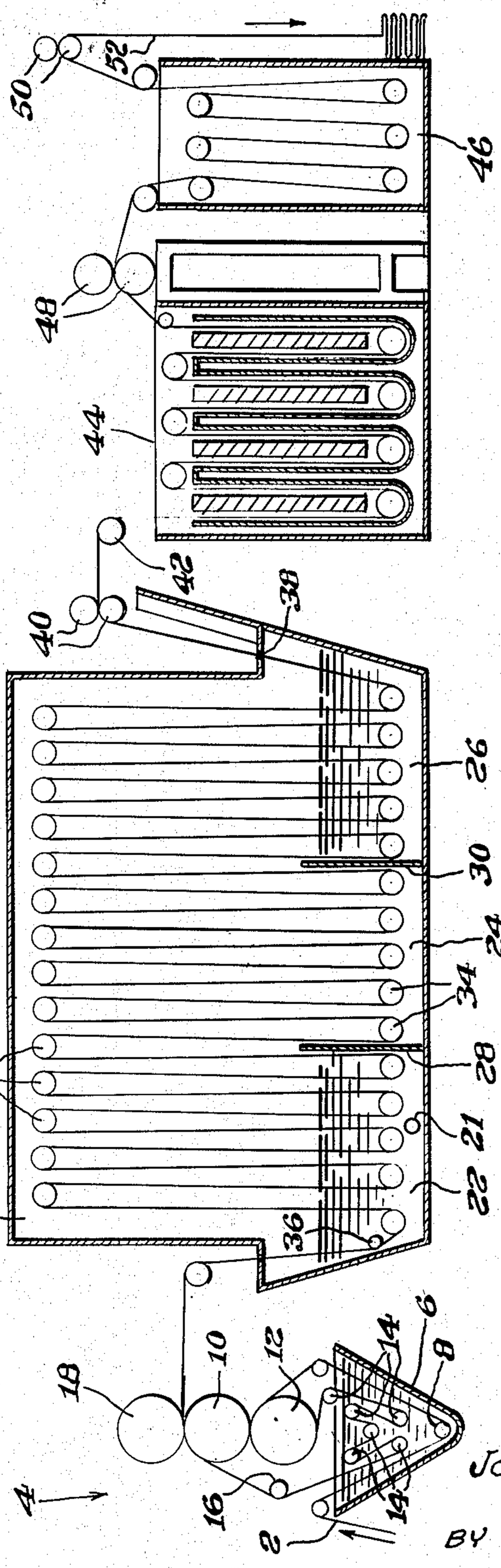
Feb. 17, 1953 J. N. DALTON ET AL 2,628,883

CONTINUOUS CHROME MORDANTING AND DYEING OF WOOL

Filed Nov. 23, 1949



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Patented Feb. 17, 1953

2,628,883

UNITED STATES PATENT OFFICE

2,628,883

CONTINUOUS CHROME MORDANTING AND DYEING OF WOOL

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Application November 23, 1949, Serial No. 129,146

2 Claims. (Cl. 8—99)

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This invention relates to the dyeing of wool textile materials and more particularly to dyeing of wool cloth by the bottom chrome method in which the wool is first mordanted and then dyed with a mordant dyestuff.

The invention provides a mordanting process by which wool cloth can be mordanted to produce the superior fastness of the color to fulling and scouring which characterizes the bottom chrome method, but at a cost which is much less than the cost of mordanting by the conventional bottom chrome methods.

It is well known that the old bottom chrome method, i. e., application of the mordant in a separate bath before the cloth is dyed gives a superior quality dyeing. This method. however, has the disadvantage of much higher cost as contrasted with other mordanting methods which have become available, such as the metachrome and top chrome methods, with the result that the older bottom chrome method has almost entirely gone out of use. However, with these more recent methods, dyeings of inferior quality are often obtained due to a poor penetration and lack of solidity of color, which is caused by formation of a chrome-dye complex in the bath.

This invention has as an object to provide a process for mordanting wool piece goods which will be comparable, in the quality of the resulting dyeings, with the conventional bottom chrome method but yet will be less time-consuming and less costly and will provide increased color yield.

We have discovered that wool cloth can be mordanted by first padding the cloth with a hot aqueous solution of a wetting agent and a water-soluble hexavalent chromium salt, such as the conventional sodium or potassium bichromate, reducing the chromium compound to a trivalent chromium compound by passing the cloth from the pad into a hot acid bath to thoroughly soak the impregnated cloth with the acid solution, alternately and repeatedly exposing the cloth to steam and immersing it in the acid bath, then exposing the cloth, still wet with acid solution, for a substantial time interval to an atmosphere of steam and finally at least partially neutralizing the acid by running the cloth through a mild alkaline bath or thoroughly washing it with water, all as the cloth is maintained continuously in motion. We have found that this treatment leaves the cloth in condition to be immediately dyed with a mordant acid dye.

