

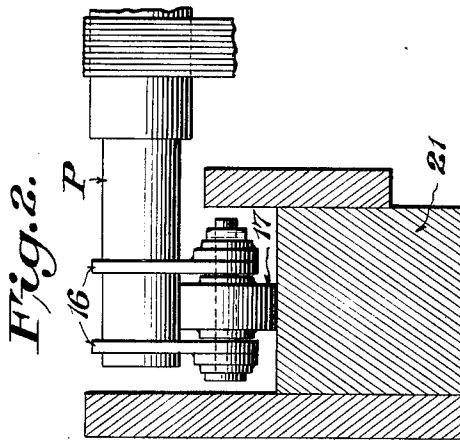
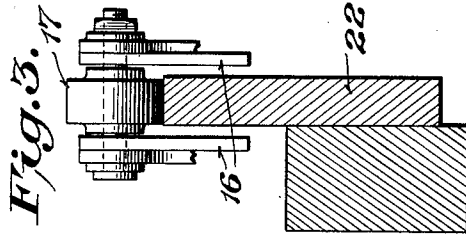
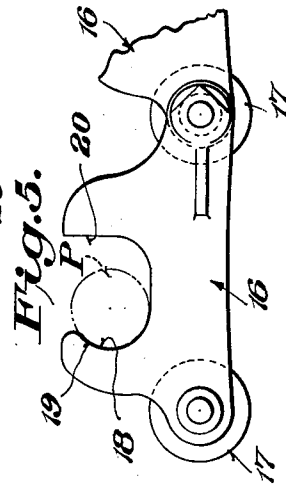
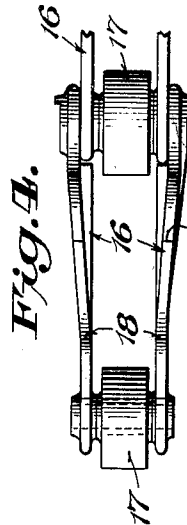
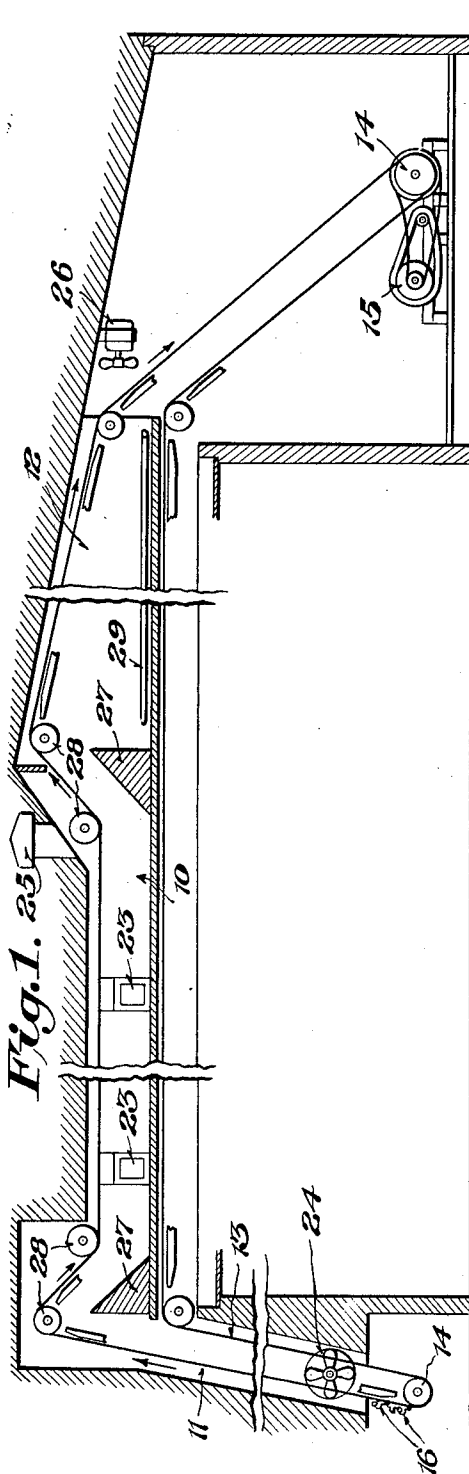
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L. H. MASON

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PROCESS AND APPARATUS FOR SULPHUR BLEACHING ANIMAL TEXTILE FIBERS

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PROCESS AND APPARATUS FOR SULPHUR
BLEACHING ANIMAL TEXTILE FIBER

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10 Claims. (Cl. 8—110)

The present invention relates to sulphur bleaching of textile materials and aims generally to improve both the methods and apparatus heretofore used for treating such materials as are advantageously bleached by sulphur fumes. While the invention is applicable to the bleaching of various kinds of textile materials or fibers, a preferred embodiment is herein described with particular reference to the bleaching of animal fiber materials such as woolen and worsted yarns.

In bleaching woolen and worsted yarns, for example, it is often desirable to "double bleach" the yarn, by first bleaching with peroxide or some oxidizing agent to remove the color from those pigments which are affected by oxidation, and then later to subject the thus bleached yarn to a reducing reaction by stoving in sulphur fumes in a "sulphur house" to remove color from other pigments, in order to produce a permanent white.

This stoving process was merely the exposure of wet or damp yarn to the fumes of burning sulphur (sulphur dioxide gas), in a carefully confined chamber, called a "sulphur house" for a period of ten or more hours, usually overnight. The sulphur dioxide gas combined with the water of the damp yarn forming sulphurous acid (H_2SO_3) gave the bleaching action, and is referred to in the art as the "sulphurous acid" and "sulphur dioxide" bleach. Apparently the bleaching action is the result of a reducing reaction taking place in the yarn, as yarn immersed in liquid sulphurous acid will not bleach satisfactorily. Nor will dry yarn exposed to sulphur dioxide gas bleach satisfactorily.

Sulphur bleaching, according to the prior practice, consisted in taking the peroxide bleached yarn, which had been washed, and while still wet or damp, was removed to the "sulphur house" usually by hand trucks where it was spread out and hung on rods or poles. The "sulphur houses" were usually on the roof of the building or in some remote portion of the plant because the escaping sulphur dioxide gas is disagreeable and harmful to the lungs and is apt to damage goods which are not to be bleached. After the yarn had been spread or hung on the rods or poles, a charge of sulphur was placed in a suitable receptacle and ignited and the house was then tightly closed against the entrance of air, except a limited amount adjacent the sulphur port to support combustion. The room was carefully constructed against the entrance of air as not to permit the formation of condensed acid liquor with traces of sulphuric acid, which is

dropped upon the goods, spoiled and damaged the yarn. The charge of sulphur was usually sufficient to last ten or more hours as numerous inspections of the yarn at shorter intervals showed that a satisfactory bleach was not obtained in less time. Usually the yarn was left in the "sulphur house" overnight. After the charge of sulphur had completely burned out and the required time for bleaching elapsed, the "sulphur house" was opened to permit the escape of unabsorbed fumes to enable the workmen to enter the house and remove the yarn. As it was difficult to get the house completely ventilated and free of sulphur fumes, the workmen often worked under disagreeable and unhealthy conditions. The sulphur bleached yarn was then piled in trucks and removed to a drying room for final drying, and in some instances was first washed to remove all traces of sulphur dioxide odor.

In addition to the long time required for such sulphur bleaching and the disagreeable and unhealthy conditions attendant thereto, the prior stoving methods had many other disadvantages. The wet yarn, hanging on the rods, for so many hours became stretched and had an inferior appearance, which was not entirely removed by the subsequent drying. Furthermore, notwithstanding the care to exclude outside air, condensation or acid liquor often collected on the ceiling of the sulphur house and dropped upon the yarn, soiling or damaging it.

Notwithstanding that the admission of air to the "sulphur house" during the burning of sulphur was, in the prior processes, attendant with the disadvantages of accelerating the formation of damaging acid liquor, I have discovered that air may be circulated through the sulphur bleaching chamber in such velocity as to prevent the condensation and presumably creates an oxidizing atmosphere which materially accelerates the bleaching action. With the preferred method and apparatus, according to the invention, it is possible to produce a highly satisfactory bleach in one hour, thus permitting the yarn to be bleached in a sufficiently short time that it will not be damaged by stretching.

