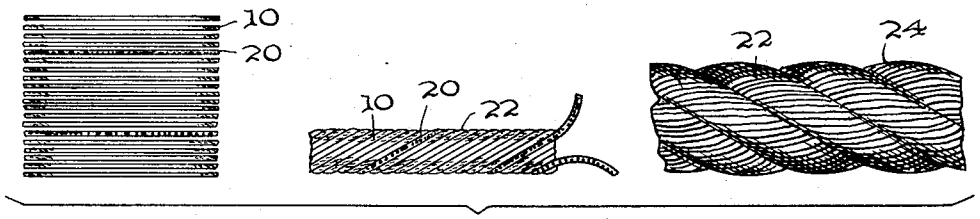


FIG. 2.

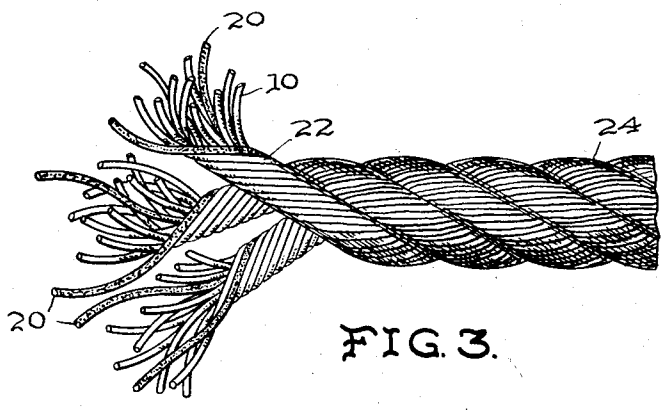


FIG. 3.

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SYNTHETIC ROPE STRUCTURE AND METHOD OF MAKING SAME

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11 Claims. (Cl. 57—140)

This invention relates to a stranded rope structure formed of synthetic yarns and particularly concerns a nylon stranded rope structure and method of making the same.

While stranded ropes formed of synthetic fibers, such as nylon, have become increasingly popular over the last several years, certain difficulties have been experienced due to the peculiar characteristics of the synthetic yarns.

To a certain extent, particularly in ropes of smaller sizes, these difficulties are overcome by following the teachings of Dodge et al. Patent No. 2,343,892. However, in large size ropes, and particularly in hawsers used in deep-sea towing, the manufacture of nylon rope in accordance with the teaching of the Dodge et al. patent is not sufficient to avoid all of the difficulties encountered under extreme conditions.

In deep-sea towing operations, the strands of larger ropes have become dislocated and distorted, forming kinks and hockles in the strands of the rope to the extent that the hawser may be rendered useless.

A major object of the invention is to provide a synthetic rope structure in which these difficulties are avoided by improving the stability and firmness of the rope.

In the attainment of this object, one feature of the invention resides in the provision of a stranded synthetic rope structure having distributed in its respective strands, a plurality of stiffened synthetic yarns. These synthetic yarns are stiffened by applying to them a coating of a compatible synthetic liquid and twisting the coated yarns with uncoated yarns while the coating is still wet, so the coating causes adherence between the twisted yarns in the strand and upon drying has a general stiffening effect on the strand. Specifically, this invention comprises the manufacture of a stranded nylon rope structure by coating a portion of nylon yarns with a liquid nylon solution and twisting the wet coated yarns with other yarns into strands, then twisting the strands into the rope.

Other objects, advantages and features of the invention will become apparent from the following specification taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a diagrammatic illustration of an apparatus for coating yarns with a synthetic coating;

Fig. 2 is a diagrammatic illustration of the steps of forming the twisted rope structure; and

Fig. 3 is a perspective view of a section of rope made according to the present invention, the end of the rope being partially untwisted to better illustrate the individual yarns.

As is shown in Fig. 1, some of the yarns **10** of synthetic fibers are immersed in a bath **12** of a water-alcohol solution of nylon to produce coated yarns. It is to be understood that the coating may be formed by spraying, brushing, or otherwise without departing from the invention.

The coating solution **12** comprises liquid nylon in an alcohol-water solvent. While coating solutions comprising other synthetic materials may be used, it is preferred that the synthetic material in solution be the same as that of the filaments in order to achieve a greater affinity to the yarns. The term nylon as it is

used herein is to be understood to be a synthetic thermoplastic polyamide. While alcohol and water are the preferred solvents for the liquid nylon, it is well known that the polyamides are soluble in other mediums. Alcohol is used in the preferred form of the solution because of its ability to evaporate quickly and hasten the drying of the treated yarns.

Upon passing through the liquid nylon solution **12**, the synthetic yarns acquire a coating of the liquid nylon. Before this coating dries, some of these coated yarns **20** are combined with uncoated yarns **10** and twisted into strands **22**. A plurality of these strands **22** are then twisted into a rope **24**. These steps of the method of making the rope are shown in Fig. 2.

