Aug. 23, 1932. R. DE V. HOPE ET AL 1,873,635

METHOD AND APPARATUS FOR FINISHING CLOTH

Filed July 11, 1929 2 Sheets-Sheet 1

Fig. 1.

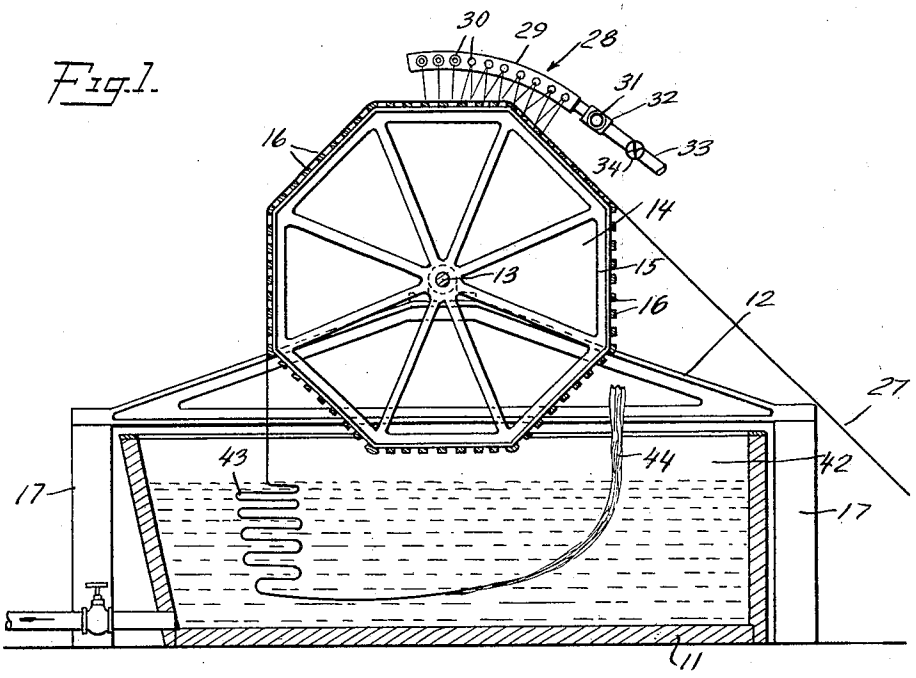


Fig. 2.

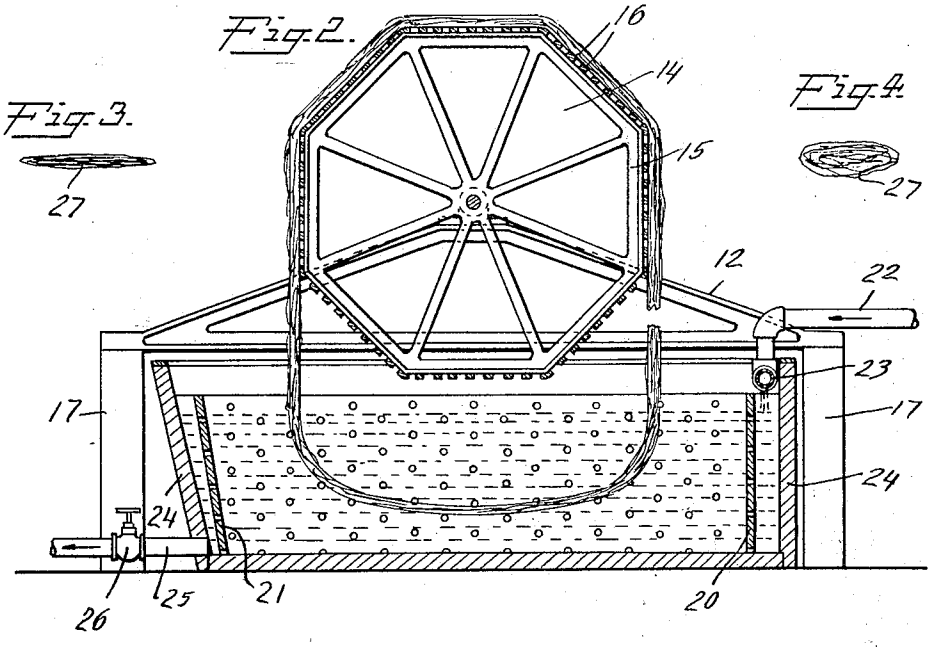


Fig. 3.

