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TREATMENT OF FABRICS

Ralph W. Brown, Belleville, Ill., assignor to
Aluminum Company of America, Pittsburgh,
Pa., a corporation of Pennsylvania

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This invention relates to the protective treatment of fabrics to preserve them from damage and deterioration by weather, fungus growth, and gases, dusts, and liquids with which canvas and other fabrics come in contact when exposed to the elements and when in industrial use.

An object of the invention is to provide a fabric or cloth, such as canvas, which will resist the action of the atmosphere in industrial areas and elsewhere for a substantially longer period than ordinary fabrics.

Another object of my invention is to provide a fabric, and especially a cotton fabric, which is resistant to the weakening effect of dampness, air and other gases, mildew and other fungus growths, alkali dust, and alkali solutions, and to provide a method of preparing such fabric.

My invention has for further objects such other operative advantages and results as are found to obtain in the process and product described and claimed herewith.

Canvas and other fabrics, especially cotton fabrics such as cotton duck and various filter cloths, are used for many purposes, both domestic and industrial, in which they are exposed to conditions which cause a deterioration generally known and referred to as rotting. One manifestation of this deterioration is a loss of tensile strength in the fabric, and other changes in characteristics of the fabric also occur. Among the factors which produce this effect in awnings, sails, tents, tarpaulins, and similar fabrics structures exposed to the elements are moisture, mildew and other fungus growths, and certain dusts, fumes, and gases which are found in the atmosphere in some localities, as well as the air itself. The extent to which rotting has proceeded is conveniently determined by testing the tensile strength of the fabric in question and I have found that the tensile strength of untreated fabrics often decreases 40 per cent or more in the course of a year's exposure to the atmosphere.

A somewhat similar but usually more rapid deterioration takes place when fabrics are employed as filter cloths and filter bags and for other industrial applications, especially when they are in contact with alkaline liquids and dusts. Under such conditions high grade canvas and other strong fabrics often rot so rapidly that they will fall to pieces when touched after an exposure of a few hours or less.

For convenience and brevity, rotting induced by atmospheric conditions and natural phenomena such as fungus growth will be designated as "atmospheric" deterioration, and rotting induced

primarily by alkali dusts, liquids and gases will be designated "alkaline" or "industrial" deterioration. My present invention provides a simple and economical method of combatting both types of deterioration, which are eliminated or at least minimized by its application.

My invention contemplates the treatment of fabrics which are to be exposed to deteriorating conditions with a chromium compound applied in such manner as to make the treated fabric highly resistant to atmospheric and industrial conditions of an injurious nature. In practice, I prefer to apply the chromium compound by heating the fabric with a solution of a trivalent chromium salt, usually to the boiling point, and in some instances in the presence of a stabilizing agent. The fabric is then treated with a fixing agent, such as caustic soda solution, which hydrolyzes the chromium salt in the fabric to produce insoluble chromium hydroxide or hydrated oxide.

Various methods of saturating the fabric with chromium salt may be used. For example, the fabric may be boiled or merely immersed in a solution of potassium chromate or dichromate or the like, and then treated with SO_2 or other suitable reducing agents. I have found that it is generally more satisfactory and economical, however, to treat the fabric directly with a solution of a trivalent chromium salt such as the sulphate or acetate. The treating solution may have a concentration of about 12.5 to 200 or more grams of chromium sulphate or acetate per liter, and this solution may be boiled with the fabric from 5 to 60 minutes or longer. I have found that boiling for about 15 or 20 minutes generally produces results equally as satisfactory as boiling for a longer period, however, and is therefore preferred because less costly.

The most desirable concentration of the solution for use in this step of the process depends somewhat on the use for which the treated fabric is intended. With chromium sulphate solutions ranging in concentration from 12.5 to 200 grams per liter, I have found that in general the stronger the solution the greater the resistance imparted to the cloth. Within this range of concentrations the chromium treatment has no appreciable effect on the feel or flexibility of the cloth. When cloth so treated is employed for filtering hot alkaline solutions, however, fabrics treated with the more concentrated chromium sulphate solutions tend to harden somewhat, and cloths intended for that use are preferably chro-

mated with solutions containing 100 grams or less of chromium sulphate per liter.

In treating cloth or fabric in accordance with my invention, the most effective results are obtained if the chromium salt remains in solution and is absorbed in the fabric as such, and is then hydrolyzed in the fabric to form the insoluble chromium hydroxide. There is a tendency towards hydrolysis of the chromium sulphate when the solution is boiled, however, especially when more dilute solutions are used, and this causes a decrease in the concentration of the solution and the amount of salt absorbed, and may lead to loss of reagents. I have found that this difficulty can be overcome by adding to the solution a small amount of stabilizing compound, preferably glacial acetic acid amounting to about 4 cc. or more per liter of solution. This amount may be varied, and with some salts such as chromium acetate the addition of a stabilizing agent is not usually necessary.