It has been found that a stranded rope structure having 5 to 25% of coated yarns is more durable and withstands indefinitely the punishment of deep-sea towing operations Particularly satisfactory results have been achieved with a rope having stiffened or coated yarns amounting to 10% of the total yarns in the rope.

In addition, the liquid coating of the treated yarns, in drying, causes some adherence between the treated yarns and the untreated yarns, which increases the stiffening effect on the rope. Best results are obtained when the stiffened filaments are uniformly dispersed throughout the cross-section of the rope.

A rope made by the method described above has the ability to withstand greater transients of load, temperature and moisture. For example, a rope manufactured according to this method has been tested in deep-sea towing services and has provided satisfactory service for a much longer period of time than any nylon hawser heretofore tested and there is no evidence that difficulty will be encountered due to shifting of yarns within the strands of the rope.

A stranded synthetic rope structure embodying this invention and having the desired characteristics enumerated above can be made in the following manner.

Example I

One satisfactory solution of nylon is prepared according to the formula:

	Parts by weight
Nylon	5
Water	10
Alcohol	85
	100

10% of the total nylon yarns which will make up the rope are immersed in the alcohol-water solution of nylon, which may be of the type identified by E. I. duPont de Nemours & Co., (Inc.), as nylon FM6901, and pick up 35 to 50% of their own weight of solution. This is equivalent to 1.75–2.50% of solid nylon. When these nylon treated yarns are twisted into strands, the treated yarns retain one-third to one-half of the nylon applied, and the remainder is squeezed out and distributed throughout the strand as it is tubed, causing adherence between the treated yarns and the untreated yarns.

Example II

The same results as in Example I are obtained when the nylon used in the alcohol-water solution is of the type identified by E. I. duPont de Nemours & Co. (Inc.) as nylon 8(DV55). The use of this type of nylon permits the use of less alcohol so the solution may be prepared according to the formula:

	Parts by weight
Nylon	5
Water	20
Alcohol	75
	100

A higher concentration of nylon solution is possible, with a practical viscosity limit of 10% in the case of nylon FM6901 and 25% in the case of nylon 8(DV55). Either by this means, or through the treatment of a higher proportion of yarns, the quantity of treating material can be raised substantially. Extreme application of the quantity of nylon in solution will make the rope unsuitably rod-like and inflexible. The range 0.1 to 0.5% nylon based on total rope weight, but concentrated mainly on about 10% of the yarns in each strand, is the best practice.

Both of the foregoing examples provide a synthetic rope which, in ropes of larger sizes, are far more stable and will withstand severe conditions indefinitely where similar ropes have failed within a short time.

Having fully described my invention, what I claim is:

1. A stranded rope structure having a plurality of twisted strands each comprising a plurality of flexible twisted synthetic yarns with between five and twenty-five percent of said yarns being stiffened by a coating of synthetic material.

2. A stranded rope structure having a plurality of twisted strands each comprising a plurality of flexible twisted synthetic yarns with approximately ten percent of said yarns being stiffened by a coating of synthetic material.

3. A stranded rope structure having plurality of twisted strands each comprising a plurality of flexible twisted nylon yarns and a lesser number of stiff twisted nylon yarns coated with nylon.

4. A stranded rope structure having a plurality of twisted strands each comprising a plurality of flexible twisted nylon yarns in which between five and twenty-five percent of said yarns are coated with nylon.

5. A stranded rope structure having a plurality of twisted strands each comprising a plurality of flexible twisted nylon yarns in which approximately ten percent of said yarns are coated with nylon.

6. The stranded rope structure defined in claim 3 wherein the coated yarns are substantially uniformly dispersed throughout the twisted strands.

7. The method of forming a stranded rope structure of synthetic yarns which comprises coating a number of

the yarns with synthetic material, twisting the coated yarn with a larger number of uncoated yarns into a strand, and twisting a plurality of such strands into a rope.

8. The method of forming a stranded rope structure of synthetic nylon yarns which comprises coating a number of the nylon yarns with liquid nylon, twisting the coated nylon yarns with a larger number of uncoated yarns into a strand, and twisting a plurality of such strands into a rope.

9. The method of forming a stranded rope structure of synthetic nylon yarns which comprises coating a number of the nylon yarns with liquid nylon, twisting the coated nylon yarns with a larger number of uncoated yarns into a strand so the coated yarns are substantially uniformly dispersed throughout the strand, and twisting a plurality of such strands into a rope.

10. The method of forming a stranded rope structure of synthetic fibers which comprises coating a number of the yarns with a liquid synthetic material, twisting the coated yarns while wet with a larger number of uncoated yarns into a strand so the coated yarns are substantially uniformly distributed throughout the strand, and twisting a plurality of such strands into a rope.

11. A stranded rope structure having a plurality of twisted strands each comprising a plurality of twisted synthetic yarns interspersed with a lesser number of twisted synthetic yarns coated with a material the same as the material of the yarns.

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