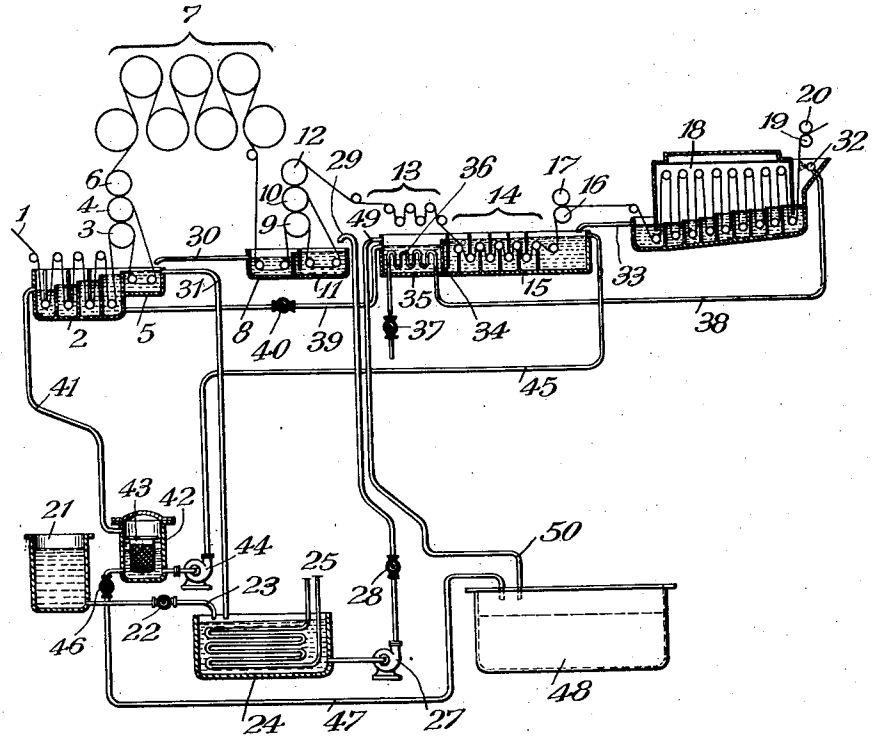
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METHOD FOR MERCERIZING COTTON FIBERS

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METHOD FOR MERCERIZING COTTON FIBERS

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This invention relates to methods and devices for mercerizing cotton fibers.

It is known to re-utilize the waste lye from the mercerization in the following ways:

1. The waste lye is used entirely independent of the mercerization in a boiling process for bleaching the cotton. But as ordinarily in most cases the amount of lye required for the boiling is much less than the soda content of the waste lye, re-utilization of the waste lye from the mercerization in this manner is as a rule only feasible to a relatively small degree.

2. The waste lye is used for preparing fresh lye by dissolving the alkali therein. Also in this manner re-utilization of the waste lye is practicable only to a small proportion, the volume of the fresh concentrated mercerizing lye being considerably smaller than the volume of waste lye available. Thus it will be seen that in dissolving solid caustic soda of 98% to a concentration of the lye of 30° Bé., only a small volume of waste lye is applicable. The possibility of re-utilizing the waste lye in this manner is further diminished by the fact that the lye used for the mercerization is during the latter process continuously diluted, so that the employment of waste lye for the preparation of fresh lye for the mercerization is for this reason alone inhibitive.

3. The waste lye is evaporized to a concentration of 30° Bé. in order to enable re-utilization thereof for mercerizing. This process is, however, expensive and in the event of the waste lye containing size it is difficult to be carried out.

4. The waste lye is used for removing lye residuals from mercerized fabrics, whereby the lye which is used for washing the fabrics and with which the latter are impregnated before the treatment and by means of which the fabrics are rinsed in a device in presence of steam is recuperated in a concentration insufficient to impart a relatively high content of caustic soda to the fabric during its passage through the lye prior to the mercerization.

In order to avoid these drawbacks, in the method according to the invention the fabric is freed after the mercerization from caustic soda during its counter course to the wash liquid under formation of a lye of such quality adapting the latter to impart a relatively high percentage of caustic soda (for instance 50% of the required amount) prior to the mercerization while the fabric passes through said lye.

This method permits of imparting directly prior to the mercerization a percentage of caustic soda of for example 12–15° Bé. to a fabric to be mercerized in dry condition and a percentage of 8–10° Bé. to a fabric to be mercerized which was squeezed out in wet condition in one and the same passage through the lye, preferably again in counter course to the latter.

