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APPARATUS FOR THE CONTINUOUS WET TREATMENT OF TEXTILES AND THE LIKE

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FIG. 1

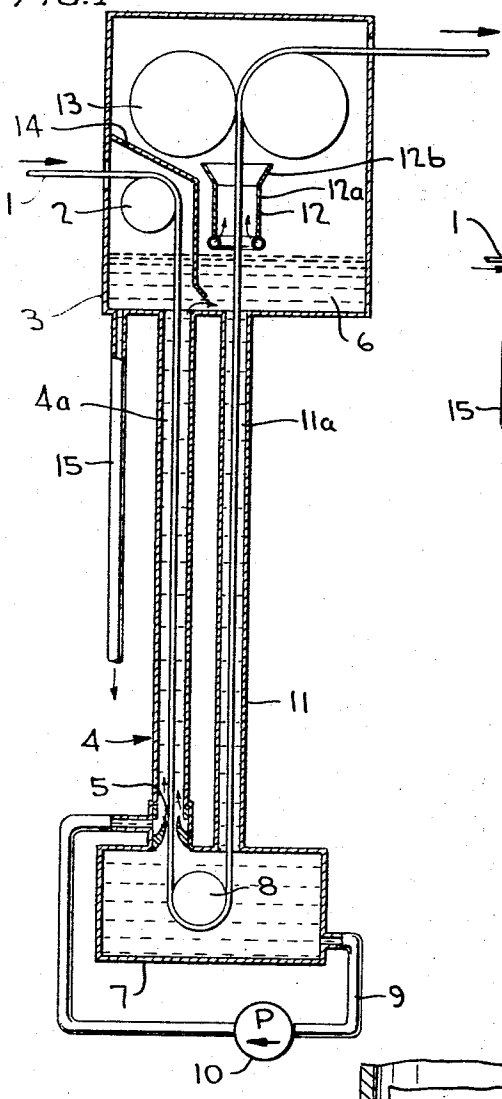


FIG. 2

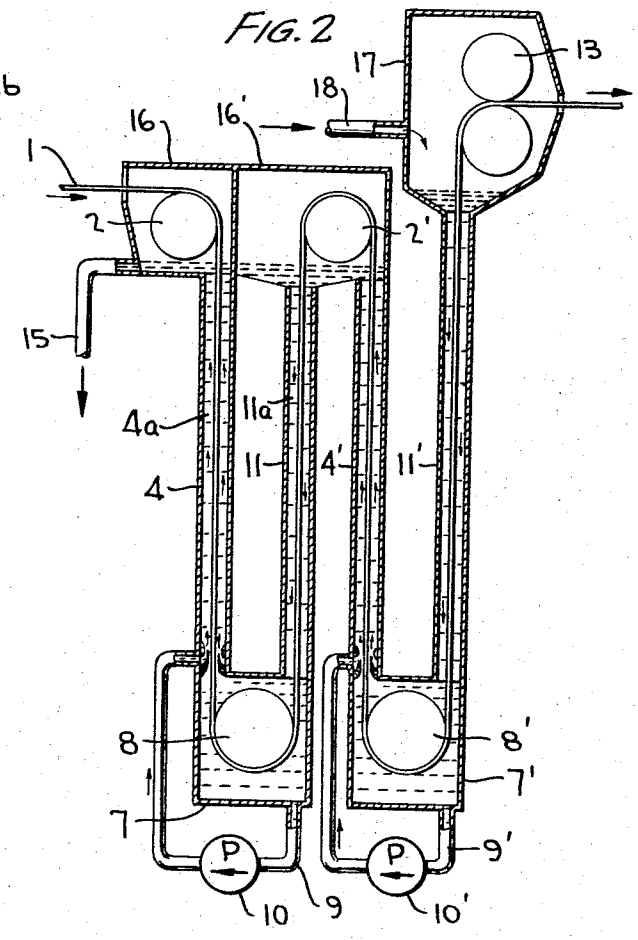
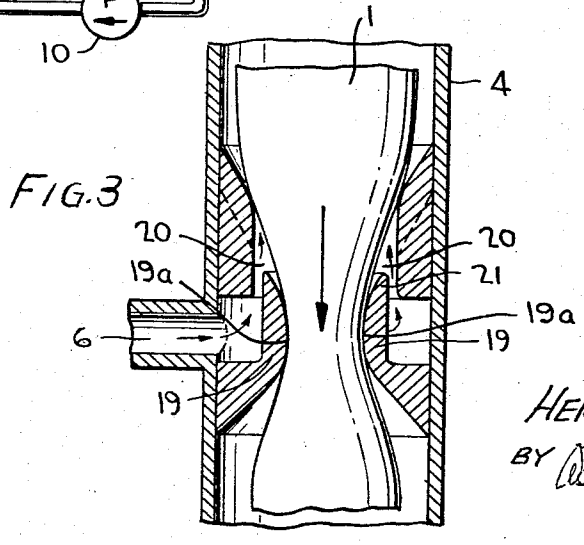


