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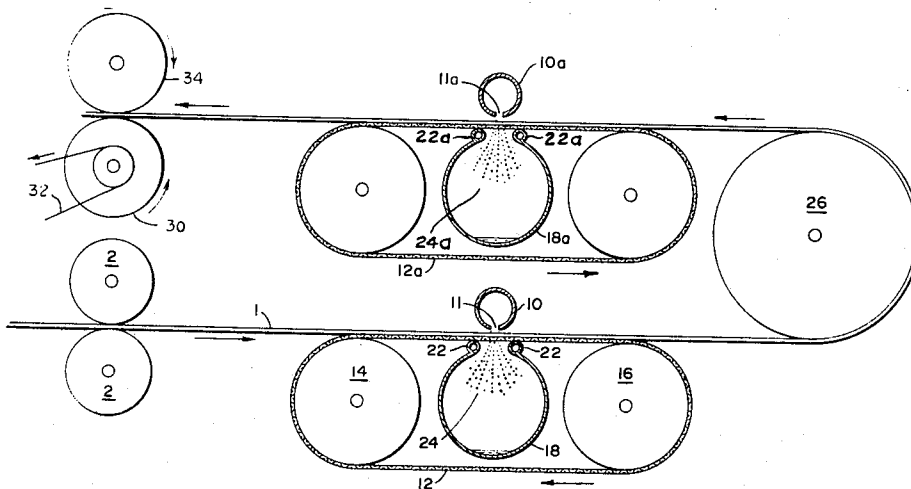
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[54] **APPARATUS AND METHOD FOR DRYING PERMEABLE WEBS**
 8 Claims, 2 Drawing Figs.

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 15/306, 68/20, 134/37, 34/162
 [51] Int. Cl. F26b 5/00
 [50] Field of Search 34/23, 14,
 16, 162, 160; 15/306.1 (Inquired), 308, 302;
 68/20 (Inquired); 34/155; 134/37

ABSTRACT: A moving textile web is expunged of liquid by a very high-pressure air jet which is directed through a thin slot transverse to the direction of travel of the web. The jet is directed downwardly at the web which is horizontally supported by an open weave wire belt. The wire belt moves at a speed different from that of the web in order to avoid a pattern formation on the web as it is impressed on the belt by the force of the air jet.



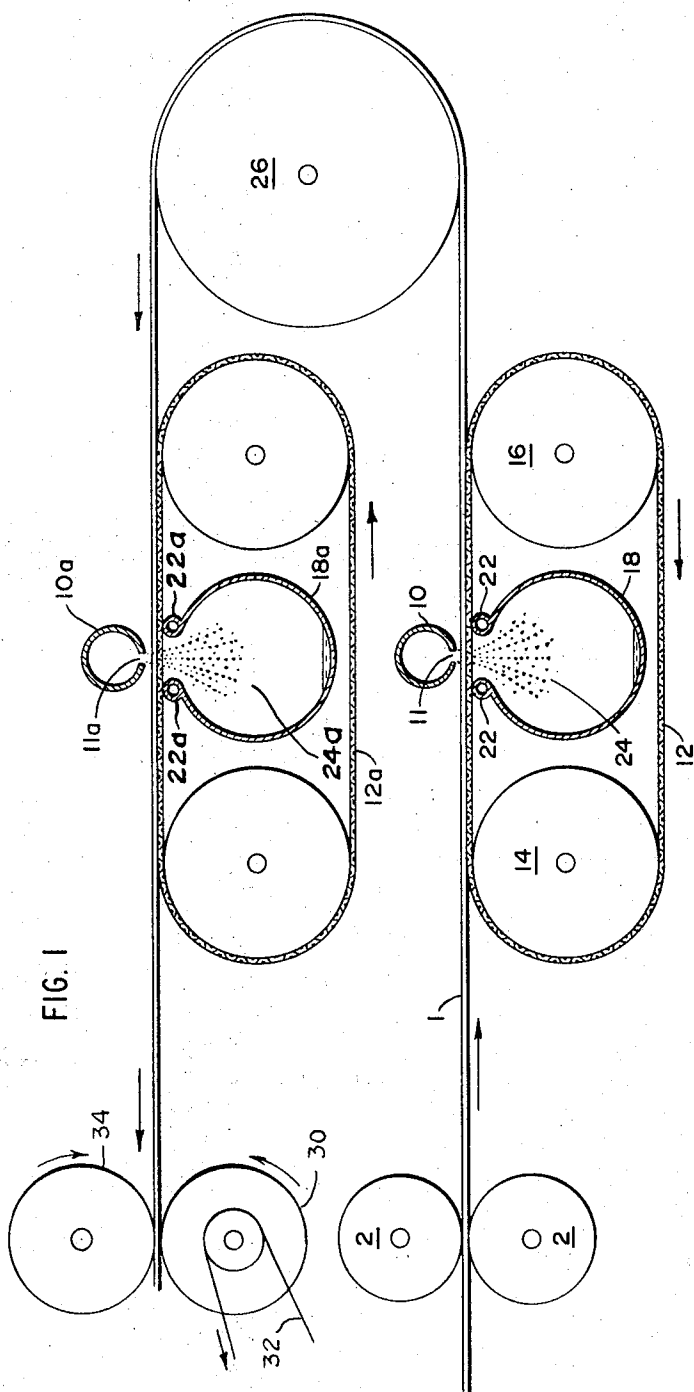


FIG. 1

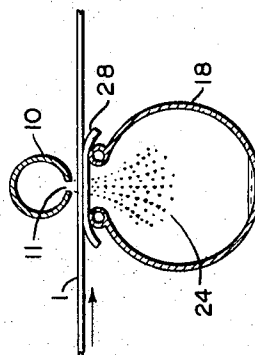


FIG. 2

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APPARATUS AND METHOD FOR DRYING PERMEABLE WEBS

BACKGROUND OF THE INVENTION

This invention relates to drying apparatus and a method for complete removal of all residues retained in the textile web after the rinsing step.

Relatively new developments in textile finishing include the application of special finishing techniques to impart crease retention, wrinkle resistance, permanent press, stain and water repellency. In order to produce essential uniformity in the application of many of the new finishes, fibers in the web must be cleared of all residual chemicals used in processing of the web prior to receiving the final finish. If chemicals used in such pretreatments are not uniformly removed, a nonuniform result may be realized in the finishing treatment.

The prior art practice is to subject the web to high pressure squeezing after a final rinse and before putting the web through a dryer where heat is applied and drying is obtained through evaporation. In preparing the web to receive the special finishes, the practice of high pressure squeezing and evaporation is unsatisfactory because it does not sufficiently clear the web of undesirable chemicals. It is particularly unsatisfactory for synthetic weaves and blends of nylons, acetates, acrylics, polyesters, etc. where the yarns in the web are relatively incompressible. As a result of this incompressibility, the squeezing process leaves varying quantities of the final rinsing medium in the web which will be evaporated when subjected to heat and will leave a varying residue (e.g. soap) on each filament in the yarn. This residue interferes with the uniformity of application of the final finishing treatment.

In some cases the final rinse contains a caustic solution which upon evaporation-drying after rinsing and squeeze-drying may be retained in the web in concentrated form. Such concentrated caustics may damage the web for example by tendering or stiffening especially if heat is subsequently applied. They may also resist bonding and saturation of resins and dyestuffs so that a nonuniform product results. In some cases odiferous chemicals such as formaldehyde are used in the final pretreatment which, if retained in the web even in small quantities, can impart an odor to the final product.

As a means for supplementing liquid removal from the webs, they are sometimes subjected to a vacuum after being processed by the squeeze rolls. One method is to attach a vacuum pump to a pipe having a narrow slot equal in length to the width of the cloth. By developing a vacuum in the pipe, an airflow is induced through the web, thereby removing additional liquid. The pressure equivalent obtained by this method is in the range of 10 pounds per square inch which is of minimal value. In addition, there is a tendency for the web to seal the slot and prevent free flow.