This method provides a simple manner of obtaining considerable economies in caustic soda in that the saturation of the fabric of approximately 30° Bé. required for the mercerization is previously attained to a relatively large extent.

In the drawing an embodiment of a device for carrying the method in which the invention resides into effect is schematically shown in a vertical section.

The fabric 1 to be mercerized enters an impregnating vat 2 subdivided into various compartments, in a stepped off manner so as to cause the lye used to form cascades, and positioned relatively to a correlated guiding appliance for the fabric, suchwise, that the flow of the lye in the vat 2 is opposed to the direction of travel of the fabric. After leaving the said impregnating vat the fabric passes between two squeezing rollers 3 and 4 of a fulling device and from thence enters the impregnating vat 5 to subsequently pass between two squeezing rollers 4 and 6 of the same fulling device. Then the fabric, for the purpose of increasing the time for the lye to act on the same, is conducted round the guide drums 7 to a second fulling device. Thereat the fabric is immersed in the impregnating vat 8 to be subsequently passed between the squeezing rollers 9 and 10, whereafter it is conveyed through the last impregnating vat 11. Afterwards it is again compressed by the squeezing rollers 10 and 12, whereby the impregnation is finished.

From there the fabric is led to a stretching contrivance 13 by means of which it is stretched in the longitudinal and in the transverse direction. From the stretching contrivance 13 the web of fabric is conducted to a further stretching contrivance 14 which is inserted in a wash tub 15. The wash tub 15 is subdivided into several compartments so as to enable the wash liquor to flow through the same in the opposite direction of movement of the web of fabric. After leaving the contrivance 14 for stretching the fabric widthwise in the wash tub 15 the fabric thus substantially washed out is passed between the squeezing rollers 16 and 17 to be conveyed from there to the device 18 for removing the lye. In the said device 18 the fabric is almost completely freed from the lye by being alternately acted upon by steam and water flowing in the opposite direction thereto. The web of fabric leaves the lye

removing device 18 by way of the squeezing rollers 19 and 20 in a state of complete mercerization and entirely free from the lye.

With this method the impregnation with the fresh mercerizing lye is effected as follows:

The fresh mercerizing lye being contained in the receptacle 21 in a state of concentration of 40° Bé. flows via the valve 22 and the pipe conduit 23 to the circulating trough 24. In the latter the lye is diluted with water to a concentration of 30° Bé. such as usually employed for mercerizing purposes and cooled to a temperature of at least 15° C. by means of the pipe coil 25. From the circulating trough 24 the lye is forced into the impregnating vat 11 by means of the pump 27 through the valve 28 and the pipe conduit 29. From the impregnating vat 11 the lye passes between two partition walls to the impregnating vat 8. Therefrom the lye is conducted through the pipe conduit 30 to the impregnating vat 5 to be re-admitted to the circulating tub 24 through the overflow conduit 31. It is obvious that as long as the pump 27 is operative and the valve 28 more or less open a corresponding amount of mercerizing lye is enabled to be forced through the impregnating vats 11, 8 and 5 in the opposite direction to the run of the fabric. The washing out is effected as follows: The fabric on its exit from the lye removing device 18 is flushed with wash water from the sparge pipe 32. The said wash water flows in cascades through the lye removing device 18 in the opposite direction to the web of fabric to be washed. While flowing through the lye removing device 18 the lye content of the wash water increases more and more, wherefore it will be hereinafter called "wash lye" which is then conveyed to the wash tub 15 by way of the pipe conduit 33. The direction of flux of the wash lye in the wash tub 15 is induced by the partition walls provided in the said tub to be opposed to the direction of travel of the fabric through the contrivance 14 for stretching the fabric widthwise and to be directed towards that compartment of the said tub where the fabric enters the tub 15 after leaving the stretching contrivance 14. On its entire way of passage through the lye removing device 18 and the wash tub 15 on which the fabric is washed the wash lye is heated by steam for promoting the removal of the lye from the fabric. Then the wash lye leaves the wash tub 15 by way of the overflow passage 34 at a concentration of from 12 to 15° Bé., and a temperature of from 70 to 75° C.

At this concentration of the wash lye the mercerized fabric has been deprived of 90 to 95% of its lye content from the preceding impregnation.

From the overflow passage 34 the wash lye at a concentration of 12 to 15° Bé. flows to the adjacent vessel 35 in which a cooling coil 36 is inserted. This cooling coil is supplied with fresh water by way of the valve 37. The cooling water reduces the temperature of the wash lye to about 30° C.; the heated cooling water is conducted to the sparge pipe 32 via the pipe conduit 38. Thus, by cooling the wash lye in this manner a double effect is obtainable: the wash lye as such is cooled and, consequently, adapted to be again used for the direct mercerization and, further, the recovered heat is utilized for pre-heating the wash water, whereby the amount of heat to be subsequently supplied for heating the wash water or the wash lye to which it is transformed respectively to a washing temperature of 70 to 75° C. is considerably lessened.

