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WEB FEEDING OF TEXTILE MATERIALS

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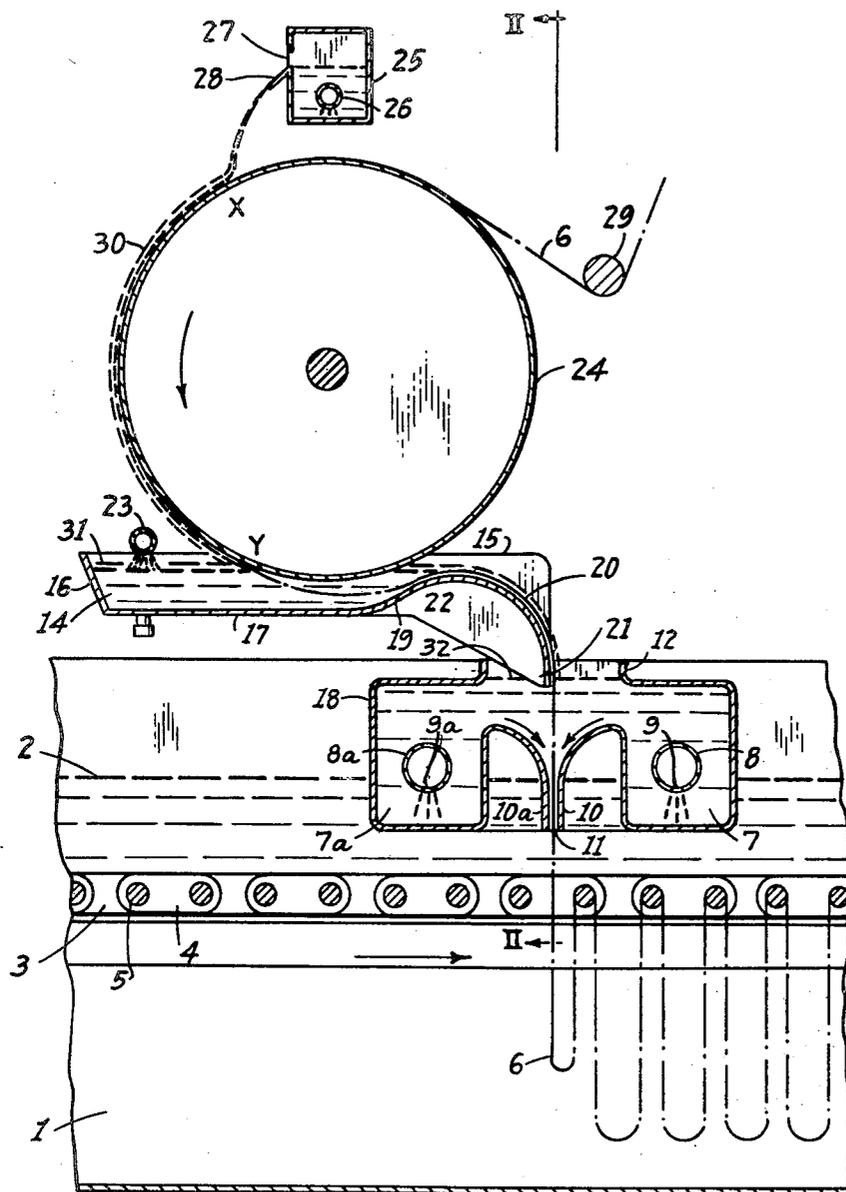


Fig. 1

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WEB FEEDING OF TEXTILE MATERIALS

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This invention relates to new and useful improvements in the web feeding of textile materials.

When textile fabrics are to be treated in a treating liquid in substantially open, i. e., full-width extended state, they must be fed into the treating liquid in substantially that condition. One means of accomplishing this in the past has been by way of a relatively shallow stream of liquid passing over a down-slanting surface onto which the fabric is led. Though devices of this type suffice for use with relatively low feed velocities of the fabric web at a relatively small depth of immersion in the treating tank, they have failed where greater web feeding velocities and depth of immersion are required, as is for instance the case when the fabric web is to be continuously draped over conveyors traveling in the treating bath. This necessitates such a relatively high velocity of the current over the slantingly arranged slide surface that air is drawn into the current or into the treating bath, and may become entrapped at the surface of the fabric. The entrapped air, by reason of its flotation effect upon the web and by reason of the adherence of air bubbles to the fabric surface, causes unevenness in the treatment of the fabric as well as difficulties in operational control.

