Apparatus is disclosed herein for the liquid treatment of textile materials. Specifically, the liquid treating apparatus comprises a vessel in which are positioned a plurality of textile guides. The textile guides define a fabric path through the vessel and are positioned along both sides of the path. Fluid movement means such as a polygonal shaped rotatable element, especially a triangular shaped rotatable element is positioned adjacent the fabric path and acts on fluid in the vessel to create undulations in the textile material around certain of the guides as the textile material passes thereby. Preferably, the textile material follows a U shaped path through the vessel. Ancillary apparatus is also disclosed as well as a method for the liquid treatment and bulking of textile fabrics, especially knit fabrics.
LIQUID TREATING APPARATUS FOR TEXTILE MATERIALS AND METHOD THEREFOR

BACKGROUND OF THE INVENTION

Numerous processes throughout the textile industry require the treating of a textile material with a liquid. For example, after a size composition is applied to a yarn and the yarn is made into a fabric, the fabric is then scoured to remove the size and other impurities therefrom. Likewise, fabrics are dyed or other liquid treatments are applied thereto so as to provide the fabric with a certain characteristic or prepare the fabric for a subsequent processing step. A great deal of apparatus has been designed for the liquid treatment of textile materials to accomplish an intended purpose, e.g., washing, scouring, dyeing, and the like.

Among the apparatus previously designed for the liquid treatment of textile materials, certain features have been incorporated into the individual units to insure proper contact between the liquid treating medium and the textile material, proper handling of the textile material in the bath, proper controlling of the bath temperature, viscosity of the like, and various and sundry other purposes. As such, vessels have been designed having guide means to direct the fabric along an intended path through the vessel and having various devices within the bath to agitate the bath, scrub the textile material or the like. For example, brushes have been applied to opposite sides of a textile material so as to contact same with a brushing action as the textile material passes therebetween. Likewise, electronic equipment has been placed within the bath so as to set up high frequency waves through the bath to insure good contact between the bath and the textile material. Furthermore, numerous types of impellers and other rotatable members have been positioned throughout the baths to insure agitation of the bath.

The present invention likewise uses means to move the fluid throughout the bath to achieve improved washing, scouring, dyeing or the like of a textile material. According to the teachings of the present invention, however, the action in the bath is such that movement of the fluid therein, in conjunction with the guides causes the fabric to experience a unique movement while passing through the bath. As such, improved contact is made between the textile material and the fluid in the bath and additionally, undulation of the textile material causes flexing of the material whereby unwanted ingredients on the textile material are more easily removed therefrom. Additionally, the apparatus of the present invention has also been found to achieve a unique bulking effect for knit goods.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide novel apparatus for conducting liquid treatment of textile materials.

Another object of the present invention is to provide novel apparatus for the manipulation of a textile material as it passes through a liquid bath.

Still another object of the present invention is to provide novel apparatus for the washing of textile materials.

Further, another object of the present invention is to provide a novel method of treating textile materials with a liquid.

Still further, another object of the present invention is to provide a novel method for the bulking of knit goods in a liquid bath.

Generally speaking, the apparatus of the present invention comprises a treating vessel, a plurality of guides received within said vessel, said guides being positioned along an intended path through said vessel on both sides thereof, and fluid movement means received within said vessel adjacent said path, said means cooperating with certain of said guides to produce movement of a fluid in said vessel and thereby causes undulation of fabric passing by said guides.

More specifically, the fluid treating apparatus of the present invention comprises a vat in which a plurality of guides are positioned along legs of one or more U shaped paths through the vat. The guides are positioned on alternate sides of a textile material path, hereinafter sometimes referred to as a fabric path with the fluid movement means positioned adjacent the fabric path and preferably between two legs of the fabric path. Actuation of the fluid movement means, which preferably is a rotatable element, creates fluid movement within the bath adjacent the textile material passing therethrough so as to force portions of the textile material outwardly from the normal path of travel while simultaneously forcing other portions of the textile material inwardly from the path of travel whereby an undulating effect is produced in the fabric as it passes the fluid movement means. The undulating effect is produced in the area of the guides and is not transferred upwardly above the guides or downwardly below the guides.

