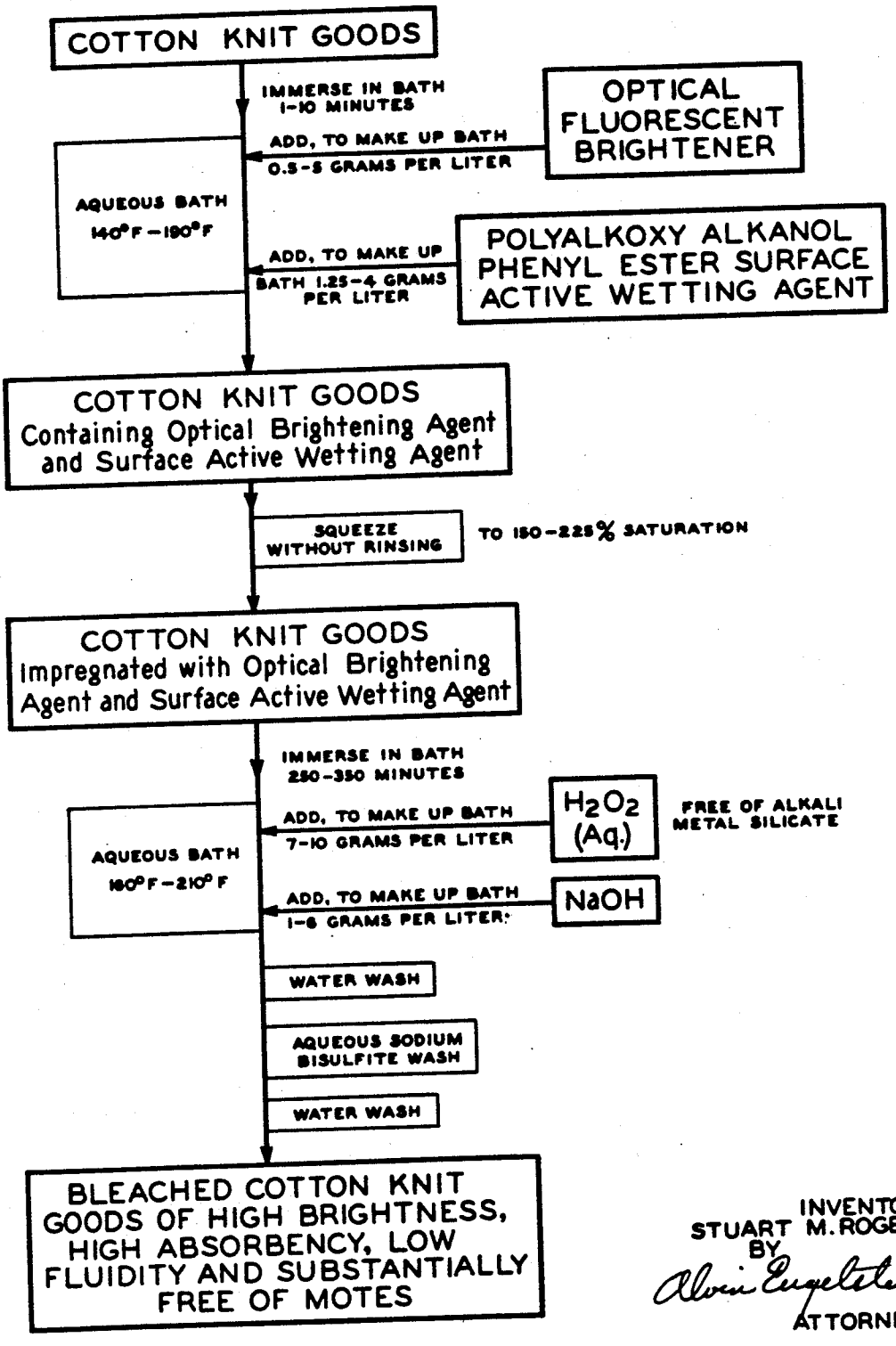
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BLEACHING OF GRAY COTTON KNIT GOODS

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BLEACHING OF GRAY COTTON KNIT GOODS

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This invention relates to bleaching cotton knit goods and more particularly to a new and improved method of bleaching to obtain bleached cotton knit goods having superior properties.