An alternative mode of feeding a fabric web in open state into a treating liquid is one in which a treating liquid is sprayed onto both sides of the fabric web thus increasing its weight and causing its gravitational feeding into the treating liquid. This, however, is equally subject to the objection of conveying air into the bath, giving rise to the difficulties hereinabove mentioned.

Air entrapment in the web feeding of textile materials may be substantially overcome, however, by the use of a web feeding device of the below-bath-surface current conveying feed-slot type. Such a device is, for instance, disclosed in the Gretler Patent No. 2,161,812 (explained in greater detail below) in which a current is created below a treating liquid surface level in a downward direction to pass through a web-feeding slot, the current gripping the fabric and continuously pulling the same into the treating liquid at a relatively high rate of speed.

It has been found, however, that this open-web feeding apparatus of the below-bath-surface current conveying feed-slot type exerts such a grip upon the fabric that the web, and particularly one of relatively delicate texture, is frequently pulled out of shape. At the same time the fabric passing through the feed-slot of such

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a device is subject to relatively rapid unchecked shrinking causing or contributing to a deformation and/or crimping of the web. When then such a fabric full of crimps and pulled out of shape reaches the conveyors in the treating liquid, it will not properly fold onto the same but will become irregularly draped, resulting in the formation of creases, causing irregularities and other defects which are frequently difficult and in some cases impossible to remove. This is particularly true of such fabrics as rayon, in which any crease in the web as it is being transported through a relatively hot treating liquid, is actually "burned" into the material, i. e., the crease will become permanent and cannot again be thereafter removed, resulting frequently in the complete loss or destruction of entire runs of material.

One object of the invention comprises inter alia a device for use with an open-web feeding apparatus of the below-bath-surface current conveying feed-slot type, which will eliminate the aforementioned difficulties normally encountered in connection with such apparatus.

Another object of the invention comprises a device permitting the feeding of an open web of textile fabric in substantially flat, non-deformed or crimped condition, to and through an open-web feeding apparatus of the below-bath-surface current conveying feed-slot type.

Still another object of the invention is a device permitting a fabric to be fed in substantially tension-relaxed condition to and into an open-web feeding apparatus of the below-bath-surface current conveying feed-slot type.

The foregoing and still further objects of the invention will be seen from the following description read in conjunction with the drawings in which:

Fig. 1 shows a side view partly in cross-section and parts broken away illustrating the device in accordance with the invention;

Fig. 2 is a sectional view of the structure shown in Fig. 1 in the plane II—II thereof;

Fig. 3 is a perspective view of the overflow tank shown in Fig. 1; and

Fig. 4 is an exaggerated view, partly in cross-sections, of a portion of the structure illustrated in Fig. 1 and exemplifying the web travel in relation to the treating liquid conveying currents over the roll and over the overflow lip of the overflow tank.

Referring to the drawings, 1 illustrates a tank for the liquid treatment of textile materials; 2 indicates the normal liquid level in said tank

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which may be adjustably controlled by a conventional overflow arrangement (not shown); 3 indicates an endless chain carrying links 4 and cross-rods 5. The chain is mounted for travel in the direction of the arrow (Fig. 1) driven by a conventional mechanism (not shown). As the continuously downwardly moving fabric web 6 meets the cross pieces or rods 5 it is draped over the rods in pendant loops.

Web-feeding apparatus 18, suitably secured to tank 1, comprises overflow compartments 7 and 7a having treating liquid supply pipes 8 and 8a provided with slots or similar apertures 9 and 9a. Overflow compartments 7 and 7a have downwardly bent lips 10 and 10a and are placed with the lips 10 and 10a opposing each other to form a web feeding slot 11. The upper portions of the compartments 7 and 7a are provided with extensions and side portions forming a frame 12 above a slot 11 and serving to establish a treating liquid surface level below which the web-conveying current is formed as indicated by the arrows (Fig. 1).

An overflow tank or tray 14 having side walls 15, rear and front walls 16 and 19, respectively, and bottom 17, is arranged above web-feeding apparatus 18 in treating tank 1. Wall 19 of overflow tank 14 extends into convexly arcuately overflow lip 20 having a substantially vertically aligned end portion 21 positioned with its surface in about vertical alignment with the vertical axis through slot 11 of the feeding apparatus 18. Braces 22 are provided to strengthen front wall 19 and overflow lip 20 and to impart rigidity thereto. Pipe 23 feeds treating liquid into tank 14.

