United States Patent [19]

Bailey

[11] **3,751,897**

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[54] **ASBESTOS YARN REINFORCED WITH CONTINUOUS STRAND OF A POLYVINYL ALCOHOL**

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[22] Filed: **Mar. 29, 1971**

[21] Appl. No.: **129,195**

[52] **U.S. Cl.** ..... **57/144,** 57/140 BY

[51] **Int. Cl.** **D02g 3/20**

[58] **Field of Search** ..... 57/12, 35, 51, 139, 57/140 BY, 144, 149, 153, 156, 160, 162, 164; 28/DIG. 5; 161/172, 175, 176

[56] **References Cited**

UNITED STATES PATENTS

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FOREIGN PATENTS OR APPLICATIONS

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Attorney—John A. McKinney, Robert M. Krone, Joseph J. Kelly and Ronald M. Halvorsen

[57] **ABSTRACT**

A high tensile strength and chemical resistant asbestos yarn product comprising a composite of a core strand composed of a spun yarn of staple polyvinyl alcohol fiber and with overlying staple asbestos fiber twisted thereabout.

5 Claims, No Drawings

ASBESTOS YARN REINFORCED WITH CONTINUOUS STRAND OF A POLYVINYL ALCOHOL

BACKGROUND OF THE INVENTION

Asbestos fibers being typically relatively short in length and stiff or impliant lack the tractability and frictional quality of many other fibers enabling easy twisting and spinning and thus interlocking into strong coherent intertwined yars. To overcome this impediment of asbestos it has been the practice to blend the asbestos fiber staple with organic fiber of a consistency more amenable to spinning, such as cotton or rayon staple, to entrain the asbestos, and/or to combine with the asbestos fiber a substantially continuous strand or plurality of strands as reinforcement such as cotton thread, rayon filament, glass filament or metal wires comprising brass, monel, or Inconel (trademark designation for nickel containing alloy of International Nickel Company), and the like as reinforcement or a carrying medium whereupon the composite of fibrous materials is more manageable in handling in the twisting and other textile processing operations, and the strength of the asbestos yarn produced thereby is supplemented.

SUMMARY OF THE INVENTION

This invention comprises providing an asbestos yarn formed of staple asbestos fiber with a continuous strand reinforcement composed of spun yarn of staple polyvinyl alcohol fiber, such as Kurashiki Rayon Co. Ltd. of Japan's fiber product identified by the trademark "KURALON".

It is the primary objective of this invention to provide a high tensile strength and chemical resistant asbestos fiber yarn well suited for most all applications and wherein the combined materials of this invention minimizes the handling problems or care in twisting or spinning the yarn including enabling direct twisting, bypassing spinning, and thereafter in weaving or carrying out other textile forming operation such as braiding, and further which permits the wet treatment including water or application of liquid agents to the yarn prior to or during spinning, twisting, or thereafter to, among other reasons, retard air pollution attributable to asbestos dust or to introduce and/or enhance desired characteristics of the yarn without incurring rot, promoting fungus growth or other deterioration or weakening effects. Moreover, the measures of this invention contribute to the alleviation of the growing shortage of the availability of the longer grades of so-called textile asbestos fibers which are more manageable in handling and spinning by facilitating the use of shorter or otherwise inferior grades thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The novel products of this invention comprise an asbestos yarn formed substantially of staple asbestos fiber containing therein as a core strand a continuous reinforcement of spun yarn of staple polyvinyl alcohol fiber.

The asbestos yarn products of this invention are composed primarily of staple fibers, either of all asbestos or of at least a major proportion—in excess of at least about 75 percent by weight—of staple asbestos fiber blended with staple organic fiber in minor proportions—at least less than about 25 percent by weight. Preferred organic fibers comprise rayon staple although others such as cotton staple and the like vegetable or animal fibers as well as synthetic fibers such as polyamide or polyester staple can be included. Preferably the proportion of the non-asbestos staple component is less than about 25 percent by weight of the total of staple fiber.

Such common organic textile staple fibers tend to entrain the stiffer asbestos and aid in spinning or twisting the asbestos into a coherent twist interlocked yarn body. The asbestos fibers may be of any common variety including chrysotile or amosite, etc., of usual spinning grades, but also including those of somewhat inferior or shorter classes since the means of this invention enhance the forming operation and yarn product quality which permits the use of such heretofore inappropriate materials, among other pronounced benefits.

The continuous strand reinforcement component of this invention for the asbestos yarn constitutes a spun yarn of staple polyvinyl alcohol fiber. This component preferably constitues less than about 5% by weight of the total composite yarn product.

Products of this invention can be conveniently formed with conventional textile apparatus designed for working with asbestos fibers, comprising a card, rub aprons and spinning or twisting frames. Moreover, the measures or yarn construction of this invention significantly facilitate carrying out of the forming process with such machines in enabling the direct and continuous feeding or transfer of the staple asbestos fiber web or sliver from the card and rubbing apron to the twisting device or operation without undue handling precautions and bypassing the usual spinning operation.

The forming steps effected by these mechanisms and sequence thereof in the manufacture of the product of this invention are essentially typical. Namely, a carding machine of usual design for asbestos combs the staple asbestos fibers, either alone or blended with other staple fiber, into substantially parallel aligned orientation and discharges it in the form of narrow ribbons or filmy webs of comb aligned fiber sometimes referred to as slivers. If the staple fiber phase of the yarn is to be composed of a fiber blend of staple organic combined with the asbestos, the carding operation is simply preceded with the usual blending procedure and device therefor.