In the bleaching of cotton knit goods, there are certain properties desired in the product bleached goods. One important property desired in the bleached goods is high absorbency. Absorbency is a property of the goods of absorbing or taking into the fibers certain liquids and liquid compositions, for instance dyes. Absorbency is especially important in knit goods destined for dyeing inasmuch as the dyeability can be affected by the absorbency, and the absorbency also determines the suitability of the cotton goods for other uses. A second important property desired in the bleached cotton goods is brightness, i.e. whiteness. It is usually desired that the bleached goods have a high brightness, and the difficulty in the prior art of obtaining high brightness has generally been the material attack on and degradation of the goods due to drastic bleaching methods used for obtaining the high brightness. A third important property desired is that the bleached cotton goods have low fluidity, which is a measure of the degree of degradation of the goods caused by the bleaching. Lower fluidities are indicative of less degradative attack on the goods while higher fluidities show greater degradation of the goods. A fourth property desired, also deemed important, in the bleached goods is freedom from motes. The product bleached cotton goods which are strived for are those which exhibit all of these properties.

Cotton goods have been bleached by scouring the same at elevated temperature in a strongly alkaline scouring liquor, followed by bleaching the goods for a prolonged period of 7 hours hours or more. This scouring and prolonged bleaching of the goods is objectionable because it may result in degradative attack on the goods and also because of the prolonged time period required.

One object of the present invention is to provide a new and improved method for bleaching cotton knit goods to obtain bleached cotton knit goods of superior properties.

Another object of the invention is to provide a method for bleaching cotton knit goods to obtain bleached cotton knit goods of high absorbency.

Another object is to provide a method for bleaching to obtain cotton knit goods of high absorbency, high brightness, low fluidity and substantially free of motes.

A further object is to provide a method for bleaching cotton knit goods to high brightness, high absorbency, low fluidity and substantial freedom from motes within a short bleaching time.

Additional objects and advantages will be apparent as the invention is hereafter described in detail.

Knowing the problems in the art, I tried a great many combinations of different chemicals and bleaching procedures in an effort to obtain bleached cotton knit goods having the four properties mentioned, viz., high absorbency, high brightness, low fluidity and freedom from motes, but the results have been unsatisfactory with either zero or very low absorbency between 1 and 1.5 usually being obtained, and unsatisfactory brightness usually in the middle 80's and lower as well as poor removal of motes from the goods also being obtained. I tried pretreating the cotton knit goods by immersing the same in

a sodium hexametaphosphate solution followed by washing the goods and then bleaching the goods with peroxide solution containing sodium silicate stabilizer but the results were still unsatisfactory with either no or low absorbency being obtained. I found that only by employing the following combination method with observance of the proportions of ingredients in the wetting-out and bleaching compositions as well as observance of the times and temperatures of the treatments was there attained bleached cotton knit goods of high absorbency as well as high brightness, low fluidity, i.e. no material degradative attack on the goods, and freedom or substantial freedom from motes. In accordance with the present invention, the cotton knit goods are immersed in a bath of an aqueous wetting-out solution at a temperature within the range 140° F.–190° F., preferably 160° F.–180° F. and containing 0.5–5 grams per liter, preferably 0.5–1 gram per liter of an optical brightening agent and 1.25–4, preferably 1.5–3 grams per liter of a wetting agent of the groups consisting of non-ionic and cationic surface active wetting agents. The goods are kept immersed in the bath for a time of from about 1–10 minutes, preferably about 2–4 minutes at temperature within the aforesaid range and the goods are preferably stirred while in the bath. Then, without rinsing the goods, the goods are squeezed to a 150–225% saturation, preferably 175–200% saturation, followed by immersing the goods in an aqueous alkaline hydrogen peroxide bleaching solution free of alkali metal silicate, preferably an aqueous hydrogen peroxide solution containing from about 7–10, preferably 8–9 grams per liter of hydrogen peroxide, from about 1–6, preferably 3–4 grams per liter of sodium hydroxide and preferably also borax ($Na_2B_4O_7$) in amount from about 0.5–2, preferably 1–1.5 grams per liter. The goods are kept immersed in the peroxide bleaching solution at a temperature within the range 160°–210° F., preferably 170°–190° F., for a period of about 250–350 minutes, preferably about 280–320 minutes, and the goods are then washed with water, preferably first washed with hot water, then with cool water, thereafter with aqueous sodium bisulfite solution and again with water.

