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METHOD OF SCOURING AND BLEACHING OF WOOL
AND OTHER ANIMAL FIBER TEXTILE MATERIALS
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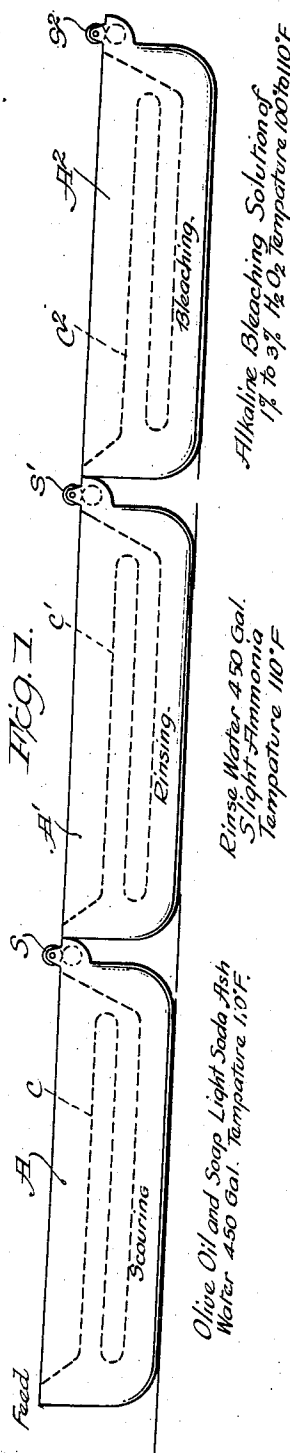
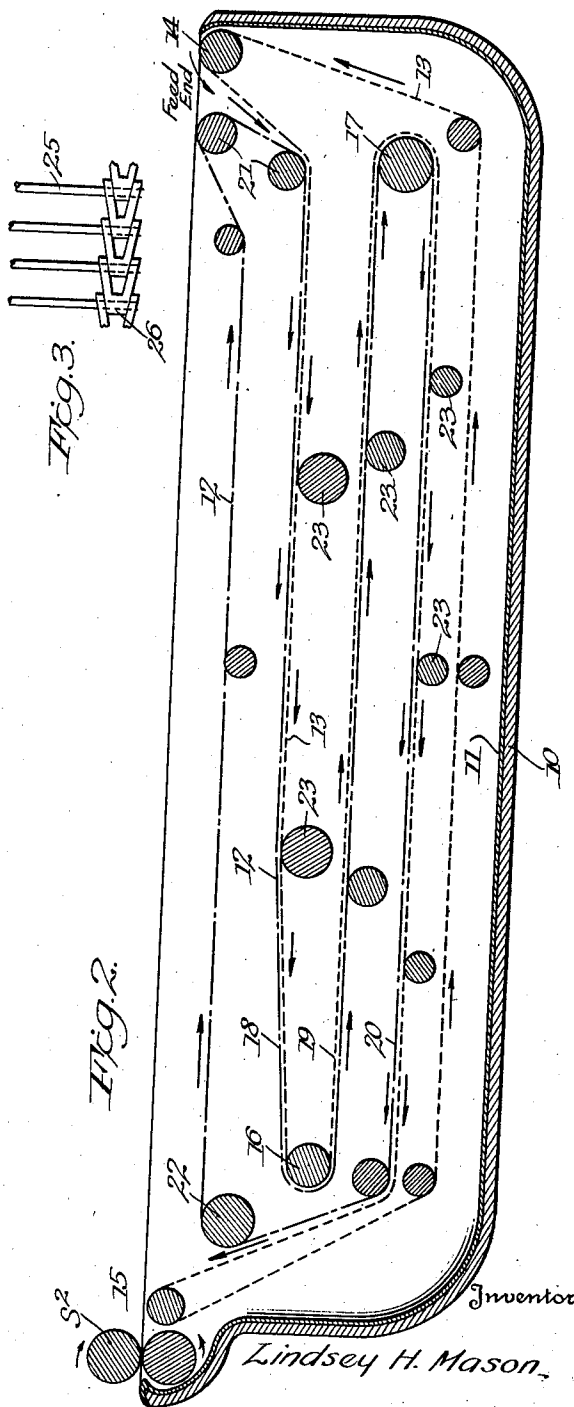
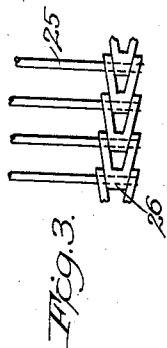


Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE

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METHOD OF SCOURING AND BLEACHING
OF WOOL AND OTHER ANIMAL FIBER
TEXTILE MATERIALS

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8 Claims. (Cl. 8—2)

My present invention relates to improvements in the method of and apparatus for continuously scouring and peroxide bleaching animal fiber textile materials, such as wool and aims generally to improve existing methods and apparatus for that purpose.

The present invention has for one of its principal aims and advantages the provision of a new method of and apparatus for bleaching textile materials of the class above referred to, to the end that the bleaching of the material may be carried out continuously with and following the scouring and rinsing.

Another principal aim and object of the invention is the provision of a suitable method and apparatus for bleaching wool and other materials without liability of damaging the animal fibers as has been experienced heretofore.

More particularly, the invention aims to improve existing methods and apparatus for continuously scouring and bleaching wool yarns, and in order that the invention may be best understood, the process and an exemplified apparatus for scouring and peroxide bleaching worsted yarns will be described, although it is to be understood that the invention is not restricted in its broader aspects to worsted yarns, as other materials of the animal fiber group may be similarly scoured and bleached.

In the processing of worsted yarns, for example, the wool fibers are spun and twisted into threads which are finished in skeins. These skeins of yarn, ready for the bleacher and dyer, are in such state that the yarn contains a certain amount of animal grease, dirt, and oil from the spinning operations. The yarn also contains more or less of a yellowish pigment, and as is well recognized, it is necessary to further scour and bleach the yarn, either preparatory to dyeing or for use for knitted white goods.

Heretofore, in the processing of woolen and worsted yarns, the skeins have been scoured and bleached in separate operations. The scouring operation, including rinsing, was necessarily comparatively rapid, seldom requiring over 15 minutes as it is not desirable to subject the yarn to the scouring solution for a period longer than is necessary sufficiently to scour and clean it of the animal grease and dirt. Generally speaking, accepted practice requires scouring for as short a time as possible, so as not to injure the fibers. Heretofore, the bleaching operation, has always required a much longer time, usually 8 to 16 hours, and the prior practice of peroxide bleaching yarns was to immerse the scoured and rinsed skeins in

a weak peroxide bath (.3% to .5%) for a number of hours. Usually, the wool was left immersed in the bleach bath overnight, and hence I refer to the prior practice as the "overnight" method, meaning thereby the bleaching in solution for 8 to 16 hours. Thus the skeins of yarn were slowly bleached for from 12 to 16 hours, and was a slow, laborious and time-consuming operation. Furthermore, because of the long time required to be consumed in the prior "overnight" peroxide bleaching process, the bleaching could not be worked continuously with the scouring which required but a few minutes for scouring and rinsing.

Furthermore, in the prior "overnight" method, it was considered necessary to start the bleaching bath at a temperature of around 140° F. in order that the weak hydrogen peroxide solution (.3 to .5%) could effectively dissolve the natural pigments. The reaction of the hydrogen peroxide solution on the wool at this temperature, however, was such as to damage the wool, in many cases burning it. A certain catalytic effect was produced on the wool, which rendered the wool hard and relatively stiff as compared to wool bleached by my method. Furthermore in the summertime, where room temperatures remained between 90° and 100°, the resulting high temperatures of the bleaching bath often reacted upon the wool as to produce a soft, mushy and gelatinous mass that was spoiled for any use as yarn. This was a direct loss to the bleacher who was liable for the value of the spoiled wool.

My invention provides for the continuous scouring and bleaching of worsted and woolen yarns by continuously passing the yarn rapidly through a scouring bath, a rinsing bath, and a bleaching bath, the latter being more concentrated than heretofore (1-3% and preferably from 1% to 2% of H_2O_2) and at a temperature below the damaging temperature of wool (preferably between 100° and 110° F.). The yarn is immersed in the bleaching solution for a very short time (sufficient to thoroughly and uniformly saturate the fibers) which time may be substantially equal to or in some instances less than the time required for scouring or rinsing, although it will be appreciated that either the scouring or rinsing operation, or both, may be lengthened to a point where either or both are of greater duration than the bleaching. As the skeins are removed from the bleaching bath the excess bleaching solution is removed, as by squeezing between rolls or by a centrifugal extractor, and preferably the extraction of surplus bleach solution takes place before

the skeins are handled. The skeins are then in a dry or semi-dry state and bleaching continues and takes place with the wool in that condition. When the skeins are sufficiently bleached, i. e. when they are sufficiently white, they may be washed in clean water to stop the bleaching action of the peroxide.

My improved process may advantageously be carried out by a large variety of apparatus, one type being diagrammatically illustrated in the accompanying drawing, wherein

Fig. 1 is a diagrammatic view illustrating how the process may be carried out;

Fig. 2 is a longitudinal sectional view of the bleaching vat; and

Fig. 3 is a detail view of a portion of the conveyor.

According to my invention, the process may be conveniently carried out in the manner and by apparatus illustrated in the accompanying drawing. Preferably three or more vats, A, A' and A² are provided, arranged in line so that the yarn to be processed may be continuously moved through each of the three vats in succession, to effect respectively and successively a continuous scouring, rinsing and bleaching of the yarn. Each of the vats is provided with conveying means for conveying the yarn, submerged in the bath, through the vat, and preferably the conveying means is arranged to reverse the direction of movement of the yarn through the vat so as to obtain a required amount of treatment in a minimum of space as will be hereinafter more fully described.

The vat A is advantageously a scouring vat for removing the dirt, grease and foreign matter from the wool, and for this purpose I find that a solution of water, olive oil soap and light soda ash is admirable for the purpose. This may advantageously be in the proportion of 450 gals. of water, 6 lbs. of soap and about 9 lbs. of 58% light soda ash. This scouring bath is maintained at a temperature well under 130° F. (at which temperature the wool is damaged) and preferably I maintain the bath at approximately 110° F. as I find that at this temperature the scouring action is sufficiently rapid and effective and the yarn is not damaged, but remains soft, light, fluffy and possessing its original elasticity.

The yarn is fed upon the conveyor C in vat A (Fig. 1) at the feed end and is conveyed through the scouring bath a number of times, advantageously three times, when it is delivered to rotating squeeze rolls S which squeeze the excess solution from the yarn. The time required for this scouring is usually from one to five minutes, depending upon the condition of the wool, strength of the scouring solution, and other factors.

As the scoured yarn passes from the squeeze rolls S, it falls upon a conveyor C' in a rinse water tank containing a slight amount of ammonia, advantageously one pint to 450 gals. of water. This rinse bath is likewise maintained at a temperature below 130° F. and preferably at 110° F. or substantially so, it being desirable that the temperature of all baths be approximately alike. The conveyor C' in the rinse vat may be of the same type and construction as the conveyor C in the scouring tank, and I find that highly satisfactory results are obtained when all of the conveyors are alike and move at substantially the same speed. The conveyor C' carries the rinsed yarn to the squeeze rolls S' which remove the excess rinse from the yarn and ad-

vantageously deliver the yarn to the conveyor C² in the next vat in line A².

Advantageously the third vat may be a bleaching vat, although my invention is not to be so restricted. For example, in some cases I prefer to again subject the yarn to a further and light scouring as for example, about 2 lbs. of soap and 3 lbs. of soda ash and 450 gals. of water, in which case a further rinsing would be necessary and desirable. On the other hand, the light scouring mentioned above, may follow the initial scouring, so that a single rinsing could be effected in the third vat, and the bleaching be performed in a fourth vat. Also it is not essential to all phases of the invention that the yarn be continuously moved from the rinse tank to the bleaching tank as obviously satisfactory results could be obtained by interrupting the continuity of the process after the rinsing.

Preferably it is desirable to bleach the yarn with a concentrated solution of hydrogen peroxide (H₂O₂) (preferably 1% to 2% of H₂O₂) and this is advantageous in my method owing to the short time the yarn is submerged in the bleaching solution as compared with the prior method of bleaching overnight.