A roll 24 suitably driven by, for instance, a motor (not shown) is arranged above overflow tank 14. An overflow tank 25 is arranged above roll 24 and receives treating liquid through a suitable slotted or perforated feed pipe 26 and discharges treating liquid through the opening 27 and overflow lip 28 onto the fabric 6 carried over driven roll 24. Fabric 6 is guided onto the roll by way of guide roll 29 from a suitable reel of fabric (not shown).

In the practical operation of the invention, treating liquid fed into overflow tank 25 discharges through opening 27 and lip 28 onto the fabric web 6 carried on roll 24 as the latter rotates. The treating liquid is fed into the compartment or tank 25 in sufficient amount to have enough treating liquid pass onto the fabric 6 on roll 24 to insure at least a thorough soaking thereof and preferably in amount sufficient to cover the web with an overlying sheet of treating liquid as it is conveyed by the driven roll. This is, for instance, illustrated in Fig. 4, showing the fabric 6 and the overlying treating liquid layer 30.

While the fabric 6 and overlying liquid layer 30 rotate on the roll from point X to a point of entry Y into the treating liquid in overflow tank 15 (at the treating liquid level 31) the fabric receives a gradual, controlled shrinking to at least a partial extent. Throughout this shrinking or preshrinking, the fabric web is substantially held in shape by its position on roll 24 whereby the shrinking or partial shrinking results in a tensioning of the fabric, which in its turn contributes to a firm positioning of the web uniformly over the width of the roll without danger of deformation.

As fabric 6 and the overlying liquid layer 30 reach the liquid level 31 in tank 15, the fabric

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web is pushed off the surface of the roll due to the resistance offered its travel through the treating liquid and aided by its subsequent change in direction as the result of its current-guided passage over the overflow lip 20. The treating liquid input into tank 15 through, for instance, pipe 23 is such as to create a continuous overflow over lip 20. This creates a current traveling in the direction of the overflow lip and the amount of liquid flowing over lip 20 is so adjusted that it has sufficient depth to substantially envelop the fabric web passing over the lip and to act as a conveying current therefor. Thus the fabric web as it passes off the roll slacks sufficiently to become tension-relaxed and in that condition is moved along by the conveying or carrying current onto and over the overflow lip 20 and its vertically aligned end portion 21 terminating below the surface of the treating liquid level 32 in web-feeding apparatus 18. The web is then gripped by the conveying current from the compartments 7 and 7a being fed downwardly through slot 11 and draped in the dependent loops over the rods or cross pieces 5.

The carrier or conveying current passing over lip 20 is to some extent aided by the sheet or layer of liquid 30 as it enters tank 15 and may be still further influenced, depending upon conditions and speeds of rotation by such impeller action as may be produced by the rotation of roll 24 aided by the fabric at or adjacent to its line of entry into the treating liquid in tank 15.

The feeding velocity of the sub-surface bath current through slot 11 of the feeding apparatus 18 depends inter alia upon the amount of treating liquid fed into the individual compartments 7 and 7a, the type of material to be treated and the hydrostatic differential between the level 2 in the treating tank 1 and the level 32 within the web-feeding apparatus 18. The higher the differential, the greater the current (at constant feeding pressure to the compartments) and the greater the rate of feed of the web through the slot 11. On the other hand, if the differential between these two liquid levels is lessened, the rate of feed of the web through the slot 11 decreases. In all cases it is important that the lower end of slot 11, i. e., the lower end portions of the individual lips 10 and 10a of compartments 7 and 7a be below the liquid level 2 in treating tank 1. The liquid level in treating tank 1 may be varied or adjusted in any known manner such as by adjusting the overflow height of a conventional overflow pipe or valve (not shown).

Once a given rate of feed of the textile web through slot 11 is established for a given material, the web carrying or conveying current over the overflow lip 20 and end portion 21 may be suitably controlled by appropriate adjustment of the treating liquid input into tank 15 and, dependent upon conditions of treatment, additionally by adjusting the treating liquid input to tank 25. The conveying current to and over lip 20 is preferably so regulated that the fabric web will be conveyed onto and over the lip substantially at the same rate of feed at which it is drawn into the treating tank 1 by way of the web feeding current in web-feeding apparatus 18 passing through slot 11.