Fig. 4.

INVENTORS
Robert De Vere Hope
Henry Quegg
BY
Parnie Davis Marion & Edmonds
ATTORNEYS

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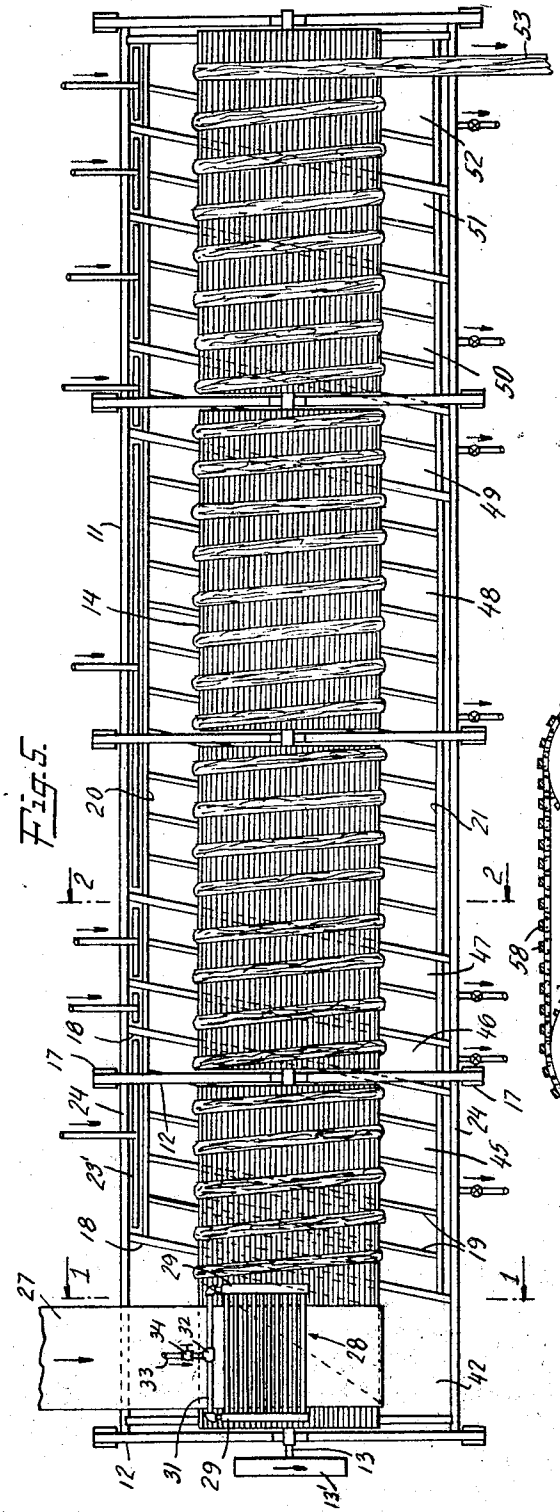


Fig. 5.

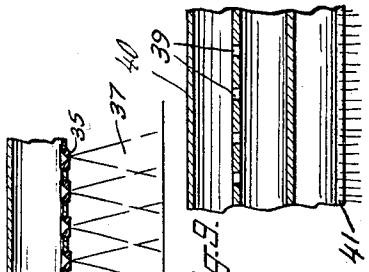


Fig. 7.

Fig. 9.

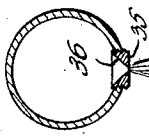


Fig. 6.

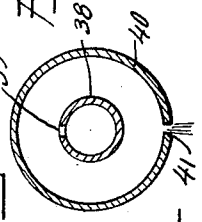


Fig. 8.

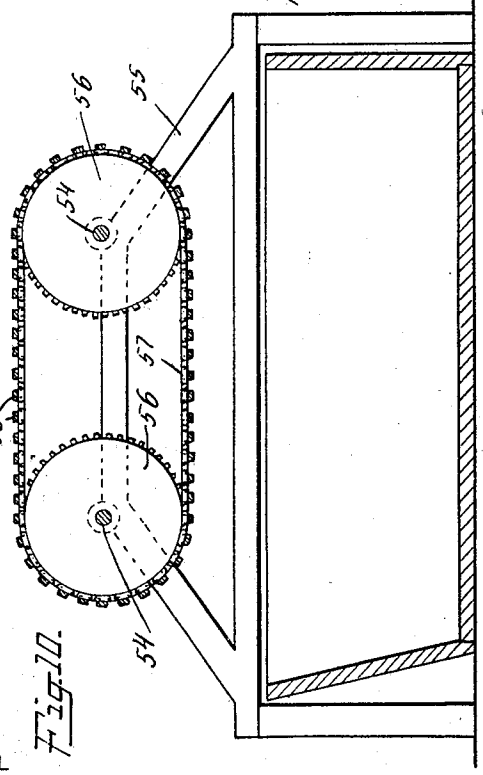


Fig. 10.