The fluid movement means could be any means which produces fluid movement in opposite adjacent directions, whereby adjacent portions of the textile material move in opposite directions to create the undulation of the material. Preferably, the fluid movement means is a rotatable element that is polygonal in nature. Polygonal in the sense of the present system is preferably a triangle, but may be other multi-sided shapes. For the sake of further discussion of the present invention, the triangle will be discussed.

The rotatable element in the shape of a triangle, that is, having a triangle cross section, causes an unusual effect on the textile material passing through the fluid treating apparatus. As the material passes the guides during rotation of the triangular element, the fluid in front of any one of the angles is forced away from the side of the element and against the textile material. The area behind the angle experiences a reduction in pressure which causes “cavitation” behind the angle of the element. As such, fluid is drawn into the area behind the angle which, in turn, carries a portion of the textile material in the same direction. Hence, as the textile material passes the rotating element, the material continuously undulates which may be conveniently referred to as a “hydraulic washboard” effect.

The continuous flexing in opposite directions that the textile material experiences while passing the rotatable element, accomplishes multiple purposes. First, the liquid in the treating bath which may contain water, detergents, scouring agents, dyestuffs, or any other liquid treating agents, is continuously agitated whereby the liquid maintains its intended composition balance and additives to the liquid bath are not per-
mitted to settle to the bottom of the vessel. Further, agitation of the fluid by the rotatable element insures excellent contact between the fluid and the textile material. The unique combination of the rotatable element and the path of travel of the textile material through the bath, however, not only insures proper contact, but also the undulation of the textile material assists in loosening extraneous matter from the textile material so as to better facilitate its removal by the liquid bath if the textile material is being washed or scoured therein. Moreover, the continuous flexing of the material insures good uniformity of treatment since the undulating effect is both constant and continuous.

The fabric path through the liquid treating apparatus is preferably in the shape of a U where the rotatable element is placed between the legs of the U such that the edges of the element formed by the angle are very close to the fabric path without coming into contact with the fabric. In the preferred embodiment therefore, where the textile material passes through the treating vessel in a U shaped path with the fluid treating means between the legs of the U, the textile material passing around the U will undergo undulation in both legs of the U. In other words, the fluid treating means in the preferred form of a triangular cross section, rotatable element will create the force effects on the fluid adjacent both legs of the U. The textile material will thus first undergo undulation on the downward leg of the U and again on the upward leg of the U on the opposite side thereof and exit the vessel in a greatly improved, treated condition.

Depending upon the particular environment in which the fluid treating apparatus of the present invention is employed, preceeding and succeeding equipment may vary. For example, in the washing of a warp knit fabric, the fabric is generally presoaked in a tank, passes through nip rolls, into a scray, over an expander roll and then into the fluid treating apparatus. Subsequent to washing, the textile material will again be expanded after which it is fed to a dryer or other treating apparatus. In the case of double knits, an inclined conveyer may be conveniently employed out of a pre-soak bath which transports the fabric directly to a guide roll prior to the treating vessel. After treatment as desired, the textile material may be deposited on a second conveyer and transferred through a drying zone.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side pictorial illustration of a typical system embodying teachings of the present invention.
FIG. 2 is a side pictorial illustration of a further system utilizing teachings of the present invention.
FIG. 3 is a side view of a treating vessel showing one arrangement of apparatus according to the teachings of the present invention.
FIG. 4 is a side view of a treating vessel showing a further arrangement of apparatus according to the teachings of the present invention.
FIG. 5 is a pictorial illustration of the effects produced on a textile material by apparatus according to the teachings of the present invention. FIG. 6 is a further embodiment of the teachings of the apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the figures, preferred specific embodiments of the present invention will now be described in detail. In FIG. 1, for example, the textile material treating apparatus of the present invention is shown employed with additional equipment to provide a system for washing or scouring of textile materials, especially warp knit fabrics. Textile materials as used herein refers to continuous lengths of textile materials such as woven fabrics, knit fabrics, and the like. The materials may be manufactured from natural yarns, synthetic yarns or combinations thereof.