By the present invention an airflow of considerably higher pressure than that employed in the prior art is used so that the web can be dried without retaining deleterious amounts of residue in the yarn.

BRIEF SUMMARY OF THE INVENTION

Compressed air under very high pressure, on the order of 90 pounds per square inch, is delivered through a narrow slot across the width of the web transverse to its direction of movement. The air jet thus created carries liquid out of the web as it passes through and out of the opposite side. To aid in carrying the liquid away, in one embodiment the web is drawn horizontally under the air jet which is directed downwardly so that the liquid falls away from the web. The liquid may be collected in a trough or other disposing device. Slot sizes in the range of 0.003 to 0.015 inch through which the air is delivered have been successfully used.

In order to support the web as it passes under the air jet and to insure that it remains in close proximity thereto, a foraminous supporting member may be provided which by reason of its openness will not interfere with the flow of liquid out of the web.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows in diagrammatic form an elevation view of a preferred embodiment of the invention.

FIG. 2 shows in diagrammatic form an elevation view of an alternative embodiment of the web support.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the textile web 1 flows from a preceding operation represented, for example, by the squeeze rolls 2 from which rinse solution is removed. A pressure nozzle 10 having a slot 11 is superposed above and directed downwardly in the path of the textile web 1. The slot is positioned transversely to the direction of flow of the web 1 along its entire width. The nozzle 10 is connected to a source of compressed air (not shown). A continuous open weave wire belt 12 is disposed to travel below the nozzle and is installed on a takeup roll 14 and a drive roll 16.

A drain trough 18 is positioned between the rolls 14 and 16 and under the upper run of the belt 12 and has an opening directly opposite an air jet 24 which emanates from the slot 11. The opening should be larger than the slot 11 because the liquid-air flow may be somewhat dispersed after it has passed through the web and the belt. Lips 22 are disposed on the opposed sides of an opening in contact with the undersurface of belt 12 to wipe liquid which may collect on the undersurface of the belt 12 and to provide additional support for the web 1 as it passes under the nozzle 10.

After passing through the squeeze rolls 2, the web 1 still contains a considerable amount of the final rinse solution. The web 1 moves onto the belt 12 and is supported thereon as it passes closely under the slot 11. The high pressure air jet 24 blows through the web 1, passing between the fibers or filaments of each thread of the web and blows a high percentage of the remaining liquid out of the web. The jet 24 containing entrained liquid from the web continues through the foraminous belt 12 and enters the drain trough 18 as a fine mist. The drain trough 18 acts as an expansion chamber so that the liquid droplets coalesce and condense on its inner surface. Undesirable chemicals resident in the liquid rinse medium are concurrently removed from the web 1 and deposited in the trough 18. Exhaust blowers (not shown) may be provided to facilitate removal of the liquid from the trough 18.

As the web 1 and the underlying belt 12 move under the slot 11, the force of the air jet 24 tends to impress the textile web against the open weave of the belt which may cause an undesirable pattern formation on the web. To overcome pattern formation the belt 12 is driven at a linear speed slightly differing from that of the web 1 so that they are in constant relative motion.

In the embodiment of FIG. 1 a speed difference between the web 1 and the belt 12 on the order of 1 inch per linear yard of web has sufficed to prevent pattern formation.

In many fibers, the air jet will have a "facing" effect on the web compacting the fibers on one side and causing fiber ends to project on the other. In order to avoid this facing effect a second identical apparatus may be provided to blow air through the web from the inverse side. This may be done, for example, by inverting the web 1 over a roll 26 (FIG. 1). The web 1 is then drawn through a second identical apparatus having its opposite face adjacent to the air jet. In this way the facing effect may be equalized.

The second apparatus is shown in FIG. 1 having a second nozzle 10a a second open weave wire belt 12a which carries the web 1 under the second nozzle 10a and which is supported at that point by a second pair of lips 22a on a second drain trough 18a. As the opposite face of the web 1 is drawn under an air jet 24a emanating from a slot 11a in nozzle 10a the facing effect is reversed, the fibers of the yarn being blown back to their original orientation. In addition, any remaining liquid is blown off into the trough 18a.

