Feb. 20, 1940. H. A. WHITLOCK 2,190,854

FIBER ROPE STRUCTURE

Filed July 23, 1938

Fig. 1

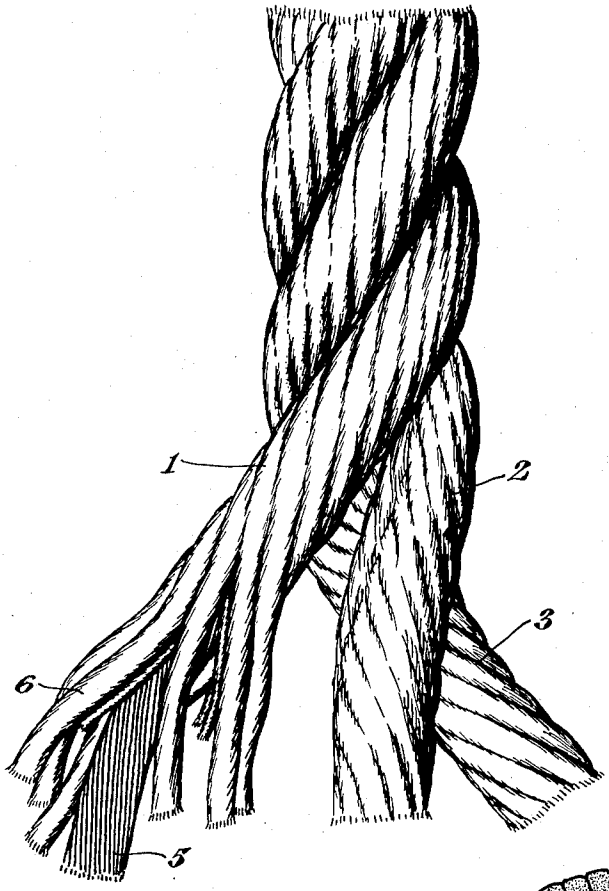


Fig. 2.

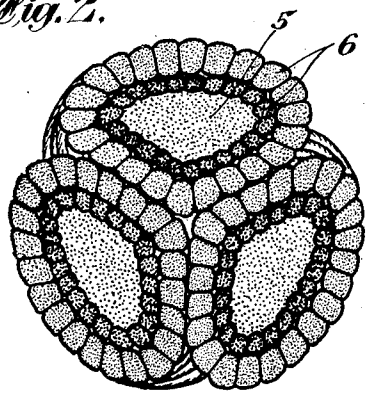
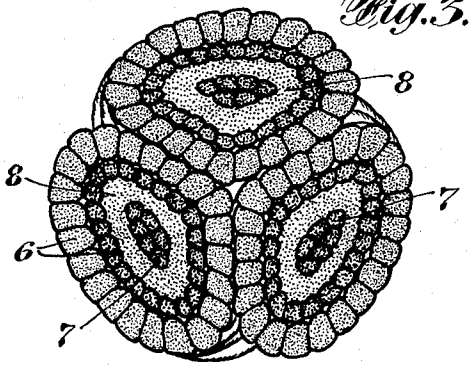


Fig. 3.



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FIBER ROPE STRUCTURE

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14 Claims. (Cl. 57—144)

This invention relates to fiber rope structure and more particularly to an improvement in the strand structure disclosed in the patents of H. V. Whitlock, Reissue No. 16,101 and No. 1,558,420, wherein the strand has a core of unspun fibers as distinguished from a core composed of spun yarns as previously used.

In fiber core rope made according to these two patents, the strands were provided with centers composed of unspun fibers instead of the formerly-used, relatively short "inside" yarns, and such centers were enclosed by cover yarns of the same size (or length per pound) as the standard yarns for all-yarn rope. In rope of five-inch circumference or larger size, the ordinary standard practice in all-yarn rope has been to employ yarns of a size not larger than 270 feet per pound and in many cases yarn of smaller size or greater number of feet per pound. Such fiber core ropes were provided in the centers of the strands with cores of unspun fibers in place of the relatively short yarns which are subject to breakage under heavy strains, thus resulting in ropes of much greater strength and as shown by the experience of users, of greatly increased durability and life. In due time, it became evident that in fiber core ropes, the cores outlasted the cover yarns, which was in sharp contrast to the experience of users of all-yarn cordage in which internal wear and failure of the inside yarns often caused the retirement from service of hawsers and other lines as soon as, if not before, the cover yarns had been severely worn.