My invention may be utilized in various embodiments either for the continuous sulphur bleaching or stoving in a sulphur house, one of the most satisfactory forms being shown in the accompanying drawing, in which

Fig. 1 is a diagrammatic longitudinal sectional view through one type of apparatus, constructed

in accordance with the invention and suitable for sulphur bleaching of yarns continuously;

Fig. 2 is a detail sectional view of the track for supporting the active run of the conveyor chains;

Fig. 3 is a similar view of the track for supporting the idle or return run of the conveyor chain; and

Figs. 4 and 5 are plan and elevation views respectively of the section of the conveyor chains.

For convenience in explaining the nature of the invention, the process and apparatus will be described as for sulphur bleaching woolen and worsted yarn in skeins, although it is to be understood that the invention is applicable to the bleaching of textile materials in other forms, as for example fibers, piece goods or fabricated articles.

My invention, in its broader sense, comprises subjecting the damp or moist material to the fumes of burning sulphur (sulphur dioxide) in a bleaching chamber while establishing a forced circulation of air through said chamber during the time the material is in contact with the sulphur dioxide.

According to the illustrated embodiment of the invention the sulphur bleaching chamber 10 may be constructed of suitable material, as for example, wood, and is elongated and of desired width, height and length. Advantageously, though not necessarily, it may be located on the roof of a building, or at some plane elevated above the level of processing apparatus which may be the washers and extractors commonly employed in preparing the yarn in a damp or moist condition for sulphur bleaching. Conveniently the washers and extractors may be on a lower level, in which case the chamber 10 may be provided with an inclined loading chamber 11. Advantageously the rear end of the sulphur bleaching chamber 10 communicates with a continuous drying chamber 12 of suitable length, though it will be apparent that these need not be connected to form a continuous chamber.

A suitable conveying means is provided for conveying the material to be bleached through the loading chamber 11, bleaching chamber 10 and drying chamber 12, and when treating yarn in skein form while it is hung on poles, this conveyor may be advantageously formed of opposed chains 13 on opposite sides of the chambers, trained over sprockets 14 and driven by a suitable driving means 15, preferably a variable speed reduction gear drive. The conveyor chains may be composed of a plurality of links (see Figs. 4 and 5) each of which comprises a pair of side frames 16, journaled at one end to a roller 17, and formed with a pole-receiving notch 18 on one edge. The rear edges of the notches 19 are preferably curved so as to securely hold the ends of the poles P on the chain during the upward travel of the poles from the loading end of the chamber 11 to the bleaching chamber 10. The opposite edges 20 may be straight or inclined outwardly for the ready discharge of the poles from the descending conveyor at the discharge end. The opposite ends of the side frames are pivotally connected to the roller end of the adjacent link so that the conveyor chains are made up of a series of notched links. Thus the poles P with skeins of yarn spread thereon may be placed on the conveyor with the ends of the poles seated in the notches 18, so that a succession of poles of yarn are moved progressively through the chambers 11, 10 and 12.

The chains are preferably supported in any

suitable manner, as by tracks or rails, as shown in Figs. 2 and 3. As shown in Fig. 2, the rail 21 may be relatively broad to provide a track for the roller 17 and chain on its active run, when there is considerable weight on the chain due to the loaded skein rods. On the return run, however, the track 22 may be narrow to be positioned between the depending notched frames 16 and provide a track for the rollers 17.

The bleaching chamber 10 may be provided with one or more recesses 23 at or near the entering end and, if desired, spaced throughout the length of the chamber 10 for the sulphur burning pot or receptacle. The number and spacing of these recesses is such that the fumes from the sulphur burning in them will fill the bleaching chamber and be absorbed by the moisture of the yarn.

In order to accelerate the bleaching action, as well as to prevent condensation within the bleaching chamber, I establish a forced circulation of air through the bleaching chamber as the material is brought into contact with the sulphur fumes. This may be accomplished by the use of blowers or fans 24 adjacent the loading end of the chamber 11 for forcing air into the bleaching chamber, and an offtake or ventilator 25 in the ceiling of the chamber 10, and preferably located at or near the rear end of the bleaching chamber 10. Fans 26 also may be employed in the drying chamber and arranged to blow air onto the skeins as they leave the bleaching chamber to remove substantially all traces and odors of sulphur dioxide gas. The arrangement of fans, one at the entrance end of the loading chamber 11 and the other in the drying chamber 12 serve to keep the obnoxious sulphur fumes from the workmen at the opposite loading and take-off ends of the apparatus, as well as to set up the desired circulation of air and sulphur fumes.