Accordingly the bleaching vat which, in the illustrated embodiment, is a vat A², is formed of a material resistant to hydrogen peroxide, such as wood, porcelain etc. Iron or steel are not suitable because of the rapid rusting. As the bleaching vat is conveniently fifteen or twenty feet long, it is most conveniently made of cast iron, and in such case it is preferably lined as at 11, with a suitable metal, such as lead, which will resist the hydrogen peroxide solution. The bleach bath has sufficient hydrogen peroxide added to make about a 1% to 2% concentrated solution and preferably also includes a small amount of silicate of soda, to make the solution alkaline. The temperature of this bleach bath is maintained considerably below 140° F., preferably between 100° and 110° F. for the purpose of avoiding a too rapid catalytic action upon the wool and thus injure the fibers. At 110° F. I have found that the solution maintains its hydrogen strength for a longer time, even though more concentrated than before where a .5 per cent H₂O₂ solution at 140° F. was maintained overnight according to the prior method.

The yarn may be carried through the bleaching bath, as by means of a conveyor C², specially constructed of a material to resist the action of hydrogen peroxide, such as stainless steel or lead coated conveyors. This action of moving the yarn through the bleach bath also accelerates the bleaching and a thorough and uniformly bleached skein is produced by repeatedly compressing and expanding the skein (kneading) in the bleach bath.

The yarn is immersed in the bleach bath for a period of time sufficient to thoroughly and uniformly saturate the yarn, which is seldom more than 1 to 5 minutes, depending upon the strength of the solution, and other factors, at which time the yarn is delivered to the squeeze rolls S² to extract the surplus bleach from the skeins.

The skeins of yarn having been thoroughly saturated with the hydrogen peroxide bleach solution, are conveyed to the extractor where the excess solution is removed, and this without intermediate handling of the yarn. I find that the fibers still hold a sufficient amount of the bleach, so that the bleaching action will continue, and I permit this continuance of bleaching in the dry

or partially semi-dry wool until the desired degree of whiteness is obtained, at which time, the bleached skeins may be rinsed in a clear water bath to stop the bleaching action.

5 In Fig. 2 I have illustrated in section, one manner of constructing a bleaching tank, which has been found highly satisfactory in use for the bleaching of skeins of yarn, and which may be satisfactorily used in conjunction with scouring and rinsing apparatus of similar construction 10 when the invention is applied in the process of continuously scouring and bleaching yarns.

15 In the form of apparatus shown in Fig. 2, the vat 10 which may advantageously be of cast iron construction, is provided with a lining 11 resistant to hydrogen peroxide, such as lead.

20 The conveying member C² for conveying the yarn through the hydrogen peroxide bleach solution preferably comprises endless opposed aprons or chains 12, 13, as the case may be between which the yarn is supported and repeatedly conveyed through the peroxide bleaching bath.

25 In some instances it may be desirable to maintain the wool immersed in the bleaching solution for a time longer than that required for the conveyor to cause the material to traverse a single length of the vat 10. This is true, particularly where the fibers of the wool contain oxidized oil or pigments difficult for the liberated oxygen to 30 penetrate and dissolve. As it is advantageous to use the equipment in a continuous scouring, rinsing and bleaching machine, it is desirable that the yarn be fed to the bleach vat, at one end, and delivered from the opposite end of the vat. 35 Hence, the conveying member as arranged, makes three passes through the vat.

40 This may be accomplished by the arrangement shown in Fig. 2, for example, wherein the conveying apron or chain 12 is trained over a driven sprocket 14 at the receiving end, and a driven sprocket 15 at the delivering end adjacent the final squeeze rolls. The intermediate portion of the apron or chain 12 is double-looped 45 over spaced driven sprockets 16 and 17 so as to provide in the apron three separate runs 18, 19 and 20.

50 However, it is not essential, according to my invention, that the material being bleached, traverse the length of the vat three times. Obviously, the character and condition of the material may be such that a much shorter period of submersion is preferable. To this end, if only a brief immersion of the material in the bleaching solution is desired, the level of the solution need only be 55 high enough to cover the lower run 20 in which case the material is only submerged during one traverse of the vat. Again the bath may be above the run 19, in which case the material is submerged for twice as long.