Translation of the web may be accomplished by any number of conventional means known in the textile industry, and such means is not part of the present invention although it is of

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course necessary in order to use the apparatus and process. One such means is illustrated in FIG. 1 where the web passes in the nip formed by a drive roll 30, driven from a power source (not illustrated) by a belt 32 and an idler roll 34.

An alternative embodiment is shown in FIG. 2 where the belt 12 is absent and the web 1 is instead supported under the slot 11 by a fixed support member 28 such as a plate. The plate may be attached to the trough 18 by any convenient means. The support member 28 may be foraminous as in the case of the wire belt 12 of FIG. 1 or may have an opening such as a slot conforming to the shape of the emanating air jet 24.

The embodiments herein contained consist of a horizontally flowing or translating web and a foraminous support in a similar orientation so that the air jet blows downwardly through them. However, the invention comprehends an orientation of the web to any direction of flow with equivalent adjustments in the other members. Thus the web may flow vertically or at any intermediate angle and the air jet is adjusted to blow through it. In particular, in the case of the second identical apparatus used to equalize the facing effect, the web may continue to flow horizontally and the relative positions of the foraminous support 12a and the nozzle 10a reversed so that the slot 11a blows the air jet 24a upward. Such versatility is useful in solving plant layout problems where economy of space is an important factor.

I claim:

1. The method of expunging liquid retained in a textile web comprising; translating the textile web past a transverse nozzle, blowing a jet of relatively high pressure air out of the nozzle and through the textile web while supporting the web opposite the nozzle on a foraminous belt which is translating at a linear speed differing from that of the web so that patterning of the web against the belt is avoided.

2. The method of expunging liquid retained in a textile web comprising; translating the textile web past a transverse nozzle; blowing a jet of such high pressure air out of the nozzle and through the web as to entrain the liquid in a fine mist on the opposite side of the web; and supporting the web opposite the nozzle on a foraminous belt which is translated past the nozzle at a linear speed differing from that of the textile web.

3. The method of claim 2 further comprising; coalescing and condensing the fine mist in a confined chamber as it emerges from the web and through the foraminous surface.

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4. An apparatus for removing liquid retained in a textile web which is adapted for translation through the apparatus comprising; a foraminous belt for supporting the textile web; a nozzle disposed transversely to the direction of movement of the web and directed to inject a relatively high pressure air jet through the textile web and the foraminous belt and further wherein the foraminous support belt is adapted to be drawn under the air jet at a speed slightly differing from that of the textile web so as to avoid patterning of the textile web by the support belt as it passes the nozzle.

5. An apparatus for removing liquid retained in a textile web which is adapted for translation past the apparatus comprising; a foraminous support member for supporting the textile web which support member is adapted to translate at a linear speed differing from that of the web so that patterning of the web against the support member is avoided, a nozzle disposed transversely to the direction of movement of the web and directed to inject such high pressure air jet through the textile web as to entrain liquid contained therein in fine mist emanating on the opposite side of the web and the foraminous support member.

6. The apparatus of claim 5 further comprising; an expansion chamber positioned under the foraminous belt opposite the air jet for coalescing and condensing the liquid as the fine mist expands into the chamber.

7. The apparatus of claim 5 wherein the foraminous support member is a belt adapted to translate at a linear speed differing from that of the web so that patterning of the web against the belt is avoided.

8. An apparatus for removing liquid retained in a moving textile web comprising a nozzle disposed transversely to the direction of movement of the web and directed to inject a high pressure air jet downwardly through the textile web; a foraminous support belt drawn horizontally under the nozzle and in close proximity thereto as it supports the moving web, means positioned to collect the expunged liquid; means for inverting the textile web to place its opposite face upward; a second transversely disposed nozzle directed downwardly through the opposite face of the textile web; a second foraminous belt drawn horizontally under the air jet and the textile web as it passes under the air jet; and a second means for collecting the expunged liquid.

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