Following carding of the staple fiber—either of asbestos alone or blended with staple organic fiber—the card formed sliver or strip of substantially parallel aligned staple is conducted to one or more rubbing aprons in series. It is however at this point—intermediate the carding operation and the rubbing apron—that the continuous strand reinforcement of spun yarn of staple polyvinyl alcohol fiber is introduced into the process and combined with the said card formed sliver or web of generally aligned staple asbestos alone or combined with other staple fiber prior to its being subjected to the rolling and condensing action of the rubbing aprons.

The opposing transverse oscillating motion of the rubbing apron belts moving the combined staple sliver with the continuous strand pressed therebetween, rolls the aligned loose staple fiber about the strand which is thus incorporated as a core within the overlying staple fiber, rounding and consolidating the materials and producing a composite roving. The conventional textile operation of the rubbing aprons effecting a reciprocating rolling action upon the body of the fibers in a direc-

tion transverse to the direction of its continuous travel due to the lateral motion of the belts provided by rubbing aprons, introduced the so-called "false twist" to the sliver forming a roving, which actually constitutes a consolidating action.

Following the combining of the staple fiber essentially including asbestos and the core strand of spun yarn of staple polyvinyl alcohol fiber and the effect of the rubbing aprons disclosed, the resultant roving exhibits ample strength to be conducted directly and without undue care or precaution to a twisting device of conventional design, thereby obviating the need for the usual spinning operation. Twisting, or spinning, of the thus formed and constructed composite roving intertwines and frictionally interlocks each the staple fibers intertwined about themselves and together with the underlying previously spun yarn core, uniting one to the other. Thus, an asbestos yarn product of high tensile strength and chemical resistance attributable to the polyvinyl alcohol yarn core in concert with the overlying staple fiber is produced. The product is not adversely affected when treated with water solutions or other liquids applied for subsequent operations or product enhancement, retaining its integrity and resisting rot, mildew or other deterioration, and is of ample strength to endure weaving, braiding and the like textile operations. Moreover, products woven or otherwise formed therefrom are of superior strength and chemical resistance.

A specific illustration of the invention comprises the following. To a usual carded staple asbestos fiber strip web or sliver composed of a blend of about 80 percent by weight of staple asbestos, grade 3T-12 by Quebec Standard Asbestos Test, and about 20 percent of rayon staple 3 denier 1 9/16 in. dull crimped passing from the card to the rubbing aprons, a continuous strand of 20/1 yarn of staple polyvinyl alcohol fiber, Perlohke spinning system. "KURALON" fiber yarn of Kurashiki Rayon Co. Ltd., of Japan, was fed at a rate commensurate with the overall speed of the operation. The reinforcing core strand comprised about 1.7 percent by weight of the composite. The so combined staple fiber and continuous strand was then continuously passed through the usual series of two rubbing aprons, and thereafter to a twisting unit whereupon it was twisted to commercial grade asbestos yarn into a strongly interlocked and coherent yarn.

The chemical resistance of this yarn product was evaluated and compared with a like yarn as a standard except for the reinforcing core strand being composed of a twisted staple cotton fiber yarn. The test conditions and data derived therefrom are set forth in the following table.

	Testing conditions			Percent retention after exposure—control—100%			
				20/3 cotton in 108/4 asbestos		20/1 Kuralon PVA in 108/4 asbestos	
	Concentration, percent	Temp., F.	Time, hr.	Tensile strength, percent	Flex life, percent	Tensile strength, percent	Flex life, percent
Hydrochloric acid	[1] 3.7	72	24	91	20	90	22
	3.7	72	150	50	3	68	−6
	10	72	24	58	0.6	76	10
	10	200	6	[2]		16.9	
Sulfuric acid	[1] 5	72	24	100	56	92	22
	5	72	150	59	11	76	5
	10	72	24	84	28	93	33
	10	200	6	6.2		37.1	
Sodium hydroxide	[3] 4	72	24	115	53	94	50
	4	72	150	80	57	98	98
Content of reinforcement by weight, percent					8.4	1.7	
Asbestos content of yarn without reinforcement, percent					77.9	79.0	

[1] pH 2.
[2] Too weak to test.
[3] pH 13.

I claim:

1. A high tensile strength and chemical resistant reinforced yarn, relatively unaffected by approximately one day's exposure to concentrated hydrochloric or sulfuric acid at ambient temperature, and consisting essentially of an over-lying staple fiber component comprising asbestos fibers and a core strand reinforcement consisting essentially of spun staple polyvinyl alcohol fibers.

2. The reinforced yarn of claim 1 wherein the overlying staple fiber component comprises a blend of staple asbestos fibers in the major proportion and including dispersed therethrough a minor proportion of staple organic fiber.

3. The reinforced yarn of claim 2 wherein the staple organic fiber blended with the asbestos fiber is rayon.

4. The reinforced yarn of claim 3 wherein the staple organic rayon fiber comprises up to about 25 percent by weight of the total staple fiber blend.

5. The reinforced yarn of claim 1 wherein said yarn is twisted about itself to twist interlock the staple fibers in said staple fiber component both with themselves and with the fibers of said reinforcement.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,751,897 Dated August 14, 1973

Inventor(s) Gerald D. Bailey

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 63, following "system", "." should be --,--;

Column 4, in last column of table, "-6" should be --6--.

Signed and sealed this 18th day of December 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents