

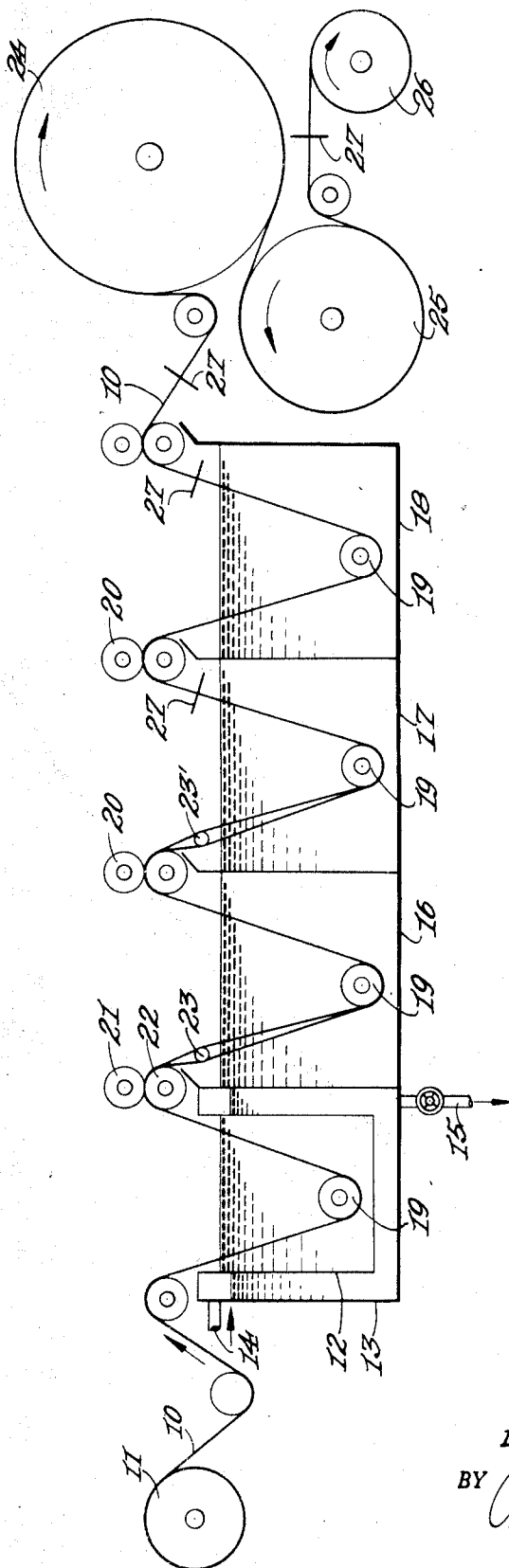
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PROCESS FOR SIZING WARP YARNS

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PROCESS FOR SIZING WARP YARNS

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This invention relates in general to woven fabrics and a process of making a woven fabric and includes improvements designed to enhance the properties of the warp yarns prior to weaving.

In the customary practice of weaving, the warp yarns are sized with an aqueous solution of starch, gum, dextrine, gelatine and other water-soluble colloids to facilitate weaving the yarns. However, the speed of slashing warp yarns with such water-soluble colloids is relatively low due to a number of factors including (a) the high viscosity of starch solutions employed, (b) the slow penetration of the viscous solutions, (c) the high temperature required during drying the sized yarns and the low drying ratio. Moreover, the use of these water-soluble substances as a warp sizing is attendant with certain inherent disadvantages.

The water-soluble size is not laundry resistant so that it is necessary to remove it after weaving, otherwise the woven fabric will show a pronounced decrease in stiffness after the first laundering. This pronounced change has been the cause of much dissatisfaction on the part of the purchasers because the sized yarn gives to the fabric a temporary appearance of a higher yarn count and closer weave than is actually present in the fabric.

Moreover, if it is desired to dye, mercerize, or bleach the yarns or fabrics made with such sized warp yarns, it is first necessary to desize the yarn as by kier boiling. Such operations always cause a softening and loosening up of the yarn structure resulting in a decrease in the yarn resistance. Further, warp yarns sized with starch have a low resistance to abrasion and thus fall short of the desired result. The friction caused by the drop wires and the heddles, as well as by transverse movement of the bobbin containing the filling yarn tends to raise the nap on starch sized yarns, thus resulting in the shedding of loose fibers. Finally, in weaving starch sized warp yarns, it has been found necessary to carry out the weaving operation in an atmosphere of relatively high humidity, which tends to corrode the metal parts of the loom, in particular the drop wires.

Accordingly, it is the general object of the present invention to provide a method of slashing warp yarns in a rapid and economical manner and which will enable them to be woven faster and with fewer difficulties than with prior warp sized yarns.

Another object is to provide a woven fabric comprising warp yarns having a permanent size

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which does not have to be removed before dyeing, mercerizing, or bleaching.

A more specific object of the invention is to provide a method for permanently sizing warp yarns prior to weaving.

A further specific object of the invention is to provide an apparatus for slashing warp yarns at a greater speed and with reduced cost over that required for slashing warp yarns with starch and the like.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

According to the present invention, there is provided a process of making a woven fabric by sizing the warp yarns prior to weaving with an alkali-soluble water-insoluble cellulosic colloid and weaving the yarns. More particularly the invention includes the process of collectively treating a multiplicity of warp yarns while arranged in the form of a weftless web with an alkaline dispersion of an alkali-soluble water-insoluble cellulosic colloid, separately coagulating said colloid on the individual warp yarns and weaving said yarns. Thus, the invention provides a woven fabric comprising warp yarns individually sized with a water-insoluble colloid which permanently lays the nap and stabilizes the twist of the yarn.

The apparatus of the invention comprises, in combination, means to treat warp yarns in the form of a weftless web, with an aqueous dispersion of a water-insoluble coagulable colloid, means to separate the yarns, means for coagulating the colloid on the yarns while so separated, and means for drying the yarns. The apparatus preferably includes means for separating the yarns before and after coagulating the colloid thereon whereby the yarns do not adhere to each other in passing through subsequent treating devices.

The invention accordingly comprises a process having the steps and the relation of the steps one to another, and an apparatus having the elements and relation of elements, one to another, as set forth in the following detailed description and the scope of the application of which will be indicated in the claims.

The present process is applicable for slashing singles yarns and plied yarns of all types, in particular, warp yarns comprising cotton, ramie, jute, flax, casein fibre, rayon, also fibres formed of synthetic resins, such as vinyon, vinylidene chloride and nylon, or mixtures of these fibres, and whether carded or combed, or made of continuous filaments.

The permanent sizing composition of the pres-

ent invention comprises, in general, an aqueous dispersion, preferably an alkaline dispersion of alkali-soluble water-insoluble cellulosic colloid. For the cellulosic colloid there may be employed the alkali-soluble water-insoluble cellulosic ethers as a class, such for example as alky-cellulose ether, hydroxy-alkyl cellulose ether, carboxy-alkyl cellulose ether, and the like; also, the alkali-soluble water-insoluble cellulose materials per se as a class such, for example, as cellulose dissolving in any of its known solvents such as an alkali solution of 5% to 10% concentration, alkaline solutions of zincates, and stannates, or strong organic bases such as aralkyl ammonium hydroxides; also alkali-soluble water-insoluble-degraded cellulose such, for example, as the degraded cellulose solutions disclosed in the copending U. S. application, Serial Number 427,389, filed January 19, 1942, and the degraded cellulose solutions disclosed in U. S. Patent 2,289,085, and in British Patent 507,138.

Among the cellulose ether solutions, there is preferred an alkali-soluble water-insoluble hydroxy-ethyl cellulose ether dissolved in an aqueous alkali solution, and among the cellulosic solutions, there is preferred a degraded cellulose dissolved in an aqueous alkaline zincate solution as disclosed in U. S. Patent 2,289,085.

The cellulosic colloid may be coagulated from its alkaline dispersion by means of any of the known coagulants for viscose such, for example, acids, acid salts, salts and heat, also by the action of hot water.

The alkaline dispersion of the cellulose colloid is preferably applied to the yarn while the dispersion has a low viscosity. It is characteristic of the degraded cellulose solutions above disclosed that their alkaline dispersions have very low viscosities. However, alkali solutions of the cellulose ethers may be made of low viscosity either (a) by degrading the cellulose ether before or after its manufacture by the use of heat alone or by heating with acids, alkalies, or oxidizing agents; or (b) the viscosity of the alkaline solutions may be lowered by adding to the solution an oxidizing agent such, for example, as ammonium persulfate, alkali perborates, alkali perchlorates, hydrogen peroxide, and the like; or by heating the aqueous alkaline solution of the cellulose ether during application to the yarn to a temperature at which it shows a pronounced drop in viscosity such, for example, at a temperature between 140° to 160° F.

The cellulosic content of the alkaline dispersion may be varied over a wide range, but usually if the dispersion contains from 3% to 8%, preferably about 6% by weight of the solution of the cellulosic colloid, a satisfactory warp sizing will be obtained. The quantity of alkali, which is normally a strong alkali such as sodium hydroxide, potassium hydroxide or aralkyl ammonium hydroxide, may be varied according to the amount required to completely and uniformly disperse the cellulosic colloid, which amount is usually between 5% and 10% by weight of the solution.

To the dispersion there may also be added a wetting agent such, for example, a sulfated fatty alcohol, a sulfonated fatty acid, and the like. Likewise, there may be added to the sizing composition, pigments or dyestuffs which are stable in alkali. Since the sizing agent will not be removed after weaving nor during laundering, the pigments or dyestuffs will serve to permanently color the yarns, a feature which can not be achieved by the use of conventional starch or

other water-soluble colloids. The coagulated water-insoluble colloid serves to permanently bind the pigments or dyestuffs to the yarns.

For a more complete understanding of the nature and objects of the present invention, reference should be had to the accompanying drawing in which there is illustrated one embodiment of the apparatus of the invention for permanently sizing warp yarns.

Referring to the accompanying drawing, the warp yarns 10 are unwound from the beam 11 and passed into the sizing composition held in the first box 12 of a four-box slasher. The box 12 is provided with a jacket 13 and, in the space so provided, hot water is introduced through the pipe 14 and withdrawn through the pipe 15. The remaining boxes 16, 17, and 18 of the slasher are substantially identical in construction, and each is provided with a submerged roller 19, and a pair of pressure rollers 20 positioned above each box respectively so that the excess liquid carried by the yarns is caused to flow back into the respective box. The pressure rollers 21 and 22 at the exit of the box 12 are of special construction. It has been found that to avoid flattening the yarns and to produce an even distribution of the size thereon, one or both of the rollers 21 and 22 is provided with a very rough surface, for example, by wrapping the roller with a very rough fabric such, for example as burlap. The top roller 21 will normally be the wrapped roller and the bottom roller 22 will be a roller provided with a soft resilient surface such as rubber. The rollers are provided with a means (not shown) for subjecting the yarn to substantial pressure as it passes between the rollers.

From the nip of the rollers 21 and 22 the sized warp yarns are separated by a leash or splitter rod 23, and the cellulosic colloid coagulated as the yarn passes through a liquid coagulant contained in box 16. After coagulation the yarns are again separated by a leash or splitter rod 23'. The yarns are washed in hot water contained in box 17 and then subjected to a second washing with dilute alkali in the box 18. After this treatment, the sized yarns are dried by suitable means as by passing them over and under the heated drying cans 24 and 25, and the dried yarns are then wound upon the beam 26, which may be a split beam. To prevent overlapping of the yarns one upon the other there may be provided, at suitable points in the course of travel, combs or reeds 27 of conventional design, such reeds being shown in the figure at points where the yarns leave the box 17, the box 18, and before and after they pass over the drying cans.

It is important and highly desirable that the warp yarns be separated by passing alternate yarns over and under the leash or splitter rods 23 and 23' before and after coagulation of the cellulosic colloid, since the coagulation of the colloid on contacting yarns tends to cause the yarns to adhere to each other.

By way of illustrating, but not by way of limiting the invention, there will be given the following specific example.

Combed or carded cotton warp yarns, intended for use in twills or drills for military uniforms, are sized by passing the yarns through a sizing composition comprising 6% alkali-soluble water-insoluble cellulose ether (initial viscosity of 2 compared to glycerin), 8% sodium hydroxide, and the remainder water. To this solution is added 0.2% of ammonium persulfate which reduces the relative viscosity of the composition by oxidation

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to between 0.5 and 0.1. The sizing composition is placed in the box 12 of the apparatus shown in the drawing and the composition heated to a temperature of 150° F. The warp yarns are passed successively through the hot composition contained in box 12, then through the pressure rollers 21 and 22, separated by the leash rod 23, and then passed into the box 16 containing a 5% aqueous solution of sulphuric acid as a coagulant. The excess coagulant is squeezed out by means of the pressure rollers 20, the yarn separated by the rod 23, and then washed in water contained in the box 17 heated to 140° F. Finally, the yarns are subjected in the box 18 to washing with an aqueous solution of 5% ammonia, and the washed yarns are then dried on the cans 24 and 25.

It has been found that when the cellulose ether is coagulated and finally dried on the yarns, the coagulated colloid shrinks and draws the nap fibers of the yarn into the body, that is, it lays the nap and provides the yarn with a smooth surface distinctly different from that produced when such yarns are sized with starch. Moreover, since the fibers in the yarn are now bound to each other by the water-insoluble binding agent, the yarn twist is stabilized and the tendency of the fibres and/or plies to separate is decreased. Also the permanent sizing agent herein provided sets the dimensions of the yarn and thereby reduces shrinkage during repeated laundering. Warp yarns sized with the composition of the present invention showed a marked decrease in the shedding of fibers during weaving because the friction of the drop needle or wires and heddles, and the transverse movement of the bobbin does not raise a nap on the yarn but, in contrast with starch sized yarns, such friction tends to make the present yarns smoother.

It is obvious that the present process and apparatus embodies many advantages over conventional methods of slashing warp yarns with starch solutions. In the first place, the alkali employed in the present composition tends to swell the yarns and this promotes the more rapid penetration of size into the interior of the yarn. Unlike starch, the dispersions of alkali-soluble water-insoluble cellulosic colloids can be reduced in viscosity by simple means above described thus increasing the speed with which the yarns may be passed through the sizing composition. Moreover, the yarns of the present invention can be woven at normal atmospheric humidity since the cellulosic colloid appears to be relatively more hygroscopic than starch, thus the costly humidifying devices required for weaving starch-slashed yarns may be eliminated. Finally, the present

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yarns need not be desized or ~~mercerized~~ boiled before dyeing, and/or mercerizing, and/or bleaching the yarns. Since the cellulosic colloid is not removed during these operations and does not interfere with the dyeing, mercerizing, or bleaching, where specifications limit the non-cotton content of warp yarns, the present process enables such specifications to be met more readily than with starch because the sizing agent applied herein is itself cellulosic.

It is obvious that certain changes can be made in the process and apparatus without transcending the scope of the invention. If desired, there may be added to the sizing composition compatible colloids, such for example as rubber latex, alkali-soluble synthetic resins, wetting agents and other materials for improving the properties and characteristics of the warp yarns.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a process for sizing warp yarns, the steps comprising treating an alkaline dispersion of an alkali-soluble water-insoluble cellulosic colloid with an oxidizing agent to lower the viscosity, individually treating warp yarns with said low viscosity dispersion, subjecting the treated yarns to pressure to cause the dispersion to impregnate the yarns, coagulating said colloid within the yarns, and drying the impregnated yarns.

2. A process for sizing warp yarns, comprising degrading an alkaline dispersion of an alkali-soluble water-insoluble cellulosic colloid to lower the viscosity, individually treating warp yarns with said low viscosity dispersion, subjecting the treated yarns to pressure to cause the dispersion to impregnate the yarns, coagulating the colloid within the yarns while maintaining the yarns separate from each other, and drying the impregnated yarns.

3. A process for sizing warp yarns, comprising degrading an alkaline dispersion of an alkali-soluble water-insoluble cellulose ether to lower the viscosity, individually treating warp yarns with said low viscosity dispersion, subjecting the treated yarns to pressure to cause the dispersion to impregnate the yarns, coagulating the cellulose ether within the yarns while maintaining the yarns separate from each other, and drying the impregnated yarns.

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