FIG. 3



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5 Claims. (Cl. 68—181)

The present invention has reference to an improved apparatus for the continuous wet treatment of rope or web-shaped textiles (for instance fabrics, knitted goods and so forth) wherein the textile material is conveyed through at least two narrow communicating pipe-shaped chambers or compartments filled with treatment liquid and in an opposite direction to the direction of flow of the treatment liquid. The invention is also concerned with an improved tangential nozzle used in the inventive apparatus. Under the term "wet treatment" there comes under consideration the following: washing, bleaching, dyeing, impregnating, treatment in a caustic-soda bath, acidification and so forth.

Accordingly, it is a primary object of the present invention to provide an improved apparatus for the wet treatment of textile materials and, more specifically, to achieve as high as possible treatment action (also with very delicate textiles) while protecting against mechanical forces, and to carry out such treatment action in as simple a manner as possible and by means of inexpensive apparatus while using small quantities of treatment bath.

It has been found, particularly with so-called exchange processes, that the treatment effect, notwithstanding the velocity of the textile goods, itself can be considerably increased by increasing the flow velocity of the treatment liquid at the surface of the textile goods. It has already been proposed to somewhat increase the treatment effect by increasing the velocity of the textile goods. The increase of the treatment effect by increasing the velocity of the treatment liquid with stationary textile goods is, thus, incomparably larger than that achieved by increasing the velocity of the textile goods with stationary treatment liquid.

In order to be able to maintain the counterflow principle simultaneously with high velocity of the textile goods there was previously always employed wide compartments or chambers, bringing about the disadvantage of having to use a large quantity of bath. With narrow compartments, particularly with vertical arrangement of the same, it was not up to the present possible to uphold the counterflow principle in a sufficient manner, that is, with large velocities of the textile goods as well as also the treatment liquid. Furthermore, with known method techniques working with large pump pressures there further existed the danger of damaging the fabric.

Therefore, a further important aspect of the invention resides in the features that by means of an appropriate apparatus it is possible to make the flow velocity of the treatment liquid in narrow chambers as high as possible at all locations during the throughpassage while employing the counterflow principle, without thereby damaging the textile goods.

According to the teachings of the present invention the textile goods are conveyed through two communicating pipe-shaped compartments in counterflow to the treatment liquid; the treatment liquid is introduced into that pipe-shaped compartment in which the textile goods pass in upward direction; in the lower connecting portion of both communicating pipe-shaped compartments at least a portion of the treatment liquid is removed by a

pipe and by means of a pump conducted through a liquid delivery apparatus, preferably a nozzle, and guided in a direction opposite the feed direction of the textile goods in the lower portion of that pipe-shaped compartment through which the textile goods travel in downward direction.

Thus, in the one chamber the treatment liquid is upwardly conveyed by the pump pressure in counterflow to the flow of the textile goods, whereby there is achieved a liquid velocity at the surface of the textile goods which is increased a number of times in comparison with known systems. In the other compartment there occurs an acceleration of the liquid velocity over that velocity resulting from the free fall in that pump at the same time sucks down the liquid through the pipe. The textile goods are, therefore, imbued in both pipe-shaped compartments by the treatment liquid moving with high velocity in countercurrent flow.

In so doing, the treatment liquid is advantageously conducted into the lower portion of the one ring-shaped compartment in approximately parallel direction with respect to the surface of the textile goods by means of the liquid delivery apparatus, permitting the application of high liquid pressures previously never employed in actual practice, without also delicate fabrics and textiles becoming damaged and fiber displacement occurring. Due to the high flow velocities of the treatment liquid in the direct region of the surface of the textile goods there is achieved a quicker exchange action between the liquid surrounding the textile goods and that liquid itself located between the fibers, yarn, or as the case may be, intermicelles in the textile goods, than with a direct spraying of the treatment liquid upon the textile goods. In the latter situation the treatment liquid rebounds from the textile goods and after impact is thus again deflected away from such textile goods. The impingement and thereby the duration of contact or "residence time" is relatively short, whereas with the invention, with approximately parallel introduced treatment liquid over a longer path of the textile goods and thereby for a longer period of contact, there advantageously occurs a very intensive liquid exchange.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description and drawing in which:

FIGURE 1 schematically illustrates an apparatus for the performance of the wet treatment of textile materials;

FIGURE 2 schematically illustrates a further embodiment of inventive apparatus; and

FIGURE 3 is an embodiment of nozzle used with the inventive apparatus.