FIG. 1 illustrates apparatus that, though useable in numerous situations, is quite satisfactory for the washing of warp knit fabrics. A fabric F enters the apparatus from a source not shown and passes around an idler roll 10 and downwardly into a soak tank 12 that is supported by suitable framework 14 and generally contains water plus a detergent or scouring agent but may contain any desirable liquid composition. Soak tank 12 has a guide roll 16 adjustably received therein. Guide roll 16 is mounted in a pair of vertical slots 18 and is vertically adjustable. During start up of the unit, guide roll 16 is presented above soak tank 12 as shown in broken lines where the fabric may be easily threaded therethrough. Once the fabric has been passed around guide roll 16, roll 15 can then be lowered along slots 18 into soak tank 12 and will carry fabric F therewith.

A pair of squeeze rolls 20 and 22 are located above tank 12 and produce a nip therebetween through which fabric F passes. Roll 22 is operatively associated with a cylinder 24 which can be actuated to apply pressure against roll 22 through rod 26, whereby the pressure at the nip between rolls 20 and 22 can be varied to expel a predetermined amount of liquid from fabric F. As fabric F passes between rolls 20 and 22, the desired amount of liquid is removed therefrom and falls onto a drip pan 27 located below rolls 20 and 22 which directs the liquid back into soak tank 12. Above nip rolls or squeeze rolls 20 and 22 are a driven roll 28 and an idler roll 30. Fabric F passes around driven roll 28 and idler roll 30 after which it turns downwardly into a scray 32 where the fabric collects prior to being fed into the liquid treating vessel of the present invention. Scray 32 is provided with a drain line 33 which returns any excess liquid carried by fabric F back to soak tank 12. Positioned above the feed end of scray 32 is an expander roll 34 which is driven and thus removes fabric F from scray 32 while simultaneously expanding fabric F to its full normal width so as to insure proper treatment thereof in the fluid treating apparatus. An idler roll 36 is provided above the fluid treating apparatus of the present invention. Fabric F passes around idler roll 36 and downwardly into a treating vessel 40.

Treating vessel 40 is a suitable vessel for holding liquids to be used in the treating of the textile material, and is supported by suitable framework. A plurality of heater coils or the like 42 are provided in the bottom of vessel 40 to provide heat as desired for the treating medium within vessel 40. As shown in FIG. 1, the fabric path through vessel 40 is U shaped and is provided with a plurality of guides 44, 45, 46, 47 and 48 along one vertical leg of the U; an idler roll 49 at the bottom of
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the U and guides 50, 51, 52, 53 and 54 along the opposite vertical leg of the U. As further shown in FIG. 1, guides 44, 46 and 48 on the entrance leg of the U are positioned on one side of the fabric path while rolls 45 and 47 are positioned on the opposite side of the fabric path. Likewise, on the exit vertical leg of the U, rolls 50, 52 and 54 are positioned on the outside of the fabric path while rolls 51 and 53 are positioned on the inside of the fabric path. A fluid movement means 56 is shown in the preferred form as a rotatable element having a triangular cross section. Fluid movement means 56 is positioned between the legs of the U, within the clusters of fabric guides and will be described in more detail hereinafter. After the fabric exits from the liquid treating vessel, a further roll 58 which may be an expander roll is provided which carries the fabric away from treating vessel 40 and if an expander roll is employed will insure that the fabric is expanded to its full width for drying or further desirable processing.

Referring now to FIGS. 3, 4 and 5, the operation of the fluid treating unit of the present invention will now be described. In FIG. 3, the fluid treating vessel 140 is shown to have a plurality of guides 144, 145, 146 and 147 along one vertical leg of a U shaped path, an idler roll 149 at the bottom of the U shaped path and guides 150, 151, 152 and 153 along the other vertical leg of the path. An entrance roll 136 and an exit roll 158 are provided above vessel 140 for directing fabric F into and out of vessel 140. A rotatable triangular shaped element 156 is journaled for rotation in vessel 140 positioned between the legs of the U shaped path. Rotatable element 156, as discussed above, is shown in triangular form and during rotation while fabric is passing through the bath, imparts fluid movement in the bath which in conjunction with the guides along the legs of the U shaped path produces an undulating effect in the fabric. See, for example, FIG. 5.