60 The cooperating apron or chain 13 is trained over an idler 21 spaced from the sprocket 14, thence over sprockets 16 and 17 and finally over an idler 22 adjacent the delivery sprocket 15. Thus the apron or chain 13 cooperates with and 65 is directly opposed to the apron or chain 12 throughout runs 18, 19 and 20 so that the yarn may be supported throughout the several runs.

70 The conveyor chains 12 and 13 are preferably constructed of a material which is resistant to the action of hydrogen peroxide, as for example, stainless steel. The aprons or chains 12 and 13 may be of any suitable construction for the purpose. The construction shown in Fig. 3 has been 75 found satisfactory for the purpose and may ad-

vantageously comprise an apron or chain composed of transverse bars 25 of stainless steel, constituting the supporting members of the conveyor, the opposed ends of which extend through and serve to pivotally connect together links 26, 5 thus forming on each side of the conveyor, sprocket chains suitable for engagement with the sprockets 14, 15, 16 and 17. A plurality of idlers 23 may be positioned below each of the runs 18, 19 and 20, if desired, and the chains may be sufficiently loose so that there will be some slack 10 between each idler. This accentuates the expansion and compression of the yarn (kneading) above referred to, which insures thorough and uniform saturation and speeds up the bleaching operation and increases the effectiveness of the scouring and rinsing. 15

It is to be understood that the invention is not restricted in its scope to the continuous scouring and bleaching of yarns but is useful in the scouring or bleaching of other materials such as raw stock, tops, piece goods, knit goods, felts etc. 20 For example, piece goods may be scoured and bleached or, if sufficiently clean, may be bleached by continuously moving the piece goods in the web through a concentrated hydrogen peroxide bleaching solution to fully saturate the goods and then immediately passed through squeeze rolls to extract the surplus bleaching solution from the fabric and permit bleaching to continue and take place in the semi-dry state, after which the fabric may be rinsed with water as above described. 25

30 Furthermore, raw stock, and loose fibers may be bleached by immersing the fibers in a drum or basket moving in the bleaching solution and then whirling the basket out of the bleaching solution to extract the surplus solution therefrom, so that bleaching may take place and continue in the semi-dry state. 35

40 In the bleaching of most materials it is advantageous that the excess solution be extracted from the saturated material before handling. This is because the hydrogen peroxide particularly at temperatures of 100° to 120° acts to dissolve the natural pigments in the wool. Handling of the wool in its wet or saturated state often causes damage or weakening of the strands, and with skeins or piece goods, if handled manually 45 between immersion and extraction, the solution is apt to drain toward the lower portion of the skein or fabric and the bleach will be more concentrated and pronounced at that portion. The result is non-uniformly bleached material which is not advantageous. 50

55 As stated above, although the invention is highly useful when employed in a continuous scouring and bleaching process and apparatus, it is not to be so restricted in its broader features. It is to be understood that the improved bleaching process may be carried out in other than that shown and described and also with or without the scouring and rinsing steps or apparatus. 60

65 Advantages of my invention reside in the economy of manufacture as well as the new and improved qualities of the product produced. The bleaching method and apparatus is adaptable for use continuously with a scouring and bleaching process and apparatus, heretofore considered impossible because of the long time required for hydrogen peroxide bleaching. This makes for considerable economy in manufacture and insures uniformity in result. 70

75 The improved process of peroxide bleaching, 75

as well as the apparatus is highly efficient in economically effecting bleaching material according to my invention. The material is thoroughly and effectively saturated with the bleaching solution and extracted without the necessity of intermediate handling and consequently uniformity of bleach is assured and damage to the fibers avoided. As the period of saturation or immersion is exceedingly short compared to the prior "overnight" method, the production of a soft, gelatinous and spongy mass is avoided.

Normally, this period of saturation may be as short as from 1-5 minutes, although it is not necessarily that brief. For example, the period of saturation may exceed 5 minutes without damage to the fibers, though such longer period might not be necessary to obtain a satisfactory bleach. In this respect the term "normally 1-5 minutes", as used in some of the claims is not intended as limiting the invention to that period, but merely to an exceedingly short period as compared to the prior art processes. Moreover, the product is more improved and the fibers retain their natural properties, such as strength and elasticity, but are more suitable for use in garments as they are bleached and free from grease, dirt or discoloring pigments.