Considering now the embodiment of FIGURE 1 it will be seen that the rope-shaped textile goods **1** are conveyed via a roller **2** disposed in a container **3** into the one pipe-shaped compartment **4***a* of a pipe **4** which is relatively narrow with regard to the fabric rope **1**. Such rope-shaped fabric or textile goods **1** pass through a circular-shaped slotted nozzle **5** providing a liquid delivery apparatus which is arranged in the lower portion of the pipe **4** and through which the treatment liquid **6** is pumped vertically upwards, parallel and opposite to the direction of travel of said rope-shaped textile goods **1**. Thereafter, the rope-shaped textile goods **1** arrive in a lower deflecting chamber or compartment **7** containing a deflecting roller **8**, for the purpose of changing the direction of travel of such textile goods **1**. A pipe or conduit **9** leads from this deflecting compartment **7** to a pump **10**. The treatment liquid **6** flows from the deflecting chamber **7** to the pump **10** and is sprayed or injected by the latter under pressure through the nozzle **5** into the pipe **4**.

The textile goods **1** arrive from the deflecting chamber or compartment **7** at the second pipe-shaped compartment

or chamber **11***a* of the pipe **11** and traverse the latter in vertical direction, opposite the flow direction of the treatment liquid which overflows from the pipe **4** from above into the container **3** and then arrives at the pipe **11**. Thus, the treatment liquid **6** circulates through both pipe compartments **4***a* and **11***a* streaming up-and-down in counterflow to the textile goods **1**. The aforesaid textile goods **1** finally still pass through a second ring-shaped liquid delivery or supply apparatus **12** by means of which fresh treatment liquid arrives in the treatment apparatus in that, the treatment liquid is sprayed onto the rope of textile material **1** within a tube **12***a* surrounding such rope of textile material shortly before the treatment liquid is pressed-off by means of the squeezing or pinch roller arrangement **13**, at the same time serving as transport means for the textile goods.

The pressed-out treatment liquid flows into the liquid delivery apparatus **12** which is configured at its top **12***b* in the form of a funnel. The treatment liquid **6** which arrives at the container **3** by means of the delivery apparatus **12** then likewise flows, together with that quantity of treatment liquid which overflows from the upper end of the conduit or pipe **4**, into the conduit or pipe **11**. The separating or partition wall **14** serves the purpose of preventing the newly introduced treatment liquid from being able to flow-off unused through the overflow pipe **15**.

Since the treatment liquid according to the circulation is continuously agitated in both of the pipe compartments **4***a* and **11***a* by means of the pump **10** it is necessary that the treatment liquid consumed and/or entrained by the textile goods is continuously replenished by new treatment liquid, this occurring by means of the aforementioned delivery apparatus **12**. On the other hand, due to the mentioned exchange effect there continuously takes place a change in the concentration of the circulating bath. Accordingly, in order to maintain constant the concentration of the treatment liquid, in most cases, a portion of the consumed treatment liquid is advantageously conveyed away, this taking place by the overflow pipe **15**. By virtue of the inventive apparatus it is possible to also uphold the principles of counterflow with high velocity of the goods in that extremely high pump pressures can be employed without the danger of damaging the textile goods, which pressure must be at least so large that there is effected an overflow in the container **3** from the pipe **4** into the pipe **11**.

In FIGURE 2 wherein like reference numerals are employed for the same or analogous elements, there is depicted a further embodiment of inventive apparatus. The flat, spread-out web of fabric **1** is conveyed into an upper container **16** through the agency of a roller **2** and travels through the compartment **4***a* of the pipe **4** with vertical downward movement, is guided via the deflecting roller **8** of the deflecting compartment **7** into the compartment **11***a*, and then arrives at the container **16'** of a second analogous assembly or aggregate **4'**, **7'** and **11'**, passing through such in the same manner as aforesaid. After passing through the chamber or compartment **11'** the textile material is guided into the compartment **17** containing the squeezing roller arrangement or unit **13** serving for the forward conveying of the textile goods. The treatment liquid is introduced into the compartment system at the inlet **18** and flows by virtue of the operation of the inventive apparatus in complete countercurrent to the web of goods **1**, notwithstanding the narrow compartments and notwithstanding the vertical arrangement of the same, with relatively high velocity through the entire bipartite apparatus. The treatment liquid then leaves such apparatus via overflow pipe **15** provided at the container **16**.