In the case of fiber core ropes, it was found that the cores remained in good condition after the cover yarns had worn sufficiently to cause retirement of the ropes. Not only did the fiber cores provide the rope with greatly increased strength, but gave it much greater durability than ordinary all-yarn cordage due to the substitution of the unspun fibers for the ordinary center spun yarns. The cores of the strands of such rope were found to be in excellent condition and in shape to have been used for considerable additional time after the rope was discarded because of external wear of the surface yarns. Such fiber core ropes (with cover yarns of ordinary size) were longer lived than similar size all-yarn ropes and were continued in service long after similar size all-yarn ropes would have been discarded. However, in such ropes, the surface yarns through rubbing and abrasion became worn to such extent that many of the yarns were ruptured and the remainder, because of broken fibers, developed a hairy or shaggy appearance which caused such ropes to be retired from service, although the internal cores were still in good condition. In other words, cover yarns of the ordinary size, although wearing fully as well as similar yarns on the strands of all-yarn rope, failed to be of commensurate durability with the fiber cores and for this reason caused earlier discarding of the rope than was warranted by the strength and probable remaining life of the strand interiors. As a result, full advantage was not realized of the better wearing qualities of the unspun fiber core over the ordinary spun yarn core.

An object of this invention is an improved fiber core rope in which the surface wearing qualities are commensurate with the inherently greater strength and durability provided by the unspun fiber cores of the strands.

In rope embodying the present invention, the cover yarns forming the surface of the rope are of a size materially in excess of the size of yarns commonly used in the manufacture of rope either of the ordinary all-yarn type or the fiber core type. Prior to this invention, the cover yarns for fiber core rope had been of the standard size for all-yarn rope or approximately 270 feet per pound or longer. Yarns running less than 250 feet per pound have heretofore been considered as extra large for either all-yarn rope or fiber core rope. In contradistinction to the heretofore standard yarns, the cover yarns for the rope of the present invention preferably run less than 200 feet per pound and as such are a very great departure from regular manufacturing practice with respect either to cover yarns or inside yarns of all-yarn rope. Such large size cover yarns furnish a much deeper outside surface layer than heretofore provided and give much longer wear and better resistance to abrasion as well as reduce the possibility of yarn breakage. Thus, full advantage is taken of the inherent superiority of unspun fiber core strands over all-yarn strands and as a result there is obtained a rope in which the superior surface wearing quality matches the greater internal strength and durability of the fiber core.

In the case of ordinary all-yarn rope, spun yarns of less than 270 feet per pound have at times been employed as inside yarns for reasons of economy, but such yarns, however, have not been used as outside or cover yarns for the purpose of providing greater strength and durability. Such use would not have improved the wearing qualities of all-yarn rope since the inside yarn would wear, stretch and break through excessive

strain or long continued use prior to failure of the cover yarns, with the result that such rope would commonly be discarded as unfit for further use on account of interior breakdown without regard to its surface condition. Consequently, no claim is made herein for the use of oversize yarns as the strand surface of all-yarn rope, since no practical advantage would be secured through providing longer-wearing strand covers.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawing, wherein:

Fig. 1 shows in elevation a portion of a rope structure embodying the invention, one of the strands being frayed, and

Fig. 2 shows a cross-section of such rope structure, and

Fig. 3 shows a cross-section of a modified structure.

In the drawing, is illustrated a rope such as a marine hawser or the like having three strands 1, 2 and 3, laid together in the usual manner. As clearly shown in the frayed strand 1, each strand consists of an unspun fiber core 5 which is enclosed by a series of spun yarns 6. The yarns 6 are helically wound about the core to provide a continuous cover therefor and preferably there are two layers of yarns 6, although it is contemplated that a single layer of yarns 6 may also be used. The core 5 consists of a large number of fibers which may lie substantially parallel to the strand axis as illustrated in Reissue No. 16,101, or as illustrated in Patent No. 1,558,420 may be slightly twisted about the axis of the strand so that each fiber lies substantially in a helix about said axis. The pitch of each helix preferably is substantially equal to the pitch of the helices of the several cover yarns but may be greater. The core may consist of a single fiber element as illustrated in the aforementioned patents or may be composed of a plurality of elements as shown in patent to Reisenberg, No. 1,445,556.

Each of the surface-forming yarns 6 is of much larger size than the yarns normally used in the manufacture of all-yarn rope of the same size or the yarns heretofore used for fiber core ropes made in accordance with the two patents previously mentioned. Whereas the yarns normally used in the manufacture of all-yarn rope or previously used as the cover yarns of fiber core ropes have run substantially 270 feet per pound, the surface-forming yarns 6 of the rope herein illustrated runs less than 250 feet per pound and preferably less than 200 feet per pound. Surface-forming cover yarns running 195 feet per pound have been used in rope embodying this invention and such rope has excellently fulfilled the object of this invention. Such yarns provide additional yarn depth around the fiber core which results in giving the strand cover, wearing qualities comparable with the wearing qualities of the fiber core.