In FIG. 5, a vat 340 is shown having a plurality of guides 344, 345, 346, 347 and 348 along an entrance leg of a U shaped path; an idler roll 349 at the bottom of the U and guides 350, 351, 352, 353 and 354 along the exit vertical leg of the fabric path through the vessel. The fluid moving means shown as a triangular shaped rotatable element 356 is positioned between the legs of the U shaped path. Note also that the guides 345, 346, 347, 351, 352 and 353 are tangent to a circle C that is positioned just beyond the apexes of the angles that form rotatable element 356, and is equidistant from the apex of each angle therearound. Hence, while it is important that the fabric F not be contacted by any portion of rotatable element 356, the outermost points of rotatable element 356 should be closely proximate to the fabric path. During rotation of element 356 in a counterclockwise direction as shown by the arrow in FIG. 5, the front edge of each angle, identified by a plus sign, propels treating liquid against fabric F which forces fabric F outwardly away from the normal line of fabric travel. As shown by the solid lines in FIG. 5, fabric F is thus forced outwardly between guides 346 and 348 on one leg of fabric travel and outwardly between guides 350 and 352 on the opposite leg of fabric travel. Further, as element 356 rotates, the areas behind the angles, identified with minus signs, create negative pressures which causes momentary cavitation, after which fluid rushes into the evacuated area. This move-

ment of fluid into the area following the apex causes a further portion of fabric F to move inwardly towards rotatable element 356 and away from the normal fabric travel path. Such movement is illustrated in solid lines in FIG. 5 between rolls 345 and 346 and rolls 352 and 353. Depending upon the position of rotatable element 356, the fabric between the guides mentioned hereinafore will move in opposite directions to that described. For example, see the broken lines in FIG. 5 which would correspond to fabric position when the rotatable element is positioned as also shown in broken lines. Fabric in the upper part of the treating vessel between the upper guides and the idler rolls above the vessel is maintained in a straight path. Likewise, fabric beneath the rotatable element, between the lower guides and the idler roll at the bottom of the U shaped path is maintained in a straight path.

FIG. 3 shows a different guide configuration from that shown in FIG. 5, in that, the middle or single guides between the pairs is missing. In this case, the fabric would undulate as shown by the solid line fabric path.

FIG. 4 shows still a further configuration of guides within a vessel 240. The fabric passes an idler roll 236 and extends downwardly along the fabric path defined by guides 244, 245, 246, 247 and 248 of the entrance leg of the path, around idler roll 249 and back upwardly between guides 250, 251, 252, 253 and 254 after which the fabric passes in a straight path by a further idler roll or driven expander roll 258. The fluid movement means 256 is again shown positioned between the legs of the fabric path and acts in the same manner as described hereinafter.

FIG. 6 shows still a further embodiment of the fluid treating apparatus according to the present invention. FIG. 6 illustrates a fluid treating vessel 440 with an idler roll 436 positioned thereabove. Fabric passes around idler roll 436 and through a plurality of U shaped paths having guides and idler rolls as mentioned hereinafore. Note also that a further idler roll such as, for example, 442 is necessary to return the fabric back into the bath for a further pass. Idler roll 442 may be positioned within the bath or without the bath as desired. Insofar as the embodiment shown in FIG. 6 is concerned, a rotatable element 456 is shown between the legs of the first U within the bath. Furthermore, a second rotatable element 456' is shown between the legs of the second U path through the vessel. Fluid movement means or rotatable element 456' is shown in phantom in FIG. 6 to indicate that it is not necessary to have fluid movement means within every U shaped path in the bath. In this respect, the number of fluid movement means should be dictated by the intended result. Moreover, other path arrangements could be embodied including a straight line or various curved paths, where one or more rotatable elements are deployed adjacent the fabric path. For the sake of efficiency, however, it is preferred that a U shaped path be employed and further that the rotatable element be positioned between the legs of the U.