When the fabric has been saturated with the trivalent chromium salt, it is removed from the salt solution and treated with a fixing agent. This is preferably a caustic soda solution, which may suitably contain about 12.5 to 100 grams of NaOH per liter. Hydrolysis of the salt absorbed in the fabric takes place rapidly in contact with the hot (preferably boiling) caustic, and only a few minutes of contact are required to produce good results. When the fabric is to be employed for filtering hot alkaline liquors or for similar purposes, the fixing treatment may be omitted, as the chromium is hydrolyzed and fixed when the fabric is put into use.

While many chromium salts and chromium compounds are effective in reducing deterioration when employed to impregnate fabrics, many of these are readily washed out of the fabric and consequently only temporarily effective. I have found that substantially permanent resistance to both atmospheric and alkaline conditions which normally produce rotting is imparted to fabrics which are properly impregnated with insoluble chromium hydroxide, and that this is most conveniently effected by saturating the fabric with a salt of trivalent chromium and hydrolyzing the salt in situ, as described hereinabove.

Example 1

Standard test strips of canvas were cut and several of these were tested and found to have an average tensile strength of 186 pounds per inch. Other strips were boiled for 15 minutes in solutions containing 12.5, 25, 50, 100, and 200 grams of $\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}$ per liter and about 4 cc. of glacial acetic acid per liter. Sets of four strips from each bath, two strips cut for testing in the direction of the warp and two for testing in the direction of the woof, were boiled for periods ranging from 7.5 minutes to 60 minutes in caustic soda solutions containing 12.5 to 100 grams of NaOH per liter. These test strips were exposed to the atmosphere for a year, along with untreated strips. At the end of the year the strips were tested, and the strengths of the four strips in each set were averaged. The average strength of the untreated strips was 114 pounds per inch; strips boiled in solution containing 50 grams of chromium sulphate per liter and then boiled 30 minutes in caustic soda solution containing 12.5 grams per liter averaged 158 pounds per inch; and strips boiled with a 200 gram per liter chromium sulphate solution and then with a 25 gram

per liter caustic soda solution for 7.5 minutes averaged 189 pounds per inch.

Example 2

A set of four test strips of filter cloth was boiled in a chromium sulphate solution containing 100 grams per liter of $\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}$ for 15 minutes. This set and a similar set of strips of untreated cloth were then subjected to an accelerated rotting test, in which the strips were alternately immersed in and withdrawn from a strongly alkaline solution containing caustic soda, soda ash and sodium aluminate, maintained at a temperature of 210° Fahrenheit, for 16 hours. The strips were then tested, and the average strength of the chromated strips was found to be 199 pounds per inch, while the average strength of the untreated strips was 40 pounds per inch.

Example 3

A set of test strips of filter cloth was boiled in a solution containing 50 grams of chromium acetate per liter for 15 minutes, and then subjected to an accelerated rotting test as in Example 2, along with a set of untreated cloths. After the test the average strength of the treated cloths was 172 pounds per inch, while the average strength of the untreated strips was 16 pounds per inch.

Various examples have been given hereinabove in order that the operation and application of my invention may be more readily comprehended, but it is to be understood that these examples are given by way of illustration only, and not as limitations, and that my invention may be variously embodied within the scope of the appended claims.

I claim as my invention:

1. In a process of rendering fabric resistant to rotting, the step comprising boiling fabric with a solution of chromium sulphate containing about 4 cc. of glacial acetic acid per liter.

2. In a process of rendering fabric resistant to rotting, the step comprising boiling fabric with a solution containing from about 12.5 to about 200 grams of $\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}$ per liter and a small amount, not less than about 4 cc per liter, of glacial acetic acid.

3. The process of rendering fabric resistant to rotting, which comprises boiling the fabric with a solution of chromium sulphate stabilized with 50 acetic acid, and then contacting the fabric with a hot alkaline solution.

4. The process of rendering fabric resistant to rotting, which comprises boiling the fabric for an hour or less with a solution containing about 12.5 to 200 grams of chromium sulphate and about 4 cc. of glacial acetic acid per liter, removing the fabric from the solution, and boiling the fabric with a solution containing caustic soda.

5. In a process of rendering fabric resistant to rotting, the step comprising impregnating fabric with a solution containing from about 12.5 to about 200 grams of $\text{Cr}_2(\text{SO}_4)_3 \cdot 15\text{H}_2\text{O}$ per liter and a small amount, not less than about 4 cc. per liter, of glacial acetic acid.

6. The process of rendering fabric resistant to rotting, which comprises impregnating the fabric with a solution of chromium sulphate stabilized with acetic acid, and then contacting the fabric with a hot alkaline solution.

7. The process of rendering filter cloth resistant to rotting, which comprises impregnating the cloth with a solution containing about 12.5 to 100 grams of chromium sulphate per liter and there-

after filtering a hot alkaline solution through the cloth whereby the chromium sulphate is hydrolyzed and an insoluble chromium hydroxide is formed in the cloth.

5 8. The process of rendering filter cloth resistant to rotting, which comprises impregnating the cloth with a solution containing about 12.5 to 100

grams of chromium sulphate and about 4 cc. of glacial acetic acid per liter and thereafter filtering a hot alkaline solution through the cloth whereby the chromium sulphate is hydrolyzed and an insoluble chromium hydroxide is formed in the 5 cloth.

RALPH W. BROWN.