The inner spun yarns 6 of the two layer strand cover preferably are of standard size and a lesser number of such yarns may be used in the inner layer than have previously been used when both layers were made up of standard size yarn. The use of the lesser number of inner layer yarns avoids material increase in the circumference of the strand due to the use of the oversize yarns in the outer layer. In a strand having a single layer cover of yarns, a sufficient number of oversize yarns are used to yield a strand of the desired circumference for the particular size fiber core used.

From an inspection of Fig. 2, it will be apparent that the amount of wear which would reduce the extra size surface-forming yarns 6 by approximately one-fourth would reduce standard size yarns such as shown in the inner layer by approximately one-half. The same situation, of course, prevails with respect to the oversize yarns in a single layer cover. Thus, either in a single layer or a two-layer cover, the use of oversize yarns to form the surface of the strand gives to the strand additional life and durability due to the fact that the cover wearing qualities of the strand are commensurate with the wearing qualities of the fiber cores.

Fig. 3 illustrates a form of strand in which the core is composed in part of unspun fibers and in part of spun yarns. The center of the core consists of a group of standard size spun yarns 7 which may be twisted together to any desired extent. A sheath 8 of unspun fibers encloses the yarns 7 and around the sheath are arranged cover yarns 6 as in the first modification, the surface-forming yarns being of the over-size type. Rope having the type of strand of Fig. 3 has the same advantage respecting superior wearing qualities as pointed out in connection with the first modification.

It is to be understood that other types of core consisting wholly or in part of unspun fibers may be used in conjunction with oversize surface-forming yarns in accordance with this invention and that the claims are intended to cover the combination of such oversize surface-forming yarns with any and all types of cores composed wholly or in part of unspun fibers, that is, cores composed of elements other than ordinary spun yarns.

Also it is to be understood that the invention comprehends a fiber core strand having a surface layer of oversize yarns either with an underlying layer of standard size yarns as specifically illustrated in the drawing or without such underlying layer of standard size yarns and with the surface layer of oversize yarns directly contracting the fiber core.

I claim:

1. In a fiber rope structure, a strand comprising a core of unspun fibers and a surface layer of yarns surrounding said core, said yarns being of a size running less than 250 feet per pound.

2. In a fiber rope structure, a strand comprising a core of unspun fibers and a surface layer of yarns surrounding said core, said yarns being of a size running less than 200 feet per pound.

3. In a fiber rope structure, a strand comprising a core of unspun fibers and a surface layer of yarns surrounding said core, said yarns being of a size running not in excess of 195 feet per pound.

4. In a fiber rope structure, a strand comprising a core of unspun fibers, an inside layer of spun yarns surrounding said core, and an outside layer of spun yarns surrounding said inside layer, said outside layer yarns being of a size running less than 250 feet per pound.

5. In a fiber rope structure, a strand comprising a core of unspun fibers, an inside layer of spun yarns surrounding said core, and an outside layer of spun yarns surrounding said inside

layer, said outside layer yarns being of a size running less than 200 feet per pound.

6. In a fiber rope structure, a strand comprising a core of unspun fibers, an inside layer of spun yarns surrounding said core, and an outside layer of spun yarns surrounding said inside layer, said outside layer yarns being of a size running not in excess of 195 feet per pound.

7. In a fiber rope structure, a strand comprising a core containing unspun fibers, and a surface layer of yarns surrounding said core, said yarns being of a size running less than 250 feet per pound.

8. In a fiber rope structure, a strand comprising a core containing unspun fibers, and a surface layer of yarns surrounding said core, said yarns being of a size running not in excess of 195 feet per pound.

9. In a fiber rope structure, a strand comprising a core consisting in part of unspun fibers, and a surface layer of yarns surrounding said core, said yarns being of a size running less than 250 feet per pound.

10. In a fiber rope structure, a strand comprising a core consisting in part of unspun fibers, and a surface layer of yarns surrounding said core, said yarns being of a size running not in excess of 195 feet per pound.

11. In a fiber rope structure, a strand comprising a core containing unspun fibers, an inside layer of spun yarns surrounding said core and an outside layer of spun yarns surrounding said inside layer, said outside layer yarns being of a size less than 250 feet per pound.

12. In a fiber rope structure, a strand comprising a core containing unspun fibers, an inside layer of spun yarns surrounding said core and an outside layer of spun yarns surrounding said inside layer, said outside layer yarns being of a size running not in excess of 195 feet per pound.

13. In a fiber rope structure, a strand comprising a core consisting in part of unspun fibers, an inside layer of spun yarns surrounding said core and an outside layer of spun yarns surrounding said inside layer, said outside layer yarns being of a size less than 250 feet per pound.

14. In a fiber rope structure, a strand comprising a core consisting in part of unspun fibers, an inside layer of spun yarns surrounding said core and an outside layer of spun yarns surrounding said inside layer, said outside layer yarns being of a size running not in excess of 195 feet per pound.

HAROLD A. WHITLOCK.