INVENTORS
Robert De Vere Hope
Henry Quegg
BY Pennie Davis Marvin & Edmonds
ATTORNEYS

Patented Aug. 23, 1932 1,873,635

UNITED STATES PATENT OFFICE

ROBERT DE VERE HOPE, OF FANWOOD, AND HENRY RUEGG, OF PATERSON, NEW JERSEY; SAID RUEGG ASSIGNOR TO SAID HOPE

METHOD AND APPARATUS FOR FINISHING CLOTH

Application filed July 11, 1929. Serial No. 377,522.

This invention relates to the processing of cloth and is concerned more particularly with a method of treating silk fabric with the various chemical solutions usually employed for that purpose, and also with an apparatus by which this method may be conveniently practiced.

In processing silk fabric, the customary procedure followed is to impregnate the fabric, from which the silk gum has been removed, with a solution of a tin salt, such as a chloride. Thereafter the fabric is treated with water to hydrolyze the tin salt to an insoluble hydroxide and to remove the excess of the tin salt from the fabric, and then the fabric is treated with suitable phosphate solutions followed by further washings. When the fabric emerges from the tin bath, the silk threads are weak and easily injured and it is important for best results that the impregnated fabric receive an immediate washing with an abundance of water so that the hydrolysis of the tin solution absorbed in the silk may take place at once and the excess thereof be removed, since this change in the chemical form in which the tin is present strengthens the silk to a substantial degree.

In addition to the treatment with the tin solution followed by washing and treatment with phosphate solutions, the fabric is also frequently given a silicate treatment. This treatment involves preliminary washing of the fabric and immersion in solutions of suitable silicates, which solutions are of varying concentrations and temperatures, after which the fabric is again washed with water. This silicate treatment is optional but is frequently employed and the solutions used and their effects are well known.

Both the tin and silicate treatments above briefly described must be carried on without interruption, the steps in each treatment being performed one after another without delay in order that a product of best quality may be obtained. The various steps of the treatment with tin and phosphate solutions may be repeated if desired, although it is customary to subject the fabric to the silicate treatment only once.

According to the methods heretofore used for treating silk fabrics, difficulties have been encountered in giving the fabric the necessary thorough washing with water following the impregnation with the tin solution, and as a consequence, the fabric often suffers abrasion and is frequently streaked and spotty. Also, in the prior apparatus used for this purpose it has not been possible in a single piece of apparatus to perform more than one step of the treatments on the silk so that the several operations require a plurality of pieces of apparatus to which the silk must be successively transferred. Such equipment requires much floor space, substantial amounts of power are consumed, and labor charges for handling the fabric are very high. Also, the chances of injuring the fabric are considerable by reason of the necessary passing from one machine to another and the handling of the fabric by the workmen.

The present invention is directed to the provision of a method and apparatus for processing fabric, according to which the fabric is placed in motion and while moving is subjected to a succession of processing operations performed automatically and without intervention of workmen. According to this method, the fabric moves continuously along a path without abrupt changes of direction, which would require moving the silk through guides in which abrasion or other mechanical injury might occur. We prefer to practice this method by apparatus presently to be described in which the fabric is caused to advance along a path similar to a helix with portions of the fabric in each convolution of the helix entering the various treating liquids, one after another. This apparatus includes a tank sub-divided by partitions into a plurality of compartments containing the several treating liquids, and these compartments are further sub-divided so that as the fabric in the convolutions of the helix enters the liquid in the compartments, the immersed portions of adjacent convolutions are kept separate from one another. Preferably the liquid circulates through each compartment in a direction opposite to the direction of movement of the immersed por-

tions of the fabric and a highly effective treatment is thus obtained.