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One feature of our invention is the processing of the cloth as it is kept in continuous motion through the equipment by first padding it with a wetting agent along with the unreduced mordant and thereafter thoroughly soaking it with acid before and after repeated exposure of the cloth to steam.

The accompanying drawing is a schematic illustration of representative apparatus in which our process can be carried out.

Referring to the drawing, the undyed cloth 2, in open width suitably prepared for mordanting and dyeing, is supplied to a conventional pad mangle 4, which preferably is a three-bowl padder, the trough 6 of which is filled with an aqueous solution at 70° F. to 212° F. containing a wetting agent and about 0.25% to 1.0% of its weight of sodium bichromate or other suitable mordanting agent. Several pieces of goods may be sewed together end-to-end to form a long length of cloth to be supplied to the padder. On entering the padder, the cloth is first immersed in the liquid bath by its passage about the roller 8, then is squeezed in the nip of rolls 10 and 12, again immersed in the liquid by its passage about a set of rollers 14 and finally led out of the bath over the guide roller 16 and through the nip of rolls 18 and 10, where its final liquid content is determined by the setting of the rolls.

From the pad mangle the cloth passes without interruption of its movement into a steam box 20 where the operation of reducing the chromium compound to a trivalent chromium compound is carried out by soaking the cloth with a hot acid liquid and alternately immersing it in this liquid and steaming it, followed by substantial exposure to steam. The lower part of the steam box 20 is divided into three approximately equal sized, open-topped compartments 22, 24 and 26 by low partitions 28 and 30. The cloth is led through the steam box 20 over a series of upper guide rolls 32 and a series of lower guide rolls 34 as shown.

Compartment 22 is filled with an acid solution maintained at a temperature in the range 120° F. to 212° F. by steam which enters the compartment at any suitable point below the liquid level therein, as from steam supply pipe 21.

On entering the steam box 20 the cloth is immediately led downwardly about guide roll 36 to immerse it in the acid solution in compartment 22, with which solution the web of cloth is immediately soaked in its passage about guide roll

36 and the first of the series of lower guide rolls 34.

The cloth then passes alternately over an upper guide roll 32 and under a lower guide roll 34 so that it is alternately and repeatedly immersed in the acid liquid in compartment 22 and exposed to the steam atmosphere in the upper part of the steam box provided by steam from steam supply pipe 21.

The cloth next passes in the same manner through compartment 24, which contains steam at atmospheric pressure but no liquid, so that the cloth is exposed to a steam atmosphere for a substantial period of time.

Next the cloth passes through compartment 26 which contains water which operates as a liquid seal and finally, the cloth emerges from steam box 20 at 38 and is passed between the squeeze rolls 40.

The traveling cloth then passes over guide rolls 42 and through wash boxes 44, 46 in which its acidity is reduced by washing with water. Desirably the water in the first wash box 44 may contain a mild alkali, such as diammonium phosphate, to accelerate the neutralization of the liquid content of the cloth.

The cloth on leaving the first wash box 44 is passed through a pair of squeeze rolls 48 into the wash box 46, is given a final squeeze at 50 as it leaves box 46, and is then collected in any suitable manner at 52 as by passing it into a scray. The cloth then may be taken directly to the dye vat for dyeing.

The following examples of particular process conditions and particular dyestuffs are given as illustrative of the invention.

Example I

One cut of worsted gabardine 70 yards in length and 65'' wide was continuously chrome mordanted by our process employing sodium bichromate and 0.5% of an alkylarylpolyether in the initial impregnating bath and 2% hydroxyacetic acid as the reducing solution. The material was allowed to remain within the chamber for 1 to 1½ minutes, and was then neutralized to a pH of 5.7 in a continuous open width washer with tap water. The material was then dyed with the following color combination:

Dye	Amount	Color Index No., Prototype No., or Vendor
	Per Cent	
Eriochrome Brown 3GL	0.20	Geigy.
Metomega Chrome Brown RLL	0.20	Prototype 298.
Alizarine Fast Grey BBLW	0.18	Prototype 206.
Eriochrome Flavine A	0.11	Color Index No. 219.
Omega Chrome Orange ML	0.15	Sandoz.
Metomega Chrome Grey GL	0.036	S Do.
Anthraquinone Violet 3R	0.084	Color Index No. 1080.