To assist in preventing the sulphur fumes from reaching the opposite ends of the apparatus where workmen are stationed, loading and unloading the skein rods from the conveyor, the opposite ends of the bleaching chamber 10 may be provided with baffles 27 extending across the chamber and of a height approximately equal to the height of the chamber adjacent the sulphur burning recesses 23. The sulphur fumes are heavier than air and tend to descend and hence these baffles are effective to some extent in keeping the fumes from the loading and discharging ends. The conveyor chains are trained over idler pulleys 28 above these baffles, so that as the skein rods with the skeins of yarn depending from them are successively brought over the baffles, a series of curtains are successively presented which contribute in keeping the fumes from the loading and discharge ends.

In practice the skeins of wet yarn hanging from the poles P are moved into the bleaching chamber and there come into contact with the sulphur fumes (sulphur dioxide gas) which reacts with the water on the wool, forming sulphurous acid (H_2SO_3), the reaction taking place on the yarn and effecting the bleaching. The bleaching chamber is of course filled with sulphur fumes and as the speed of travel of the conveyors is such as to require from one to two hours for each pole to traverse the bleaching chamber, there is a continuous absorption of sulphur dioxide gas by the water in the yarn, and therefore a continuous bleaching reaction. This bleaching reaction takes place in a draft of sub-

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stantial velocity produced by the fans 24 and ventilator 25, so that there is a continuous evaporating or oxidizing atmosphere which accelerates the bleaching as well as prevents condensation within the chamber 10 such as might damage the yarn.

As the yarn enters the drying chamber 12, it is quickly dried by hot air supplied by heating coils 29, while the drying is accelerated by blowing air over the yarn by means of the fans 26. This also, as stated above, aids in removing obnoxious sulphur dioxide odors from the yarn. The poles carrying the bleached dry yarn may be easily removed at the take-off end by workmen.

The particular reaction that takes place between the sulphur fumes, the water on the yarn, and the air circulating through the chamber is not at this time definitely established. It has been found in practice that the time required for a satisfactory commercial bleach is materially shortened, when a circulation of air is set up through the bleaching chamber, and hence the air appears to provide an evaporating or oxidizing atmosphere accelerating the bleaching action. Furthermore, the actual use of the invention and apparatus illustrated shows no condensation on the ceiling or other parts of chamber 10, thus producing a very different effect from merely permitting air to enter the "sulphur house" of the old stoving method.

Woolen and worsted yarn bleached according to my invention has improved physical characteristics over yarn bleached by the prior process. Due to the materially shortened time required for bleaching, the yarn in the skeins is not stretched to the same extent as heretofore, thus enabling the yarn to retain more of its natural and original resiliency. Also as the amount of sulphur dioxide gas that will be absorbed in the yarn and made available for bleaching, is directly proportional to the water content in the yarn, the water content may be increased, if desired, without serious danger of damaging the wool by undue stretching. Moreover, the various skeins are uniformly stretched and bleached, due to the fact that the successive skeins are subjected to a uniform treatment for uniform time, which was impossible according to the prior methods.

The method and apparatus herein illustrated permit of simpler, cheaper and quicker sulphur bleaching than possible heretofore, resulting in a considerable saving in the time required for and the cost of handling and bleaching material. It is more pleasant and healthful to the workmen who formerly were brought into contact with the obnoxious sulphur fumes.

Obviously, the invention is not to be restricted to the details of construction or the specific steps as above described.

I claim:

1. The method of sulphur bleaching textile materials which comprises spreading the material upon a rod-like support and subjecting the spread material in a wet condition to fumes of burning sulphur and blowing air onto said material while it is being subjected to the sulphur fumes.

2. The method of continuously sulphur bleaching textile materials which consists in spreading the material on a rod-like support, progressively moving the spread material to be bleached while wet through a bleaching chamber, and subjecting the material to the fumes of burning sulphur

in an oxidizing atmosphere of a forced air current.

3. The method of continuously sulphur bleaching textile materials which consists in spreading the material upon a rod-like support and progressively moving the spread material to be bleached through a bleaching chamber, subjecting the material while wet to the fumes of burning sulphur admitted to the chamber at points removed from the entrance end thereof, and blowing air into the entrance end of the chamber to create a circulating oxidizing atmosphere and to substantially prevent the seepage of said sulphur fumes to the entrance end of said chamber.