In this apparatus, the fabric preliminarily treated with a tin solution is first passed full width through wash water preferably discharged upon the fabric from a screen of pipes, so that a large quantity of water strikes and flows over the fabric and quickly effects the desired hydrolysis of the tin salt and removes the excess of the tin solution. At this time the fabric is supported on conveying means which may conveniently take the form of a reel or reels and the fabric is wound around the reel in such manner that it assumes a helical form. The convolutions of the fabric engage the reel loosely so that a portion of each convolution hangs below the lower surface of the reel to enter the treating liquid. The reel is made up of a plurality of sections and extends over a plurality of tank compartments through which the different treating liquids are being circulated. This reel is provided with supports engaging the reel shaft between adjacent sections and each support preferably takes the form of a truss so placed that the fabric passing from one reel section to the next passes down at one side of the truss into a compartment and up out of that compartment on the other side of the truss so that the fabric comes at no time into contact with any part of the mechanism other than the reel itself. The fabric moves along from one end of the reel to the other, entering the different solutions successively and by the time it has reached the end of the reel it has been acted on by all of the solutions commonly used for treating purposes, and is ready for other operations.

For a better understanding of the invention, reference may be had to the accompanying drawings in which

Fig. 1 is a view of the apparatus in transverse section on the line 1—1 of Fig. 5;

Fig. 2 is a similar view on the line 2—2 of Fig. 5;

Fig. 3 is a sectional view of the fabric showing its condition when immersed;

Fig. 4 is a sectional view similar to Fig. 3 showing the condition of the fabric when passing over the reel;

Fig. 5 is a plan view of the apparatus;

Figs. 6 and 7 are transverse and longitudinal sectional views, respectively, of one form of liquid discharge pipe used in the apparatus;

Figs. 8 and 9 are longitudinal and transverse sectional views of another form of discharge pipe used in the apparatus; and

Fig. 10 is a view similar to Fig. 2 showing a modified reel construction.

Referring now to the drawings, the apparatus used in practicing the new method includes a tank 11 of any suitable construction, this tank being of considerable length. Mounted above the tank on supporting members 12 is the shaft 13 of a reel, generally designated 14. This reel comprises a plurality of spoked wheels 15 of preferably polygonal form and the reel is made up of a plurality of sections, the ends of which are spaced apart. Each section comprises two or more of the wheels 15 with a plurality of slats 16 extending between the wheels. The supporting members 12 take the form of trusses and are conveniently mounted on posts 17 outside the tank. The shaft carries a pulley 13′ by which it can be driven.

The tank is sub-divided into a plurality of compartments by solid partitions 18 and each of these compartments is further sub-divided by perforated partitions 19, the partitions extending across the tank at an angle to its longitudinal axis. The perforated partitions extend between inner side walls 20 and 21 of the tank, these side walls also being perforated as shown more clearly in Fig. 2. Various treating liquids, such as water of varying temperatures and degrees of hardness, phosphate solutions, and the like, are delivered into the several compartments by pipes 22 which lead to perforated headers 23. The header 23′ (Fig. 5) lies between the first two solid partitions 18 and it discharges water into the space between the inner wall 20 and the outer tank wall 24 throughout the length of the compartment defined by the solid partitions. The liquid is withdrawn from this compartment through an outlet pipe 25 with a valve 26, this pipe leading through the outer wall 24 of the tank from the space between that wall and the inner wall 21. The liquid consequently flows in a direction generally transverse to the tank. Similar headers and discharge pipes are used in the other tank compartments.

The fabric 27 entering the apparatus has been impregnated with a solution of a tin salt, and it is first led upwardly and around the reel 14 near one end thereof. At this end of the reel, there is a screen of pipes 28 lying above it by which water is sprayed upon the fabric. The screen of pipes is made up of a pair of headers 29 and cross pipes 30 connecting the headers. The headers are connected by pipes 31 which lead to a T 32 connected to a water supply pipe 33, provided with a valve 34.

There are a plurality of pipes in the screen and the first pipes beneath which the fabric passes are of the construction shown in Figs. 6 and 7. Each pipe is drilled at closely spaced points and in the openings so formed are threaded nozzle bushings 35. These bushings have tapering openings 36 therethrough and the bushings are so placed that a plurality of fine sprays 37 of water are projected therefrom, thus securing a thorough penetration, as illustrated in Fig. 7. The pipes of the next group in the screen are of the double construction shown in Figs. 8 and 9. The in-

ner pipe 38 is provided with a plurality of openings 39 closely spaced and arranged to direct liquid upwardly against the inner top surface of the outer pipe 40. This outer pipe has a lengthwise slot 41 along its bottom and these double pipes discharge sheets of water against the fabric 27 passing beneath them, giving a most even wash.