The direct re-utilization of the wash lye for the mercerization is brought about in the following manner:

From the cooling vessel 35 the wash lye cooled to a temperature of about 30° C. and having a concentration of 12–15° Bé. passes through the pipe conduit 39 and the valve 40 to the impregnating vat 2. The wash lye flows in several cascades through the different compartments of the impregnating vat 2, whereby while acting on the fabric, its direction of flowing is opposed to the direction of travel of the fabric strip. At the point of entry of the fabric 1 into the impregnating vat 2 the wash lye leaves the latter by way of the pipe 41 to the filter tub 42 in which the filtering screen 43 is enclosed. The wash lye passes through the filtering screen 43 to be again conveyed to the wash tub 15 by means of the pump 44 through the pipe conduit 45. It is apparent that corresponding to the adjustment of the pump 44 the wash lye is forced in a more or less intense stream through the wash tub 15, the cooling vessel 35, the impregnating vat 2, and the filter tub 42.

Alternatively the direction of flowing may be varied by stopping the pump 44 and opening the valve 46 at the outlet end of the filter tub 42. In this case the wash lye flows from the filter tub 42 via the valve 46 and the pipe conduit 47 to the lye recuperating reservoir 48.

A further possible exit for the wash lye directly from the cooling vessel 35 is provided by the wash lye being enabled to pass to the lye reservoir 48, with the valve 40 closed or throttled respectively, by way of the overflow 49 and the pipe conduit 50.

The direct re-utilization of the wash lye of a concentration of 12 to 15° Bé. and a temperature of about 30° C. is suitably carried out in the following ways:

(a) When the fabric 1 to be mercerized is admitted to the mercerizing process after being squeezed off in wet condition.

In this case the wash lye is maintained, by the pump 44, to circulate through the wash tub 15, the cooling vessel 35, the impregnating vat 2, and the filter tub 42. In the impregnating vat 2 the wash lye, on the one hand, is diluted with a part of the water content entrained by the fabric 1 and on the other hand transfers a part of its caustic soda content to the fabric. Depending on the amount of water entrained by the fabric 1 and the intensity of flux of the wash lye, as controlled by the valve 40, the fabric is caused to be saturated in the impregnating vat with a lye of 8–10° Bé. concentration. Correspondingly the wash lye leaves the impregnating vat 2 in a diluted condition of from 6 to 8° Bé. in order to be re-admitted to the wash tub 15, after its purification in the filter tub 42, and subsequent to again contacting with the washed goods in the tub 15, to be replenished to a concentration of 12–15° Bé.

It will be seen, that during this regulatable circulation the wash lye, on the one hand, extracts the mercerizing lye in the wash tub 15 from the already mercerized fabric and in the impregnating vat 2 transfers the same directly to the fabric not yet mercerized. The direct re-utilization of the wash lye is thus effected while the same is constantly circulating and continuously cleaned in the filter tub 42. The amount of caustic soda directly applied to the mercerizing goods during this circulation is thus saved from being supplied for the mercerization in the impregnating vats 5, 8 and 11.

But, as during this circulation, corresponding

to the state of concentration of the wash lye only a certain part of the latter can be directly re-utilized in the previously described mercerizing circulation the excess of wash lye is enabled to be separated out of the former circulation by way of the overflow 49 and the pipe conduit 50 to run to the recuperating reservoir 48.

(*b*) When the fabric 1 to be mercerized is is dry condition before the mercerization.

In this case the pump 44 is rendered inactive and the valve 46 opened. After the valve 40 is also opened the entity of the wash lye passes from the wash tub 15 through the cooling vessel 35 to the impregnating vat 2. In the latter the dry fabric assimilates the full percentage of caustic soda of the wash lye of 12–15° Bé. The amount of wash lye not thus absorbed flows through the pipe 41 to the filter tub 42 and from thence by way of the open valve 46 and the pipe conduit 47 to the recuperating reservoir 48.