In a specific embodiment of the invention, the cotton knit goods are immersed in a bath of an aqueous wetting-out solution having a preferred concentration of 0.5–1 gram per liter of an optical brightening agent and 1.5–3 grams per liter of an anionic or non-ionic surface active wetting agent. A concentration below 0.5 gram per liter of the optical brightening agent would not be effective, and it would be unnecessary to employ concentrations of optical brightening agent above about 5 grams per liter inasmuch as these higher amounts would give no better results and may be undesirable from an economic standpoint. The wetting-out bath is at preferred temperature of about 160°–180° F. and the goods are kept immersed in the bath for preferably about 2–4 minutes at temperature within the above disclosed range, the goods being preferably stirred while in the bath. The goods should be maintained in the bath for at least about 3 minutes to insure obtainment of the high brightness and high absorbency in the final bleached product, and it is unnecessary to hold the goods in the bath for more than about 10 minutes inasmuch as little, if any, advantage is gained thereby.

Optical brightening agents are known materials, commercially available, and marketed as "Leucophor BS" (Sandoz Co.) or "Calcofluor White ST" (American Cyanamid Co.) which is 4,4'-bis(4-anilino-6-diethanolamine-s-triazin-2-ylamino)-2,2'-stilbenedisulfonic acid, disodium salt. Surface active wetting agents, well-known materials, are commercially available, of the non-ionic and anionic type and include polyalkoxy alkanol phenyl esters,

for instance isooctyl phenyl polyethoxy ethanol ("Triton X–100"), and sodium alkyl aryl sulfonate ("Alkanol WXN").

After the wetting-out treatment, the goods are removed from the bath and without rinsing, the goods are squeezed to a 175–200% saturation, which is a goods-solution ratio of 1:1.75–1:2. The goods are then placed in a kier and an aqueous alkaline peroxide bleaching solution is added to the kier so that the goods are immersed in the bleaching solution. The peroxide bleaching solution is free of sodium silicate decomposition stabilizer or other alkali metal silicate, and preferably is an aqueous hydrogen peroxide solution containing from about 7–10 g.p.l. hydrogen peroxide, about 1–6 g.p.l. sodium hydroxide and preferably about 0.5–2 g.p.l. borax ($Na_2B_4O_7$). Use of the aqueous peroxide bleaching solution devoid of alkali metal silicate in accordance with the invention resulted in bleached cotton goods having an excellent absorbency as well as a high brightness. The peroxide bleaching solution is preferably at temperature of about 160°–180° F., and the pH of the peroxide solution may be within the range of pH 8–12, preferably pH 10–11 by virtue of the sodium hydroxide. The goods are held in the peroxide bleaching solution for a time of preferably about 280–320 minutes.

The thus-treated goods are then washed with water, preferably first with hot water, then with cool water, thereafter with aqueous sodium bisulfite solution and again with water. The washed goods may then be squeezed or pressed and dried.

The brightness of the bleached cotton knit goods was determined using a standard General Electric reflectometer. A G.E. brightness of 86% or above is considered good for cotton goods.

The absorbency of the cotton knit goods is determined by the following procedure. ½-inch strips of the cotton goods are fastened without stretching between prongs projecting —from the edge of two disks, spaced about 6 inches apart by means of a supporting rod passing through the center of each disk. The assembly is then placed in a vertical glass cylinder containing 1–1½ inches of distilled water. At the end of 5 minutes as determined by a stopwatch started simultaneously with placing the assembly in the cylinder, the height of the water absorption in the cotton strips is measured by means of a transparent scale attached to the outside of the cylinder by flexible bands. The zero point is adjusted to the water level and each 1/16-inch rise of water in the fabric is equivalent to 1 point of absorbency. The absorbency test is carried out at 73° F. and a relative humidity of 50%. An absorbency of 25–30 is acceptable and absorbency above 30 is rated excellent.