The fabric should be brought onto the overflow lip in substantially tension-relaxed condition which may be accomplished, for instance, by the driven roll arrangement herein illustrated by way of preferred embodiment in accordance

with the invention. Rotation of roll 24 is so adjusted that a tension-relaxed condition of the fabric web in the overflow tank 15 is assured. This includes the limiting case on the one hand where the rotation of the roll is adjusted to a speed where the fabric is fed into the treating liquid in overflow tank 15 at a rate just sufficient to relax its tension and pass the same without substantial slack over the overflow lip 20, and the limiting case on the other hand where the rate of feed of the web by the driven roll into the treating liquid in tank 15 is such as to produce an appreciable slack in the goods before they are conveyed over the overflow lip. In the latter case care should be taken that not too much slack occurs which may result in crimping or creasing of the goods as they are fed onto the lip. The rate of feed of the web into the treating liquid of tank 15 in a manner to tension-relax the same is preferably so adjusted that the goods are substantially uniformly taken over the lip without any appreciable slack accumulating or increasing in the tank.

Depending upon various factors, including type of material, nature or temperature of treating liquid in tank 15, extent of shrinkage on roll 24, more or less additional shrinking of the fabric web may occur while the web is in overflow tank 15. The shrinking or preshrinking conditions on roll 24 can be ordinarily suitably so adjusted, as for instance by control of such factors as length of wet travel of the web on the roll, treating temperature, etc., that comparatively little after-shrinking occurs in tank 15. Care should, however, be taken that whatever after-shrinking in the overflow tank does occur is taken into consideration and compensated for, such as by slightly increasing the driven speed of roll 24, to insure the substantially tension-relaxed condition of the web as it reaches the overflow lip 20. In the practical operation of the device in accordance with the invention in connection with the open web feeding of a web of textile material by way of a downwardly directed below-treating-bath surface created web conveying current, there are involved the steps of at least partly shrinking a web of textile material with treating liquid while in substantially uniformly supported tension contact with a substantially smooth surface, thereafter substantially tension-relaxing said web in treating liquid and conveying the same in substantially tension-relaxed condition and substantially encased in a stream of treating liquid over a downwardly arcuating surface into substantially vertical position for gripping contact with a below-treating-bath surface created web conveying current.

The device in accordance with the invention for use with an open-web feeding apparatus of the below-bath-surface current conveying feed-slot type essentially comprises means defining a convexly and preferably cylindrically arcuate surface and a downwardly extending end portion, the latter being positioned for substantially vertically directional alignment, means for continuously passing treating liquid onto and over said surface toward and over said end portion, and means for continuously bringing a web of textile material in open substantially tension-relaxed condition onto said surface.

Within the preferred embodiment of my invention my novel device essentially comprises a tank, a substantially smooth overflow lip from said tank defining with at least a portion of its overflow surface a substantially convexly, preferably

cylindrically, arcuate surface and a downwardly extending end portion positioned for substantially vertically directional alignment, means for continuously passing treating liquid into said tank and preferably positioned away from said lip to create a web conveying current in said tank to said overflow lip, a roll for feeding a web of textile material into said conveying current in advance of its reaching said overflow lip and means for driving said roll at a rate of web feed into said conveying current to substantially tension-relax said web on its way to said overflow lip.

For best results it is recommended that all surfaces over which the web of textile material is conveyed and particularly those over which such web is carried by a conveying current, are substantially smooth. This is essential not only to prevent seizing of the material on or by the surface but is also important in order to assure the smoothest possible flow of the conveying current for such surface. The latter is necessary to avoid entrapment of air by the current and thus by the fabric and to assure the substantially smooth flowing of the conveying current over the downwardly curving lip to the maximum possible exclusion of any cascading effect into the treating liquid in the web feeding apparatus 18. For this reason and also by virtue of its relative strength and resistance to the effects of various treating baths, I find it of advantage and recommend the use of stainless steel for the overflow tank and particularly overflow lip 20, including its dependent end portion 21 as well as for the surface of roll 24. Cross braces, such as braces 22, are desirable in that they assure the desired rigidity of the overflow lip.