A comparable sample of the same gabardine material was mordanted by the conventional bottom chrome method, that is by boiling it in a kettle containing a bath of sodium bichromate and then dyed with the same color combination. The dyeing of the cloth mordanted by the process of Example I was of superior quality, having as good levelness and color solidity as the sample mordanted by the conventional bottom chrome method. In addition the sample mordanted by our process showed increased fastness both to fulling and to scouring as compared with the sample mordanted by the conventional bottom chrome method. In the dyeing of the sample mordanted by our process, 10% greater exhaustion was obtained than in the dyeing of the conventional sample.

Example II

The procedure of Example I was repeated, with two identical samples of cloth, employing as the dyestuff:

Dye	Amount	Color Index No., or Vendor
	Per Cent	
Eriochrome Blue Black R	0.53	Color Index No. 202.
Acid Alizarine Violet N	0.13	Color Index No. 169.
Anthraquinone Violet 3R	0.13	Color Index No. 1080.
Xylene Milling Blue FF	0.53	Sandoz.
Metomega Chrome Grey GL	0.32	Do.
Wool Fast Blue	0.49	Color Index No. 833.

The dyeing of both samples was of superior quality, showing good levelness and solidity of color. Again the sample mordanted by the process of the example showed a 10% increase in color yield and improved fastness to scouring and fulling as compared with the conventional mordanted sample.

We have found that particularly desirable results as to processing speed and quality of the dyeing are obtained by the use as a wetting agent of an alkylarylpolyether alcohol which may be present in the pad mangle in an amount of the order of about 0.5% by weight of the entire solution.

As the acid for reducing the chrome, we prefer hydroxyacetic acid because it contributes to the effectiveness and speed of our continuous process by virtue of its high reducing power in proportion to its acid value, permitting rapid passage of the cloth with rapid reduction of the chrome without significant deleterious effects on the wool substance due to acidity.

The pressure of the steam to which the cloth is exposed as it is alternatively immersed and steamed, and also during the final steaming treatment in compartment 24 is not a critical aspect of our process. Most conveniently, steam at atmospheric pressure can be employed and at this pressure is highly effective.

For best results the reducing bath should have a pH in the range 2–3.

The strength of the neutralizing alkali solution employed and the size and number of the wash boxes are so selected with respect to the other variable factors of our process, particularly the speed of travel of the cloth, that the cloth at completion is at a pH in the range 5.5 to 6.0.

We claim:

1. The method of mordanting wool cloth to prepare it for dyeing with a mordant dyestuff which consists essentially in continuously immersing the undyed and unmordanted cloth in, and squeezing it to completely saturate it with, a hot aqueous solution consisting essentially of about 0.5% of the weight of the solution of an alkylarylpolyether alcohol and 0.25% to 1.0% of the weight of the solution of a water-soluble chromium compound selected from the class consisting of sodium bichromate and potassium bichromate, continuously reducing the chromium compound to a trivalent chromium compound by passing the wet impregnated cloth into a hot acid bath consisting essentially of between 0.5% and 6.0% of the weight of the bath of hydroxyacetic acid, thereafter continuously and repeatedly exposing the traveling cloth to steam at atmospheric pressure and immersing it in said acid bath, exposing the traveling cloth to

steam at atmospheric pressure, continuously passing the cloth through an alkaline neutralizing bath to raise its pH to about 5.5 to 6.0, and thereafter dyeing the wool with a mordant dyestuff.

2. The method of mordanting wool cloth to prepare it for dyeing with a mordant dyestuff which consists essentially in continuously immersing the undyed and unmordanted cloth in, and squeezing it to completely saturate it with, an aqueous solution at a temperature in the range 70° F. to 212° F. and consisting essentially of about 0.5% of the weight of the solution of an alkylarylpolyether alcohol and 0.25% to 1.0% of the weight of the solution of sodium bichromate, continuously reducing the sodium bichromate to a trivalent chromium compound by passing the wet impregnated cloth into a hot acid bath at a pH of about 2 to 3, said bath containing between 0.5% and 6.0% of the weight of the bath of hydroxyacetic acid, thereafter continuously and repeatedly exposing the traveling cloth to steam at atmospheric pressure and immersing it in said acid bath, exposing the

traveling cloth to steam at atmospheric pressure, continuously passing the cloth through an alkaline neutralizing bath to raise its pH to about 5.5 to 6.0, and thereafter dyeing the wool with a mordant dyestuff.

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