Referring back to FIG. 2, a schematic illustration is shown of an arrangement of apparatus for the washing or other liquid treatment of double knit fabrics. In FIG. 2, the fabric F is shown passing over an idler or guide roll 510 and downwardly into a soak tank 512. An
inclined conveyer 514 is positioned partially within the soak tank and receives fabric F falling therein. Conveyer 514 is an endless conveyer and during operation in the direction of the arrow removes fabric F collected thereon out of soak tank 512 from whence the fabric passes over a roll 536 and down into a treatment vessel 540. Treatment vessel 540 has a plurality of guides positioned as desired therein to define the path of fabric travel therethrough. Preferably, the guides are arranged to provide a U shaped fabric path wherein a fluid movement means 556, preferably a triangular shaped rotatable element is positioned within the fluid and between the legs of the U shaped fabric path. Further, the treating vessel 540 is provided with heating means such as heater coils 542 which are employed to heat the fluid to the appropriate treatment temperature. As the fabric extends out of the treating vessel 540, it passes around an expander roll or the like 558 and from roll 558 proceeds to drying or further processing as desired.

Obviously, certain of the idler rolls, driven rolls, guides and the like in the apparatus of the present invention, may be modified to either become driven or to become idler rolls as the case may be. Moreover, the rotatable element as a fluid movement means and such of these rolls as are driven rolls are naturally provided with driving means. For the sake of simplicity and in view of the fact that means for driving the rolls are within the purview of one skilled in the art, description of the drive means has been omitted. Moreover, it is obvious that all of the rotatable elements of the present invention must be journeled for rotation in the structural assembly. This, likewise, is considered to be within the purview of one skilled in the art and any description thereto has been omitted.

The apparatus of the present invention operates as follows, with reference being made to FIG. 1. A fabric F which, for example, could be a warp knitted fabric of polyester yarn has been produced and still possesses the normal knitting oils, finishes and the like. It is now become desirable to remove these materials from the fabric so as to further prepare the fabric for dyeing and finishing. The fabric F thus passes from a supply roll not shown around guide roll 10 and guide roll 16 which would be in the phantom position shown above soak tank 12. Once the fabric is fed around guide roll 16 and through nip rolls 20 and 22, guide roll 16 is lowered into soak tank 12 which contains water and a suitable scouring agent. The fabric thus experiences a suitable dwell time in soak tank 12 where it is in contact with the water and scouring agent. After a satisfactory soaking, fabric F passes upwardly between the nip of rolls 20 and 22 and a predetermined amount of moisture is forces therefrom. Fabric F then passes around driven roll 28 which assists in moving fabric F from the supply roll through the soak tank and between the nip of rolls 20 and 22.

After driven roll 28, fabric F passes around roll 30 and drops down onto a scray 32 where it collects in a normal fashion. The “accordion shaped” fabric array in scray 32 again is permitted dwell time depending upon the fabric speeds through the apparatus and the size of the scray. Fabric F is withdrawn from scray 32 by a driven expander roll 34 which assists in moving fabric F through the apparatus and simultaneously causes the fabric to spread to its normal width. The fabric F in full width then passes over an idler or guide roll 36 and downwardly into fluid treating vessel 40. Under dormant conditions, as shown in FIG. 1, fabric F passes between guides 44, 46 and 48 and guides 45 and 47 in a straight line to idler roll 49 at the bottom of the U shaped path. After idler roll 49, fabric F then turns upwardly and passes between guides 50, 52 and 54 and guides 51 and 53 and then out of vessel 40 to a further expander roll 58 where the fabric is again spread to its maximum normal width. After idler roll 58, fabric F may be conveyed to suitable drying or other processing equipment.

The passage of fabric F through treating vessel 40 in straight line fashion as was previously described is not desirous if optimum washing or scouring results are to be obtained. Hence, as fabric F passes through treatment tank 40, fluid movement means 56 is actuated. As shown in FIG. 1, fluid movement means is illustrated as a triangular rotatable element, which, when driven, rotates fluid against fabric F and fabric F is forced outwardly or inwardly between the two end guides 44 and 48 and 50 and 54 on both sides of the leg of the U depending upon the particular position of rotatable element 56. In so doing, the fabric experiences undulation in the form of a wavy sine curve type effect which enhances the action of the fluid in the vessel on the fabric. Likewise, it has been found that such treatment in a boiling or near boiling bath causes a knit fabric to bulk. Presumably, the bulking action is caused by relaxation of knitting tensions though it is not intended that the present invention be bound by any such theory. Fabric passing around the U shaped path within vessel 40 of FIG. 1, thus experiences the undulating or wavy motion during travel along both legs of the U. As such, a much cleaner fabric is realized than can be obtained with other existing equipment.

