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MICROPOROUS ROLL FOR DRYING CONTINUOUS FILAMENTS

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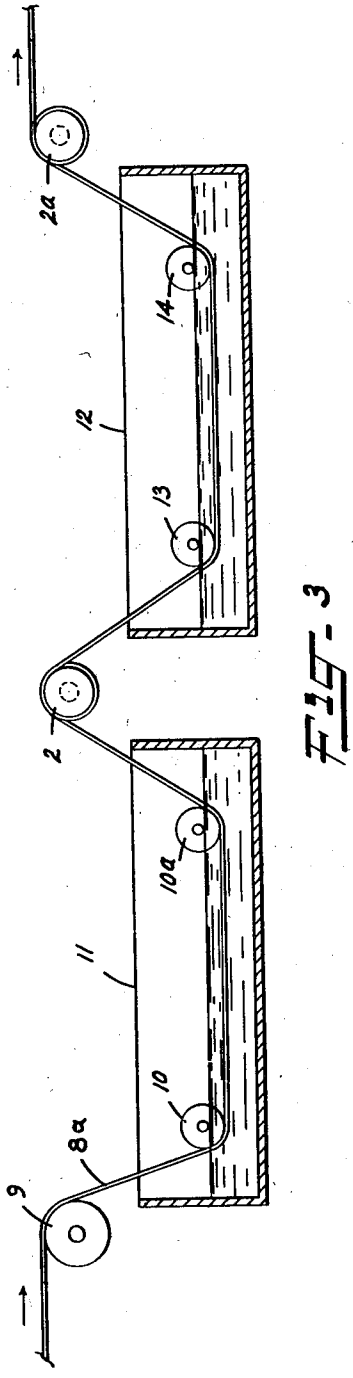


FIG. 3

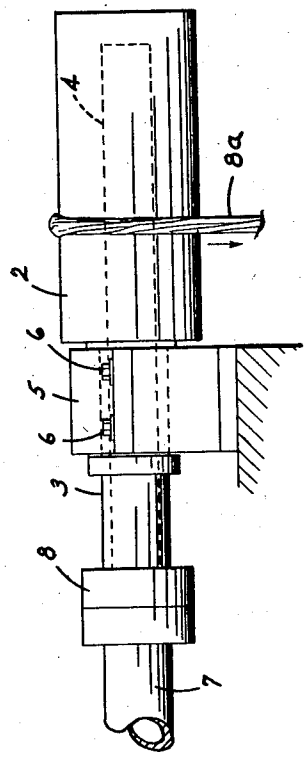


FIG. 1

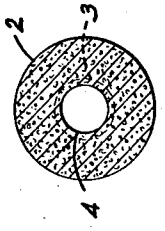


FIG. 2

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MICROPOROUS ROLL FOR DRYING CONTINUOUS FILAMENTS

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5 Claims. (Cl. 34—9)

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This invention relates to methods and apparatus for withdrawing moisture from moisture-laden fibrous products. The invention is concerned with the withdrawal of moisture from traveling filaments, yarns, fabrics, felts, paper, paper products, or the like, but more particularly with the withdrawal of moisture from traveling continuous filamentary bundles such as yarns, tows, cords, and strands of all types, especially from freshly spun continuous filaments in the form of a tow which has been subjected to liquid treatment, whether aqueous or otherwise.

Customarily, in the manufacture of bundles of artificial filaments, when it is desired to remove excess liquid therefrom prior to treating the bundles with other liquids, and chemical reactivity between the several liquids is a possibility to be avoided, or before finally drying the filaments, the bundles are passed between heavy pressure rolls. In that manner, however, only a comparatively small amount of moisture is removed from the bundles, and after passing between the rolls, the bundles are found to contain non-uniform amounts of moisture at different points along their length, largely due to the fact that liquid squeezed out of one portion of the material tends to seep, generally in irregular fashion, around the materials in the adjacent open spaces between the rolls, and to be absorbed by the portion of material approaching or being discharged from the rolls. Further, due to the strain and pressure exerted on the bundles by the pressure rolls, the filaments tend to lose their natural shape and are flattened out and acquire sharp edges.

One object of this invention is to provide a simple efficient device for withdrawing moisture uniformly from all portions of traveling fibrous products. Another object is to provide means for withdrawing the moisture in which pressure rolls or other squeezing means are avoided. A still further object is to provide a device by means of which moisture is withdrawn from traveling fibrous products mainly by capillarity.

The objects of this invention are accomplished by providing a rotatable microporous roll adapted to be positioned along the path of a traveling fibrous product from which moisture is to be withdrawn, and which comprises an effective material-receiving outer surface and an inner surface defining a suction chamber within the roll. A suction means is provided for continuously applying suction to the interior of the roll. The roll may be formed of any microporous material which is capable of being readily wetted with water or other aqueous fluids, such as a ceramic material, e. g., porcelain, pressed paper pulp, or the like, and is of sufficient thickness to prevent the passage therethrough of any appreciable amount of air.

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In the accompanying drawing,

Figure 1 is a side view of a rotatable roll in accordance with the invention;

Figure 2 is a view of the roll in cross-section, and

Figure 3 is a diagrammatic side elevation of apparatus having a roll in accordance with the invention associated therewith.

Referring to Figure 1, there is shown a roll 2 closed at one end and having a concentric reduced portion or projection 3 at its opposite end. Centrally disposed of the roll and projection, but terminating short of the closed end thereof, is a bore which constitutes a suction chamber 4 within the roll. The roll may be rotatably supported in the path of the traveling fibrous product in any suitable manner. As shown, the reduced portion 3 is journalled in a split bearing 5 which is, in turn, secured to a suitable bracket or support by bolts 6. One end of a flexible suction pipe 7 is connected with projection 3 through a rotatable coupling 8, pipe 7 being held stationary when roll 2 rotates. The other end of pipe 7 is connected to a suction apparatus, not shown. Roll 2 is an idler which is caused to rotate in the direction of travel of the fibrous product passing therearound or thereover, in response to the drag exerted by the product. However, means may be provided for positively driving roll 2, if desired. Preferably roll 2 and projection 3 are cast or otherwise formed in one piece.

In the operation of the device, the traveling moisture-laden fibrous product passes over the external material-receiving surface of rotatable roll 2 positioned in its path of travel. By reason of the microporous structure of the material from which it is formed and its thickness, roll 2 is highly resistant to the passage of air therethrough, but is readily wetted, and capillaries run inwardly from the outer to the inner surface thereof, so that when a moisture-laden fibrous product passes over, or around and over, the outer surface of the roll, the moisture passes downwardly through the product and then through the roll to the inner surface of the latter solely by capillary action. The moisture withdrawn to the inner surface of the roll by capillarity is removed by suction applied to chamber 4.

In effect, the method of the invention comprises two stages, but, in practice, the fibrous product is advanced continuously over roll 2 and suction is applied uninterruptedly to chamber 4, so that the moisture collected at the inner surface of the roll is constantly displaced. The suction applied to the chamber within the roll serves to increase the rapidity with which moisture drawn to the inner surface of the roll by capillarity is removed from the vicinity of the interior of the roll, which, in turn, increases the rapidity of replacement by capillary action, and the two stages of the process proceed continuously and concurrently.

In Figure 1, there is shown a practical adaptation of the device of the invention. Referring to Figure 1, a tow of filamentary material 8a, which may be coming from other treating devices or may comprise freshly spun artificial filaments coming from a coagulating medium, is guided, by means of guide roll 9, into a trough 11 containing suitable treating liquid, the tow being supported in trough 11 by rolls 10 and 10a. As it leaves trough 11, the tow is passed over a rotatable microporous roll 2 constructed in accordance with the principle of this invention. The tow may be lapped completely around the roll one or more times, if desired. During its passage over, or around and over the roll, the excess treating liquid carried by the tow from trough 11 is withdrawn from the tow to the inner surface of the roll, from which it is continuously withdrawn by suction.