4. The method of sulphur bleaching textile and like materials which comprises moistening the material and progressively subjecting batches thereof to the bleaching action of fumes of burning sulphur, forcibly blowing air over the material while it contacts with the sulphur fumes in such velocity as will prevent condensation of said sulphur fumes, and then progressively subjecting the batches of bleached material uniformly to a drying heat without intermediate handling of said material.

5. Apparatus for the continuous sulphur bleaching and drying of wet textile material comprising an elongated open ended housing, ventilating outlet dividing said housing into a bleaching and drying chamber, an endless conveyor for conveying said material progressively through said bleaching and drying chambers, means for supplying fumes of burning sulphur to said bleaching chamber in contact with the wet material, and means located ahead of said sulphur fume supplying means and in said drying chamber for blowing air in opposite directions toward said outlet to create a forced circulation through said bleaching chamber.

6. Apparatus for the continuous sulphur bleaching and drying of skeins of wet textile material which has been hung upon poles comprising an elongated housing having open loading and takeoff ends, a ventilating outlet between said ends dividing said housing into bleaching and drying chambers, endless conveying chains having a series of pole-receiving notches for conveying the skein laden poles from the loading to the takeoff ends of the housing, means for supplying fumes of burning sulphur to said bleaching chamber in contact with said wet material, and means located adjacent the loading end and takeoff ends of said housing for blowing air toward the outlet to create a forced circulation through said bleaching chamber and prevent the seepage of sulphur fumes to the loading and takeoff ends.

7. Apparatus for the continuous sulphur bleaching and drying of skeins of wet textile material which has been hung upon poles comprising an elongated housing having open loading and takeoff ends, a ventilating outlet between said ends dividing said housing into bleaching and drying chambers, endless conveying chains having a series of pole-receiving notches for conveying the skein laden poles from the loading to the takeoff ends of the housing, means for varying the speed of travel of said skeins through the housing, means for supplying fumes of burning sulphur to said bleaching chamber in contact with said wet material, and means located adjacent the loading and takeoff ends of said housing for blowing air toward the outlet to create a forced circulation through said bleaching chamber and prevent the seepage of sulphur fumes to the loading and takeoff ends.

8. Apparatus for sulphur bleaching wet textile material which has been spread upon rod-like supports, comprising an elongated bleaching chamber, endless travelling conveyor members mounted in said chamber adjacent opposite sides thereof, said conveyor members being adapted to removably support and transport the material-carrying rod-like supports, means for moving said conveyors to move the material through the bleaching chamber from the entering and to the exit end thereof, means intermediate the entering and exit ends of the chamber for admitting fumes of burning sulphur to said chamber, and means positioned in advance of said sulphur admitting means for forcibly blowing air into said chamber.

9. Apparatus for sulphur bleaching wet textile material which has been spread upon rod-like supports, comprising an elongated bleaching chamber having entering and exit ends for said material, a travelling conveyor mounted in said chamber adapted to removably support and transport the material-carrying rod-like supports, means for moving the conveyor to move the material through the bleaching chamber from the entering end to and out of the exit end thereof, means intermediate the entering and exit ends of the chamber for admitting fumes of burning

sulphur to said chamber, a ventilator adjacent said exit end, and means positioned in advance of said sulphur-admitting means for forcibly circulating air through said chamber and out of said ventilator in sufficient volume and velocity to prevent condensation in said chamber.

10. Apparatus for sulphur bleaching wet textile material which has been spread upon rod-like supports, comprising an elongated chamber having a substantially horizontally disposed bleaching section and a downwardly inclined loading section communicating with the bleaching section at one end, a travelling conveyor mounted in said chamber adapted to removably support and transport the material-carrying, rod-like supports upwardly through said loading section and laterally through said bleaching section, means for moving the conveyor to move the material from the entering end of the loading section to the exit end of the bleaching section, means intermediate the entering and exit ends of the chambers for admitting fumes of burning sulphur to said chamber, a ventilator adjacent said exit end, and means positioned in advance of said sulphur-admitting means for forcibly blowing air into said chamber and out of said ventilator.

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