With this mode of operation a minimum of treatment bath is consumed with a good exchange effect, such being due to the narrow compartments, the high liquid velocity and the simultaneous, consistently maintained complete

countercurrent. In contradistinction to the embodiment of FIGURE 1, in this case, the treatment liquid does not circulate in a closed cycle through both of the communicating compartments of an aggregate. The apparatus of FIGURE 2 can, for example, advantageously be employed as a open width washing machine, whereby the number of aggregates each incorporating two communicating compartments can be optionally enlarged. The rollers **2** and **2'** and insofar as desired also the rollers **8** and **8'** can be driven or freely rotate with the goods.

In the performance of the described invention such a large quantity of bath with such a large velocity is delivered through the nozzles per unit of time that the compartment overflows at its top, whereby, however, the quantity of bath flowing out at the top from the narrow compartment is smaller than the quantity pumped through the nozzles because a portion of the pumped-in bath is entrained by the textile goods moving in counterflow.

The apparatus designed according to the teachings of the invention possess the further advantage that it is independent of the thickness of the goods and independent of the weight of the textile goods to be treated. With light and thin fabrics with high velocities of the goods the treatment liquid has the possibility to more easily flow back between the transformations of the nozzle into the compartment **7** than such is the case with heavy thick fabrics. Since, also, this return flowing liquid is again conducted through the pipe **9** to the nozzle **5** by the pump **10**, there does not occur, in any manner, an additional liquid consumption, and such notwithstanding high pump loads and the thereby large conveyed quantities through the nozzle.

FIGURE 3 depicts a preferred embodiment of a nozzle as such is used for increasing the liquid velocity in the pipe compartment through which the textile goods pass with downward movement. The portion **19** of the nozzle facing towards the textile goods **1** exhibits a rounded-off wall configuration **19***a* and is arranged in such a manner that the textile goods during continuous conveyance through the nozzle slightly contact such rounded-off wall **19***a*. This construction is advantageously employed for the treatment of rope-shaped textiles. In so doing, the nozzle is constructed as a ring which preferably is provided with a continuous round slot **20** serving as the nozzle opening. Advantageously, the tips **21** of the nozzle portion **19** are outwardly directed at the region of the nozzle opening **20** (such being indicated in dotted lines in FIGURE 3), in order to thereby completely preclude damaging of the textile goods during contact of the thin wall.

It is to be understood and appreciated that the present invention is not limited to the illustrated embodiments. In particular, the treatment compartments can possess an optional cross-section, for example a wide and narrow rectangular cross-section if the textile goods should be processed in flat, spread-out condition, or a circular cross-section for the processing of rope-shaped goods. Furthermore, the individual communicating treatment compartments can also comprise a number of pipes which are connected with one another behind one another and such pipe compartments which are horizontally disposed are connected in superimposed relation with deflecting compartments, or else such pipe compartments are arranged in zig-zag formation, V-formation, J-formation or U-formation for instance. In the same manner, the inventive delivery apparatus for the approximately parallel introduction of the treatment liquid can be arranged horizontal, inclined or vertically.

While there is shown and described present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practised within the scope of the following claims.

What is claimed is:

1. Apparatus for the continuous wet treatment of a

textile material and the like comprising means providing at least two operatively communicating compartments through which the textile material is delivered in downward direction and then in upward direction, said two communicating compartments providing means including connecting means for intercommunicating said two compartments at their lower portions, at least one treatment liquid delivery apparatus disposed at the region of the lower portion of that compartment through which the textile material moves downwardly, said treatment liquid delivery apparatus including a nozzle through which passes said textile material, said nozzle incorporating means for directing a stream of treatment liquid substantially parallel to the surface of the textile material, outlet pipe means communicating with said connecting means, a pump connected with said outlet pipe means, and a connecting pipe communicating the pressure side of said pump with said treatment liquid delivery apparatus.

2. Apparatus according to claim 1 wherein said treatment liquid delivery apparatus is disposed at the region of the lower portion of that compartment through which the textile material moves downwardly in such a manner that said directing means of said nozzle directs a stream of treatment liquid in approximately opposite direction to the direction of movement of the textile material.

3. Apparatus according to claim 1, further including means for conveying the textile material in extended condition substantially axially through said compartments.

4. Apparatus according to claim 1 wherein said nozzle includes wall means directed towards the throughpassing textile material, said wall means lying in the zone of movement of said throughpassing textile material and contacting the latter during its throughpassage.

5. Apparatus according to claim 1 including a further treatment liquid delivery apparatus disposed at the region of the upper end of that compartment through which the textile material moves upwardly so that additional treatment liquid can be introduced into said two compartments.

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