Degradation or modification of the cotton fibers due to the chemicals used in the processing is very effectively and accurately measured by determining the fluidity of the cotton cellulose dissolved in cuprammonium hydroxide according to standard procedure. The fluidity values attached are largely independent of the fabric construction, and the test is a very useful one inasmuch as the degradation of the fibers can be used to predict the effect of chemical treatments on the tensile strength of the fabrics and their wearing qualities. The fluidity values are measured in rhes, i.e. reciprocal poises, with values about 6 indicative of the degradation of the cotton fibers and values below 4 indiçating superiod strength of the fibers. The mote content was determined by careful visual inspection of the cotton knit goods.

The following comparative examples illustrate the invention.

Example I

A 50 gram sample of gray tubular cotton knit goods was immersed and stirred for 3 minutes at 180° F. in 500 ml. of an aqueous solution containing 3.0 g.p.l. of an isooctyl phenyl polyethoxy ethanol ("Triton X–100") and 0.69 g.p.l. "Calcofluor ST White" solution (4,4'-bis(4-anilino-6-diethanolamine-s-triazin-2-ylamino) - 2,2' - stilbenedisulfonic acid, disodium salt) brightener. Without washing, the goods were squeezed to a 200% solution saturation and piled in a glass kier. 60 ml. of an aqueous solution containing 8.75 g.p.l. H_2O_2, 1.0 g.p.l. $Na_2B_4O_7$ and 3.0 g.p.l. NaOH and 10 cc. of water were added to the kier, circulated and heated to 180° F. and held for 5 hours. The kier was drained and the sample given 5-minute circulating rinses with separate portions of hot water, cool water, 2.0 g.p.l. $NaHSO_3$ and 0.7 g.p.l. $NaHSO_3$ after which the goods were removed from the kier and washed. The goods were then cut into pieces of about equal size which were placed between blotters to remove water, then pressed at 600 lbs. p.s.i. between fresh blotters and dried. The results of this run were:

Brightness	90.1.
Fluidity	1.9
Absorbency	61.
Mote removal	Excellent.

Example II

The procedure of Example I was repeated but the isooctyl phenyl polyethoxy ethanol of the pretreatment wetting-out solution was reduced to 0.75 g.p.l. in the wetting-out solution of Example I. The results obtained were:

Brightness	88.5.
Fluidity	1.8.
Absorbency	52.
Mote removal	Excellent.

Example III

The procedure of Example I was followed except that the pretreatment wetting-out solution contained no isooctyl phenyl polyethoxy ethanol or other wetting agent. The results obtained were:

Brightness	85.1.
Fluidity	2.3.
Absorbency	0.
Mote removal	Excellent.

Example IV

The procedure of Example I was repeated except that the aqueous peroxide bleaching solution contained 3.0 g.p.l. $Na_2B_4O_7$. The results obtained were:

Brightness	90.1.
Fluidity	1.8.
Absorbency	56.
Mote removal	Excellent.

Example V

The procedure of Example I was repeated except that the aqueous peroxide bleaching solution contained no $Na_2B_4O_7$. The results obtained were:

Brightness	88.1.
Fluidity	1.9.
Absorbency	60.
Mote removal	Excellent.

Example VI

The procedure of Example I was repeated except that the aqueous peroxide bleaching solution contained 4.0 g.p.l. NaOH. The results obtained were:

Brightness	90.8.
Fluidity	1.9.
Absorbency	61.
Mote removal	Excellent.

Example VII

The procedure of Example I was repeated except that the aqueous peroxide bleaching solution contained 5.0 g.p.l. NaOH. The results obtained were:

Brightness	89.2.
Fluidity	1.9.
Absorbency	60.
Mote removal	Excellent.