The fabric passing in full width beneath the screen of pipes is carried around by the rotation of the reel and delivered into the first compartment of the tank designated 42. This compartment is relatively wide and the fabric is laid down gently in it, the fabric piling up upon itself as indicated at 43, by reason of the shape of the reel; that is, at the angles of the reel, the diameter is greatest and the tendency is to throw the fabric toward the outer wall of the tank, while the flat sides of the reel are of less diameter so that the fabric let off from these surfaces has a tendency to move inward toward the center of the tank. The plies 43 of fabric deposited in the compartment are more or less suspended in the liquid in this compartment. The fabric passes out of the compartment and up around the reel as at 44, the fabric being wound around the reel from end to end in the general form of a helix. The convolutions of the helix fit the reel loosely so that the bottom part of each convolution dips beneath the surface of the liquid in the tank beneath.

In mounting the fabric on the reel, sufficient convolutions are formed so that there is a convolution for each of the compartments in the tank formed between adjacent perforated partitions 19 or between a perforated partition 19 and a solid partition 18. The depending portion of each convolution, while entering the liquid in the tank, does not strike the bottom wall of the tank, and the fabric is moved by the reel in a direction such that the portion of the fabric within the liquid moves in a direction opposite to the direction of movement of the liquid in that compartment. As the fabric leaves the reel and enters the liquid, the fabric tends to expand in width due to the counter-flow of the liquid so that thorough contact with the liquid is brought about. As the fabric leaves the liquid, the pull on the fabric exerted by the reel causes the fabric to rope together and it is carried over the top of the reel in that form.

In the construction illustrated, the fabric first passes beneath the water screen so as to receive a rapid treatment with an abundance of water, then passes into water in the compartment 42. The fabric then passes into the next compartment in the tank, generally designated 45. This compartment may also contain washwater. The fabric passes through the water in the compartment 45 in successive zones defined by the partitions 18 and 19 and as the fabric leaves the last subdivision of the compartment, it is carried over the top of the reel, over the partition 18 and down into the compartment 46. In this compartment, the fabric may be treated with a phosphate solution. In the compartment 47, which the fabric next enters, another solution, such as a stronger phosphate solution, may be employed. In the succeeding compartments 48, 49, 50, 51, and 52, other solutions may be used to complete the finishing operation. As the fabric rises from the last sub-division of the compartment 52 and passes around the top of the reel, it is led out of the apparatus as indicated at 53.

The partitions 18 and 19 are disposed at an angle to the axis of the tank so as to conform to the path of travel of the different convolutions of the fabric. The supporting trusses 12 for the different reel sections extend at right angles to the axis of the tank and by forming these supporting members as trusses they may be quite narrow so that the ends of the slats in adjacent sections of the reel lie close together. As the fabric passes down into the tank from the convolution nearest the end of the first section of the reel, it moves beneath the support and comes up out of the tank on the other side of the support where it is picked up on the adjacent end of the second reel section. In this way, the reel supports do not interfere with the movement of the fabric and the reel may be made in as many sections as may be desired. Also, the reel may be made as long as required since there is no difficulty about providing the necessary support at different places along its length.

In Fig. 10 there is illustrated a modified reel construction. The modified reel includes a pair of shafts 54 suitably supported in bearings on a transverse support 55. On these shafts are mounted sprocket wheels 56 around each pair of which runs a chain 57. Adjacent chains are connected by slats 58. This type of reel is supported above the tank in the manner previously described and the fabric is led around it in a helical path as before with successive convolutions dipping into the liquid in the several tank compartments.

In Fig. 3 the fabric is illustrated in the condition which it assumes when it enters the liquid in the tank, the fabric being spread out to a substantial extent. In Fig. 4 there is illustrated the condition of the fabric as it is carried around the upper part of the reel. The fabric has a tendency to form a rope in this part of its movement, this roping of the fabric being due to the pull exerted upon it to lift it out of the liquid.

