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COTTON YARN FOR WATER-PRESSURE HOSE

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4 Claims. (Cl. 117-7)

(Granted under the act of March 3, 1883; as
amended April 30, 1928; 370 O. G. 757)

This application is made under the act of March 3, 1883, as amended by the act of April 30, 1928, and the invention herein described, if patented, may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon.

This invention relates to cotton yarn useful in the manufacture of waterproof fabrics, particularly to the yarn used in making hose for carrying water under pressure.

A conventional type of hose is formed to provide a water-holding wall of woven fabric and does not have a lining. Such hose is very flexible and can be flattened. It is useful as fire hose, especially where it must be stored or carried in a small space.

The waterproof qualities of this type of hose depend on the nature of the fabric forming its wall. The fabric usually consists of very tightly woven flax or linen yarn, the fibers of which on wetting swell and close the weave so that the fabric will hold water under high pressure with only a minute amount of leakage.

Attempts in the past to use cotton yarn instead of linen have failed. Cotton yarns cannot be packed in so tightly as linen in the weaving process and the cotton yarn does not have as much expansion when wetted. With hose having cotton yarn fabric forming its wall, failure of the fibers to swell rapidly enough and sufficiently to fill the spaces within the wall structure resulted in objectionable leakage which could not be prevented without lining the hose.

The difference between linen and cotton yarn in swelling properties is shown by tests conducted by stopping leaks through predetermined size holes with yarns of a predetermined size. Linen yarn increases its cross-sectional area by about one-third, while cotton yarn increases its cross-sectional area by about one-sixth, as shown by stopping the flow of water through such holes.

This invention has among its objects the production of articles with water-holding walls woven from cotton yarn having special swelling properties when wetted.

In general, the cotton yarn is impregnated with and has formed on its surface a cellulosic material which has the capacity of swelling when wetted. Any cellulose or cellulose derivative solution can be used for treating the yarn provided the cellulose or the derivative deposited or precipitated swells freely when wetted and is insoluble in water. Solutions or dispersions of the cellulosic material in a water base solvent

are the most convenient to apply, but the solution or dispersion may be in any other medium.

A particular, and the preferred method, of treating the cotton involves the use of one of the ethers of cellulose, particularly hydroxy ethyl cellulose, which cellulose derivative is soluble in a caustic soda solution but is not soluble in water. The caustic soda solution may be applied to the inner surface of a tightly woven cotton hose, forced into the fabric by air or by hydrostatic pressure, and precipitated so as to help close the weave to resist seepage of water. It is preferable, however, to apply the solution to the yarn so that will be well distributed through the fabric after weaving. It can be applied to single ply yarns, to the fully plied yarn as usually used in weaving hose, or applied at some intermediate stage of plying or twisting.

The following specific example will serve to exhibit the invention in a particular manner.

Plied cotton yarn otherwise ready for hose weaving is repeatedly passed through a six percent solution of hydroxy ethyl cellulose in caustic soda and a pair of squeeze rolls. The dipping and squeezing is repeated until after the last squeeze the yarn contains approximately its own weight of the solution well pressed into it. Three or four dippings may be required. The yarn thus impregnated is then dipped and squeezed two or three times in dilute acid to neutralize the alkalinity and to precipitate the cellulose ether upon and within it, and is washed well and treated with a weak solution of soda to neutralize any remaining acid.

Swelling materials other than that mentioned above may be used. For example, a solution of cellulose in a quaternary ammonium base, such as trimethyl benzyl ammonium hydroxide, is satisfactory. Other suitable solutions are viscose, cuprammonium and copper ethylene diamine solutions of cellulose. If these are used, the details of applying, neutralizing and washing will, of course, be varied to suit the material used. See, for example, the copending application of Goldthwait et al., Serial No. 491,772, filed January 22, 1943.

After the application of the cellulosic material, the yarn is stretched at high tension while still wet to offset the flattening effect of the squeeze rolls, to recover the length from any shrinkage that has taken place and to remove excess stretching of the completed fabric, that is, to remove the tendency for cotton yarn to stretch, resulting in undue expansibility of the hose. Stretching the treated yarn and drying it

under tension cause a permanent set which renders the completed hose substantially non-expandible.

Conventional plied yarns, such as are ordinarily used in cotton hose, can be made into the improved hose by the aid of the added cellulosic material. Better results are usually obtained, however, if somewhat lower ply twists are used, such as one and one-half turns per inch in a 12/16 cotton yarn; the use of less closely twisted strands facilitates the penetration of the cellulose material into the yarn.

The yarn is somewhat stiffened by the added cellulosic material, but it becomes softened by passing around the various tension devices on the loom. If it causes undue friction and wear in the loom, it can be softened and lubricated with a suitable textile lubricant.

Cellulose and its derivatives of the type herein disclosed and claimed are particularly useful as a swelling material. They are not readily decomposed by fermentation and mildewing and are as well preserved as the cotton itself by mildew-proofing treatment.

Having thus described my invention, I claim:

1. A hose having a water-holding wall comprising a fabric woven from cotton yarn which is substantially non-stretching, said yarn having hydroxy ethyl cellulose incorporated therein, which cellulose derivative is non-soluble in water and which swells when wetted, whereby the hose when used to carry water under pressure is substantially non-expandible and waterproof.

2. An article of manufacture having a water-holding wall comprising a fabric woven from a cotton yarn which is substantially non-stretching, said yarn having hydroxy ethyl cellulose incorporated therein, which cellulose derivative is non-soluble in water and which swells when wetted substantially to close the pores through the woven fabric.

3. The method of making a hose having a water-holding tubular wall which is substantially waterproof and non-expandible, comprising impregnating cotton yarn with hydroxy ethyl cellulose dissolved in a caustic soda solution, treating the impregnated yarn with dilute acid to neutralize the alkalinity and to precipitate the cellulose ether, washing the treated yarn, stretching the washed yarn and drying it under tension, and weaving the dried yarn to form the hose.

4. The method of making an article having a water-holding wall which is substantially waterproof and non-expandible, comprising impregnating cotton yarn with hydroxy ethyl cellulose dissolved in a caustic soda solution, treating the impregnated yarn with dilute acid to neutralize the alkalinity and to precipitate the cellulose ether, washing the treated yarn, stretching the washed yarn and drying it under tension, and weaving the dried yarn to form the wall.

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