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# UNITED STATES PATENT OFFICE

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## PREVENTION OF DEGRADATION OF TEXTILE FIBERS BY ACIDS

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1 Claim. (Cl. 206—84)

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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 us of any royalty thereon.

The object of the present invention is to disclose a method of preventing the acid-degradation of textile fibers, particularly industrial cords, threads, and fabrics exposed to acid vapors, and a new type of acid-resistant textile structure.

It is well known that industrial fabrics that are exposed to acid vapors rapidly deteriorate, whereby their service life is greatly shortened. a particular example of such acid-degradation is that of the weakening of the sewing thread used to sew multi-wall paper bags for the shipment of the fertilizer, triple superphosphate. In this case, the fertilizer contains not only the acid constituent, $CaH_4(PO_4)_2$, but also some free phosphoric acid and a small amount of chlorides and fluorides as impurities. The thread is subjected to some acid action of halogen acids due to gradual freeing of these halogen acids. This is especially true of "green" or new fertilizer which has not had time to lose most of the halogen acids. When such fertilizer is packed in multiwall paper bags, which are almost airtight except at the top, the "breathing" action of the bag, due to atmospheric changes or to moving of the bag, probably causes the sewing thread at the top of the bag to be subjected to these vapors. It is well known that such vapors, after dissolving in the natural moisture of the thread, exert a degradative, hydrolytic action which is probably catalytic in that its action is continuous over a long period of time. Such degradative action is also exerted on the cotton of the cloth bags which may also be used to ship such fertilizer. It is one of the objects of the present invention to disclose a treatment which will prevent, or mitigate such degradative action.

There have been numerous attempts on the part of various investigators to prevent acid degradation of textile materials such as cotton thread or cloth. The use of sodium carbonate on cloth bags for holding superphosphate or other fertilizers has been patented by L. J. Pettett, J. R. Brown, and H. N. Mills in U. S. Patent 2,036,357. Such treatment with alkaline agents is sufficient, if the cloth is to be subjected to only a small amount of acid. After neutralization, however, the cloth is once again left unprotected. C. deGuide (British Patent 19,473 (1910)) has patented the use of soap solution to extend the life of cloth sacks for shipping fertilizer. The use of sodium silicate with sodium stearate has been patented by Cotton, et al. (British Patent 345,468, March 6, 1930).

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We have found that, if humectant agents are used as impregnating materials, cotton cellulose may be protected to a considerable extent against such acid vapors as we have mentioned previously. Alkaline, buffering humectant agents are particularly effective. We have found, for example, that if cotton sewing thread with a normal strength of 11 pounds be subjected, in a closed flask at 62° C. for 24 hours, to the vapors from green triple superphosphate, the strength is reduced to 1.7 pounds. If the thread be buried in the fertilizer, the strength is reduced to 1 to 1.5 pounds. If, however, the thread be treated with about 20 percent of the humectant agents named below, the following results are obtained:

| Treatment | Strength in Pounds |
|---|---|
| Control—no treatment | 1.7 |
| Urea | 5.4 |
| Glycerol | 6.1 |
| Sorbitol | 6.2 |
| Monoethanolamine | 6.7 |
| Diethanolamine | 6.2 |
| Triethanolamine | 11.1 |

We believe that this protective action is at least partially due to the fact that the acids are distributed through a relatively large amount of solvent, rather than the comparatively small amount of water naturally present in the thread.

Also, ionization in these new media may be less extensive, so that the pH is correspondingly higher. In addition, the buffering action of such a humectant agent as triethanolamine is undoubtedly helpful, because it will stabilize the pH with its high alkaline reserve. The humectant action is particularly illustrated by glycerol and sorbitol, where there is no possibility of neutralization. We have found that the humectant agent must be thoroughly distributed throughout the thread, or degradation will result at points in the thread which are unprotected. These theories as to the nature of the action of the materials are not intended to restrict the claims of this invention, but are of interest as indicating factors which we believe are active in the mechanism of this novel type of protection.

That the action of these agents is not limited to cotton is shown in the table at the end of these specifications. This table presents the results

of tests in which a variety of textile materials in threads of various construction were stored in miniature bags of fertilizer for 24 hours at 60° C.

The following are examples of treatment of thread by humectant agents. They are merely illustrative and are not to be considered restrictive. The agent may be impregnated under any of the many conditions known to those skilled in the art, and may be used in conjunction with other impregnating and coating agents for special functions known to the art.

*Table.—Bag tests on cord and threads from various fibers*

| Fiber Used | Percent Reagent Used | | Strength | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Original Sample, Lbs. | After Treatment | | | | | |
| | | | | Control | | Glycerol | | Triethanolamine | |
| | Glycerol | TEA [1] | | Lbs. | Percent of original | Lbs. | Percent of original | Lbs. | Percent of original |
| Cotton | | 22.9 | 11.0 | 1.8 | 16.4 | | | 9.7 | 88.2 |
| Sisal | 26.3 | 26.4 | 114 | 46 | 40.4 | 59 | 51.8 | 97 | 85.1 |
| Jute | 27.7 | 30.0 | 94 | 21 | 22.3 | 54 | 57.4 | 83 | 88.3 |
| Linen | 25.8 | 26.2 | 67 | 6 | 9.0 | 32 | 47.7 | 72 | 107.5 |
| Monacetylated Cotton [2] | 18.5 | 21.4 | 19.8 | 8.8 | 44.0 | 13.2 | 66.6 | 18.6 | 94 |
| Paper Cord | 28.0 | 28.9 | 7.8 | 1.2 | 15.4 | 2.6 | 33.6 | 4.7 | 60.2 |
| Viscose Rayon | 26.0 | 25.1 | 12.2 | 4.5 | 37.5 | 5.4 | 44.3 | 9.0 | 73.8 |

[1] TEA—Triethanolamine.
[2] Specially prepared laboratory sample.

## EXAMPLE I

A solution of triethanolamine is made up, consisting of 35 grams of triethanolamine and 65 grams of water. If this be heated approximately to the boiling point (about 101° C.), it is impregnated readily into sewing thread. The thread is then put through squeegee rolls to reduce the solution content to such a point as to leave, when dried, about 20 grams of triethanolamine for every 80 grams of cotton. The thread containing this amount of agent feels soft and dry enough to be used for sewing. The amount of reagent left in may be varied according to the use to which it is to be put and to the necessary characteristics needed for sewing with the particular machine to be used. The thread may also be waxed, if this be desired, as an aid to sewing. Thread-strength loss was 11.8 percent with this treatment, when the thread was buried in 3 pounds of green fertilizer for 24 hours at 60° C., as compared to a loss of 83.6 percent for untreated thread.

## EXAMPLE II

A solution of triethanolamine consisting of 35 grams of triethanolamine and 65 grams of ethyl alcohol is made up. This can be put on the thread cold, instead of hot as described above, the alcohol acting as a penetrating agent. The thread may then be squeezed and dried as described in Example I. There was no loss in thread strength, as compared to 83.6 percent loss of untreated thread when tested as described in Example I.



## EXAMPLE III

If the thread of Example I is wet with a dilute solution of a wetting or penetrating agent, or extracted with alcohol prior to impregnation, the latter may be carried out at room temperature. In this case, the thread strength loss is 30.9 percent or 29.1 percent, respectively.

It is apparent from the above examples that temperature, diluent, and other conditions may be varied without affecting the essential features of the invention.

Having thus described our invention, we claim:

A package comprising acidic fertilizer in a multi-ply wall paper bag having a sewed seam, said seam being sewed with cotton thread impregnated with at least about twenty percent by weight of triethanolamine distributed throughout the thread.

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