It will be seen that in accordance with the method of this invention, the fabric is subjected to a preliminary washing treatment in full width under conditions such that imme-

diate and rapid hydrolysis of the tin salt in the impregnating solution takes place. The fabric is then washed by repeated immersions in and passages through water, so that all of the surplus impregnating solution is removed. While continuing to advance along the helical path, the fabric is successively treated with other solutions, the succession of treatments occurring without interrupting the movement. In one piece of apparatus, all of the treating operations may be carried on and only one passage through the apparatus is required to complete the finishing. The fabric is relatively weak and readily injured when it enters the apparatus, but by reason of the successive treatments given it, it is strengthened sufficiently so that when removed from the apparatus it may be handled without likelihood of injury. No handling by attendants is required from start to finish of the operations. The treatment is carried on rapidly by reason of the thoroughness with which the fabric is acted on by the successive solutions and by the use of this method and apparatus, it has been found that fabric may be treated at a relatively low cost with little danger of injury and with an absence of streaks or spots in the finished product.

The apparatus is illustrated in a form suitable for carrying on the treatments which follow the impregnation of the fabric with tin solutions. When the silicating operations are performed, the apparatus used is similar to that illustrated except that the screen of pipes is not necessary and may be omitted.

What we claim is:

1. In fabric treating apparatus, the combination of an elongated tank containing a liquid with which the fabric is to be treated, means for conveying the fabric from end to end of the tank in the form of a helix on an axis lengthwise of the tank with portions of the convolutions of the fabric in said helix entering the liquid in the tank, and means for causing the liquid to flow counter-current to the movement of the portions of fabric in contact with the liquid, said flow being generally transverse to the axis of the helix.

2. In fabric treating apparatus, the combination of a tank for liquid with which said fabric is to be treated, means for conveying the fabric from end to end of the tank with portions of the fabric entering the liquid in the tank in spaced zones, partition means in the tank for separating said zones, and means for introducing liquid into the tank at one side and withdrawing it at the other.

3. In fabric treating apparatus, the combination of a tank, a reel mounted above the tank and extending lengthwise thereof, partitions across the tank sub-dividing it into compartments, and means for introducing liquid into the compartments along one side of the tank and withdrawing the liquid along the opposite side.

4. In fabric treating apparatus, the combination of a tank, a reel mounted above the tank and extending lengthwise thereof, devices for discharging liquid disposed above the reel, and means for introducing liquid into and withdrawing it from the tank.

5. In fabric treating apparatus, the combination of a tank, a reel extending lengthwise of and above the tank, a screen of pipes for discharging liquid disposed above the reel near one end thereof, and a plurality of partitions dividing the tank into separate compartments disposed in a line lengthwise of the tank.

6. The method of treating fabric which comprises moving the fabric along a helical path, and causing portions of the convolutions of said fabric in such movement to be acted on successively by different treating liquids flowing in a direction opposite to the movement of portions of the fabric with which said liquids contact, and substantially transverse to the axis of said helical path.

7. The method of treating fabric which comprises advancing the fabric while maintaining it in the general form of a helix, said fabric being substantially full width at the beginning of its movement, discharging a liquid on the portion of said fabric in full width, and causing portions of the convolutions of said fabric to be acted on by a treating liquid.

8. The method of treating fabric which comprises advancing the fabric along a substantially helical path, immersing portions of the convolutions of said fabric in liquid, and causing a flow of said liquid in a direction opposite to the direction of movement of immersed portions of said fabric and generally transverse to the axis of the helical path, said fabric being kept free from strains and pressure during its movement except such as are imposed by its own weight.

9. The method of treating fabric which comprises discharging treating liquid on the fabric while moving the fabric and maintaining it in substantially full width, and thereafter advancing the fabric in substantially rope form and immersing spaced portions thereof in treating liquids.

10. The method of treating fabric which comprises supporting and advancing the fabric, and causing spaced portions of the fabric to be acted on simultaneously by different treating liquids, flowing in a direction opposite to the direction of movement of immersed portions of the fabric and transverse to the path of advance of said fabric.

11. The method of treating fabric which comprises advancing the fabric in the form of a helix, and treating portions of the convolutions of the helix with liquid flowing in a direction opposite to the direction of move-

ment of said portions and transverse to the axis of the helix.

12. The method of treating fabric which comprises advancing the fabric in the form of a helix having a substantially horizontal axis, and treating the lower portions of the convolutions of the helix with liquid flowing in a direction opposite to the direction of movement of said portions and transverse to the axis of the helix.

13. In fabric treating apparatus, the combination of a tank, imperforate partitions sub-dividing said tank into aligned compartments, perforated partitions sub-dividing said compartments, all said partitions extending above the liquid level in the tank, a reel above the tank, and means for introducing liquid into the tank along one side and withdrawing it along the other.

In testimony whereof we affix our signatures.

ROBERT DE VERE HOPE.
HENRY RUEGG.