The above description is intended merely as explanatory of my invention and is to be considered as illustrative rather than definitive.

What I claim and desire to secure by Letters Patent is:

1. A method of bleaching textile materials of the animal fiber group, comprising continuously moving the material through a bleaching bath primarily consisting of an alkaline 1-3% hydrogen peroxide aqueous solution of a temperature of 100-130° F., removing the mass from the bath after a relatively short interval, normally 1-5 minutes, squeezing to remove surplus solution and rinsing the material.

2. A method of bleaching wool yarns and like animal fiber textile materials, comprising passing a loosely compacted mass of the material of moderate thickness through a bleaching bath essentially consisting of an alkaline 1-3% hydrogen peroxide aqueous solution and having a temperature preferably not lower than about 100° F. and substantially below 140° F., kneading the mass during its passage through the bleaching bath to secure thorough and uniform penetration of the solution, removing the mass from the bath after a relatively short interval of time, squeezing to remove surplus solution, exposing the resultant moist mass to the air for further bleaching if desired, and rinsing.

3. A method of bleaching scoured wool and like animal fiber textile materials, comprising rinsing the material in water containing a slight amount of ammonia and having a temperature of about 110° F., squeezing to remove excess liquid, continuously moving through a bleaching bath essentially composed of a 1-2% hydrogen peroxide aqueous solution containing a small amount of silicate of soda sufficient to render the solution alkaline and having a temperature of about 100-110° F., removing after a short interval, normally 1-5 minutes, and squeezing to remove excess water, exposing the resultant moist material to

the air to permit continued bleaching until the desired color is obtained and rinsing.

4. A continuous method of scouring, rinsing and bleaching textile material of the animal fiber group, comprising continuously passing the material through a scouring bath and a rinsing bath and then through a bleaching bath primarily consisting of an alkaline 1-3% hydrogen peroxide aqueous solution having a temperature of less than 130° F., removing the material from the bleaching bath after a relatively short interval of time and promptly removing the surplus solution from the material without intermediate handling.

5. A continuous method of scouring, rinsing and bleaching skeins of wool yarn and the like, comprising passing the skeins in a stream through a scouring bath, squeezing the skeins as they leave the bath to remove excess liquid and then continuously passing the skeins from the rinsing bath through a suitable rinse bath, squeezing the skeins leaving the rinse bath to remove excess liquid and then continuously passing the skeins from the rinsing bath for a short interval, normally 1-5 minutes, through a bleaching bath essentially composed of an alkaline 1-3% hydrogen peroxide aqueous solution having a temperature preferably not lower than about 100° F. and substantially below 130° F., kneading the skeins during passage through the bleaching bath to secure thorough and uniform penetration of the solution, removing the skeins after passage through the bleaching bath and squeezing to remove excess liquid; the skeins being passed continuously in a stream through the entire sequence of steps.

6. A method of bleaching textile piece goods of the animal fiber group comprising continuously moving a web of the goods through a bleaching bath essentially consisting of an alkaline 1-3% hydrogen peroxide aqueous solution having a temperature of less than 130° F., the immersion being for a relatively short period of time, removing excess solution from the web leaving the bleaching bath to leave the goods in a partially dry state, and exposing the goods to the air to produce continued bleaching.

7. A method of bleaching textile raw stock of the animal fiber group, comprising moving the stock for a relatively short time, normally 1-5 minutes, through a bleaching bath essentially consisting of an alkaline 1-3% hydrogen peroxide aqueous solution having a temperature of 100-130° F., immediately thereafter extracting the excess solution from the stock to partially dry it, and permitting bleaching to continue in the partially dry stock.

8. A method of bleaching textile materials of the animal fiber group, comprising continuously moving the material through a bleaching bath primarily consisting of an alkaline 1-3% hydrogen peroxide aqueous solution of a temperature substantially below 130° F., removing the mass from the bath after a relatively short interval of immersion sufficient to thoroughly saturate the fibers, normally 1-5 minutes, squeezing to remove surplus solution and thereafter rinsing the material.

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