The tow is thus conditioned for treatment with a different liquid contained in trough 12, in which it is supported by rolls 13 and 14. Another microporous roll 2a, similar to roll 2, is positioned adjacent the exit end of trough 12. The tow is passed over roll 2a, and the excess treating liquid from trough 12 is withdrawn therefrom. After leaving roll 2a, the tow may be forwarded for further liquid treatment or for other processing, as for example to a staple fiber cutter for cutting into discontinuous fibers of any desired length, or it may be directed to a drying device or a take-up means.

Although the invention has been specifically illustrated as applied to a filamentary tow, any other form of moisture-laden fibrous product may be passed over a roll or rolls 2 as described, such as fabrics, felts, paper, paper products or the like. For example, the device may be associated with a paper-making machine. The moisture is withdrawn from the product uniformly at all parts thereof, by capillarity and, since the withdrawn moisture is practically instantaneously removed from the vicinity of the product and the roll, there is no opportunity for the withdrawn moisture to contact and be reabsorbed either by fresh moisture-laden portions of the product approaching the roll or by the portion discharged from the roll as happens in the case of pressure or squeezing rolls. When filamentary bundles are treated in accordance with the invention, the moisture is withdrawn from all of the filaments comprising the bundle uniformly along their lengths, and the filaments, which are not subjected to undue stress or strain retain their natural shape without distortion.

While a preferred embodiment of the invention has been described, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. Apparatus for withdrawing moisture from a traveling moisture-laden fibrous product solely by capillarity which comprises a single rotatable roll which is microporous and of sufficient thickness to be substantially resistant to the passage of air therethrough, said roll being closed at one end and having an effective material-receiving outer surface and a centrally disposed bore terminating short of the closed end of the roll, and suction means communicating with said bore for continuously applying suction simultaneously to all portions of the inner surface of the roll which defines the bore within the roll.

2. Apparatus for withdrawing moisture from a traveling moisture-laden fibrous product solely by capillarity which comprises a single rotatable roll which is microporous, formed from a ceramic material, and of sufficient thickness to be substantially resistant to the passage of air therethrough, said roll being closed at one end and having an effective material-receiving outer surface and a centrally disposed bore terminating short of the closed end of the roll, and suction means communicating with said bore for continuously applying suction simultaneously to all portions of the inner surface of the roll which defines the bore within the roll.

3. Apparatus for withdrawing moisture from a traveling moisture-laden fibrous product solely by capillarity which comprises a single rotatable roll which is microporous, formed from pressed paper pulp, and of sufficient thickness to be substantially resistant to the passage of air therethrough, said roll being closed at one end and having an effective material-receiving outer surface and a centrally disposed bore terminating short of the closed end of the roll, and suction means communicating with said bore for continuously applying suction simultaneously to all portions of the inner surface of the roll which defines the bore within the roll.

4. The method of withdrawing moisture from a traveling moisture-laden fibrous product solely by capillarity and in the absence of pressure exerted on the fibrous product which comprises contacting the product with the outer surface of a rotatable microporous roll having one end closed and of sufficient thickness to be substantially resistant to the passage of air therethrough said roll having an inner surface defining a suction chamber extending longitudinally of the roll but terminating short of the closed end thereof, and capillaries running inwardly from the outer to the inner surface, to thereby withdraw the moisture from the fibrous product through the roll by capillarity only, and continuously removing the moisture withdrawn from the material by capillarity from the inner surface of the roll by continuously applying suction simultaneously to all portions of said inner surface.

5. The method of withdrawing excess moisture from a traveling tow of moist filamentary material solely by capillarity and in the absence of pressure exerted on the tow which comprises contacting the tow with the outer surface of a rotatable microporous roll having one end closed and of sufficient thickness to be substantially resistant to the passage of air therethrough, said roll having an inner surface defining a suction chamber extending longitudinally of the roll but terminating short of the closed end thereof and capillaries running inwardly from the outer to the inner surface, to thereby withdraw the moisture from the tow through the roll by capillarity only, and continuously removing the moisture

withdrawn from the tow by capillarity from the inner surface of the roll by continuously applying suction simultaneously to all portions of said inner surface.

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