Example VIII

The procedure of Example I was repeated except that the aqueous peroxide bleaching solution contained no NaOH. The results obtained were:

Brightness	85.2.
Fluidity	2.1.
Absorbency	53.
Mote removal	Poor.

The effective bearing of the concentration of wetting agent of the wetting-out solution is readily apparent from the above examples. When the amount of this wetting agent was lowered to 0.75 g.p.l. in Example II a marked drop in absorbency from 61 to 52 took place as well as a significant decrease in brightness. Omission of the wetting agent from the wetting-out solution of Example III resulted in zero absorbency and caused the brightness to decrease further. The effect of omitting NaOH from the peroxide bleaching solution is readily apparent from the results of Example VIII in which the mote removal was poor and the brightness was materially lowered.

The present invention not only achieves a good brightness for the cotton goods but also achieves good results with respect to 3 additional properties of the goods which the prior art has found to be difficult to achieve with respect to all four properties simultaneously. Cotton knit goods processed in accordance with the invention not only is characterized by higher absorbency but in addition by having a higher brightness, lower fluidity, i.e. less degradation of cellulose fibers and considerably improved mote removal.

Although certain preferred embodiments of the invention have been disclosed for purpose of illustration, it will be evident that various changes and modifications may be made therein without departing from the scope and spirit of the invention.

A flow diagram of the inventive bleaching process is shown in the attached drawing.

I claim:

1. A method for bleaching gray cotton knit goods which consists of immersing the gray cotton knit goods in a bath of an aqueous solution consisting of 0.5–5 grams per liter of an optical fluorescent brightening agent and 1.25–4 grams per liter of a polyalkoxy alkanol phenyl ester surface active wetting agent at a temperature within the range 140° F.–190° F., keeping the goods immersed in said aqueous solution bath for a time of from about 1–10 minutes at temperature within the aforesaid range, then directly squeezing the goods to a 150–225% saturation, then immersing the squeezed goods in an aqueous alkaline hydrogen peroxide bleaching solution consisting of 1–6 grams per liter of sodium hydroxide, about 7–10 grams per liter hydrogen peroxide and from about 0.5–2 grams per liter, keeping the goods immersed in said peroxide bleaching solution at a temperature within the range 160° F.–210° F. for a period of from about 250–350 minutes, removing the goods from the peroxide bleaching solution and water washing, then treating the goods with dilute aqueous sodium bisulfite solution, and washing the thus-treated goods with water to obtain cotton knit goods of high brightness, high absorbency, low fluidity, and substantially free of motes.

2. A method for bleaching gray cotton knit goods which consists of immersing the gray cotton knit goods in a bath of an aqueous solution consisting of 0.5–1 gram per liter of 4,4'-bis(4-anilino-6-diethanolamino-s-triazin-2-ylamino)-2,2'-stilbenedisulfonic acid, disodium salt optical fluorescent brightener and 1.5–3 grams per liter of a polyalkoxy alkanol phenyl ester surface active wetting agent at a temperature within the range of 160° F.–180° F., keeping the goods immersed in said aqueous solution bath for a time of from about 2–4 minutes at temperature within the aforesaid range and stirring the goods while in the bath, then directly squeezing the goods to a 175–200% saturation, then immersing the squeezed goods in an aqueous alkaline hydrogen peroxide bleaching solution consisting of from about 7–10 grams per liter hydrogen peroxide, from about 3–4 grams per liter sodium hydroxide and from about 0.5–2 grams per liter borax, keeping the goods immersed in said peroxide bleaching solution at a temperature within the range of 170° F.–190° F. for a period of from about 280–320 minutes, removing the goods from the peroxide bleaching solution and water washing, then treating the goods with dilute aqueous sodium bisulfite solution, and washing the thus-treated goods with water to obtain cotton knit goods of high brightness, high absorbency, low fluidity and substantially free of motes.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,142,531 July 28, 1964

Stuart M. Rogers

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 42, strike out "hours", second occurrence; column 3, line 38, after "projecting" strike out the dash; line 65, for "superiod" read -- superior --; column 6, line 7, after "liter" insert -- borax --.

Signed and sealed this 17th day of November 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

UNITED STATES PATENT OFFICE

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