Though the front wall 19 extending into overflow lip 20 of tank 15 may be angularly relatively steep, as is for instance its opposite wall 16, I prefer to have the same extend in a more or less smooth reverse curve relation substantially in continuation of the overflow lip 20. Thus as illustrated in the drawings, wall 19 extends into overflow lip 20 with a first substantially concavely, then substantially convexly, curving surface, thereby essentially defining with the substantially cylindrically arcuate surface portions of overflow lip 20, a surface of elongated substantially S-shaped cross-section. At the same time the roll 24 is so mounted and dimensioned in relation to the position, dimensions and curvature of wall 19 as to define a structure in which the curved surfaces of both at the lines of closest proximity are essentially parallel, i. e., all tangents to each curve along this line are all essentially parallel.

The foregoing specific description is for purposes of illustration and not of limitation and it is therefore my intention that the invention be limited only by the appended claims.

I claim:

1. Device in combination with an open-web feeding apparatus of the type including a feed slot and means for conveying a below-bath-surface current through said feed-slot, which comprises means defining a convexly arcuate surface and a downwardly extending end-portion, said end-portion being positioned for substantially vertically directional alignment with the inlet end of said feed-slot, means for continuously passing treating liquid onto and over said surface toward and over said end portion, and means for continuously bringing a web of textile material in open, substantially tension-relaxed condition onto said surface.

2. Device in accordance with claim 1 in which

there are included a tank, a substantially smooth overflow lip from said tank defining said substantially convexly arcuate surface and downwardly extending end portion, and means for continuously passing treating liquid into said tank.

3. Device according to claim 2 in which said convexly arcuate surface portion of said overflow lip is of a cross-section substantially defining a portion of a circle.

4. Device according to claim 2 in which said means for continuously passing treating liquid into said tank are positioned away from said lip to create a web conveying current in said tank to said overflow lip, and in which said means, for bringing a textile web in open, substantially tension-relaxed condition onto said overflow lip, feed such web into said conveying current.

5. Device according to claim 4 in which said convexly arcuate surface portion of said overflow lip is of a cross-section substantially defining a portion of a circle.

6. Device according to claim 5 in which one side of said tank has a wall substantially merging into said overflow lip with a substantially first concavely, then convexly curving surface.

7. Device in combination with an open-web feeding apparatus of the type including a feed-slot and means for conveying a below-bath-surface current through said feed-slot, which comprises a tank, a substantially smooth overflow lip from said tank defining a convexly arcuate surface and a downwardly extending end portion positioned for substantially vertically directional alignment with the inlet end of said feed-slot, means for continuously passing treating liquid into said tank and positioned away from said lip to create a web conveying current in said tank to said overflow lip, a roll, positioning means for said roll for feeding a web of textile material into said conveying current and means for driving said roll at a rate of web feed into said conveying current to substantially tension-relax such web on its way to said overflow lip.

8. Device according to claim 7 in which said convexly arcuate surface portion of said overflow lip is of a cross-section substantially defining a portion of a circle.

9. Device according to claim 8 in which one side of said tank has a wall substantially merging into said overflow lip with a substantially first concavely, then convexly curving surface.

10. Device according to claim 9 in which part of the surface of said concave portion is substantially concentric with the roller surface.

11. Device in combination with an open-web feeding apparatus of the type including a feed-slot and means for conveying a below-bath-surface current through said feed-slot, which comprises a tank, a substantially smooth overflow lip from said tank defining a convexly arcuate surface and a downwardly extending end portion, positioned for substantially vertically directional alignment with the inlet end of said feed-slot, means for continuously passing treating liquid into said tank and positioned away from said lip to create a web conveying current in said tank to said overflow lip, a roll, positioning means for said roll for feeding a web of textile material into said conveying current, means for passing treating liquid onto the web conveying surface of said roll to substantially form a web enveloping sheet of treating liquid thereon, and means for driving said roll at a rate of web feed into said conveying current to substantially tension-relax such web on its way to said overflow lip, said roll being mounted for immersion of its lower circumference in the treating liquid in said tank.

12. Device according to claim 11 in which said convexly arcuate surface portion of said overflow lip is of a cross-section substantially defining a portion of a circle.

13. Device according to claim 12 in which one side of said tank has a wall substantially merging into said overflow lip with a substantially first concavely, then convexly curving surface.

14. Device according to claim 13 in which part of the surface of said concave portion is substantially concentric with the roller surface.

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