In the procedures described under *a* and *b* in both cases a substantial proportion of the caustic soda content of the wash lye is transferred to the fabric to be mercerized either in dry or wet condition of the latter. The thus for the first time impregnated fabric leaves the impregnating vat 2, is squeezed off to pass on to the impregnating vats 5, 8 and 11, where the fabric in counter-course to its flow contacts with the primary mercerizing lye from the circulating trough 24. The mercerizing lye in the impregnating vats is diluted by the wash lye absorbed by the fabric in the impregnating vat 2 of a concentration of from 6 to 8° or 12 to 15°, i. e. most diluted in the vat 5, less diluted in the vat 8 and so diluted in the vat 11 that at all times such a concentration of the lye exists therein (approx. 30° Bé.) which produces the best surface sheen.

It will be seen that this effect can be brought about by increasing or decreasing the speed of circulation of the mercerizing lye between the circulating trough 24 and the vats 11, 8 and 5. This speed is regulated by opening the valve 28 more or less, depending on the amount and concentration of the lye particles entrained by the fabric 1 in the vat 2, suchwise, that in the vat 11 at all times a concentration in the lye of approx. 30° Bé. is produced. The concentration with respect of the fabric is equalized in the vats 8 and 5. Obviously, from the vat 8 to the vat 5, the concentration of the mercerizing lye decreases, whilst its temperature increases. Upon re-entering the circulating trough 24 this diluted and re-heated mercerizing lye is brought back thereat into normal condition by the cooling effect of the cooling coil 25, while simultaneously fresh concentrated lye of 40° Bé. is admitted from the receptacle 21. Naturally, the impregnating conditions in the vats 11, 8 and 5 may be so regulated, depending on the adjustment of the valves 28 and 22 and the temperature of the cooling coil 25, that the fabric during its last impregnation in the vat 11 is treated with a lye of 30° Bé. at 15° C. or, if desired, under other conditions. Owing to this regulating effect a final mercerization under constant conditions is at all times ensured independent of the wash lye originally applied in the vat 2.

Depending on the manner described in the paragraphs *a* and *b* respectively in which the wash lye is applied to either dry or wet fabrics to be mercerized the following advantages will result.

An economy in caustic soda is obtained as follows:

In a mercerizing installation wherein the fabric is highly squeezed off after the last impregnation the consumption of solid 100% caustic soda per 100 kg cotton amounts to about 25 kg.

When the wash lye of 12–15° Bé. is directly re-utilized according to the described method, whilst the fabric in the impregnating vat 2 is squeezed off 120% as compared with the weight of the cotton the absorption of solid 100% caustic soda per 100 kg cotton amounts to 9:6–12 kg.

Consequently, the economy in caustic soda with fabrics that are mercerized in dry condition amounts to 38–48%.

When a wet fabric is mercerized, under application of a wash lye of a concentration of 6–8° Bé., the economy in solid 100% caustic soda per 100 kg cotton amounts to 4:8 to 6:3 kg.

Consequently, with fabrics mercerized in wet condition an economy of 19–25% is obtained.

Out of the abovesaid economies in the consumption of caustic soda the mercerizing process is further cheapened by the regeneration of heat from the wash lye.

It is obvious that the described method and device may be used in conjunction with every mercerizing installation for fabrics as well as for yarns.

Thereby it is not necessary that the impregnation of the fabrics to be mercerized is effected with the wash lye and the normal mercerizing lye in immediate succession. The two operations may as well be separately carried out on different machines.

I claim:

1. A method of mercerizing cotton goods under recuperation of the caustic soda contained in the waste water, which includes impregnating said goods with a relatively high caustic soda content as compared with the amount required for the mercerization, extracting the caustic soda from the mercerized goods by water flowing in counter course to the run of the latter to form a wash lye, cooling said wash lye down and passing said goods through said wash lye prior to the mercerization.

2. A method of mercerizing cotton goods under recuperation of the caustic soda contained in the waste water, which includes impregnating the goods with a relatively high amount of caustic soda compared to the amount required for mercerization, extracting the caustic soda from the mercerized goods by washing in water flowing in counter course to the run of the latter to form a wash lye, cooling said wash lye by means of the water used for washing the mercerized goods and preheating said water thereby, and passing said goods through said wash lye prior to the mercerization.

3. A method of mercerizing cotton goods particularly wet squeezed goods, under recuperation of the caustic soda contained in the waste water, which includes imparting to said goods by impregnation a relatively high caustic soda content as compared with the amount required for the mercerization, extracting the caustic soda from the mercerized goods by water flowing in counter course to the run of the latter to form a wash lye, conducting said wash lye from its place of generation to its place of application to said goods, passing said goods through said wash lye at said place of application of the latter to said goods prior to the mercerization, conducting said wash lye back to said place of generation, and filtering said wash lye on its way back to said place of generation.

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