The following examples further explain the operation of the present apparatus and provide illustrations of several methods for treating textile materials therewith.

**EXAMPLE 1**

A double knit polyester fabric was processed through apparatus as shown in FIG. 1. Soak bath 12 and treating vessel 40 contained a composition comprising 3 weight percent emulsified xylene and 97 weight percent water. The composition in treating vessel 40 was heated to approximately 212°F. and fabric was fed through the apparatus at a linear speed of 30 yards per minute. The fluid treating means (element 56) in treating vessel 40 was not used. After a single pass through the apparatus, the fabric was dried in a conventional manner and inspected. The treated fabric was some cleaner after passing through the apparatus, though not completely clean.

**EXAMPLE 2**

A like polyester knit fabric was run through the apparatus of FIG. 1 at 30 yards per minute as stated in Example 1. This time, however, triangular element 56 was actuated and thus rotated during passage of the fabric through the treating vessel. After drying, the fabric was perceptibly cleaner than the fabric of Example 1. Additionally, excellent bulking of the knit fabric was observed.
EXAMPLE 3

A cotton woven fabric was batched on a roll and passed through a dyebath. The dyebath comprised a treating vessel as shown in FIGS. 1, 2 and 4. The dye composition in the bath contained 4 g.p.l. solitine red 8 BLN. After passing through the dyebath, the fabric was taken up on a roll and the dye shade determined. The dyed fabric was then reversed and fed in reverse, back through the dyebath a second time and taken up on a roll on the opposite side of the bath and then fixed with a 10 percent salt solution. A deeper shade of dyeing was evident.

EXAMPLE 4

Example 3 was repeated using a treating vessel as illustrated in FIG. 6. Only one triangular shaped element was employed. This arrangement permitted more dwell time in the dyebath and a darker shade of dyeing was obtained than from the single pass through the apparatus as used in Example 3.

Insofar as the apparatus for the present invention is concerned, the materials of construction are up to the desires of the individual. In view of the normal constituents in a textile treating bath, stainless steel is preferred. Additionally, while reference has been made to the action on the fabric as the fabric passes through the treating bath, such action may be exaggerated. In other words, it is felt that the action as described in what takes place within the bath. Obviously, it is not the intent that the present invention be limited thereby, but only by the result attained. Moreover, one skilled in the art may readily be able to make modifications and adaptations based on the teachings herein. Accordingly, the scope of the present invention should be limited only by the claims appended hereto.

What is claimed is:
1. Fabric treating apparatus comprising:
   a. a treating vessel;
   b. a plurality of fabric guides received within said vessel to be submerged in a treating liquid received therein, said guides defining a fabric path through said vessel and being positioned on both sides thereof; and
   c. a rotatable element received in said vessel adjacent at least certain of said guides and out of contact with a fabric passing thereby during rotation thereof, said element having positive and negative pressure producing areas thereon and cooperating with said guides during rotation whereby adjacent liquid flow in opposite directions causes undulation of said fabric about said guides.
2. Fabric treating apparatus as defined in claim 1 wherein said fabric guides define a U shaped fabric path in said vessel.
3. Fabric treating apparatus as defined in claim 2 wherein fabric guides are positioned on both sides of each leg of said U shaped path.
4. Fabric treating apparatus as defined in claim 3 wherein said rotatable element is triangular in shape.
5. Fabric treating apparatus as defined in claim 1 wherein said rotatable element is polygonal in shape.
6. Fabric treating apparatus as defined in claim 5 wherein said rotatable element is triangular in shape.
7. Fabric treating apparatus as defined in claim 6 wherein said rotatable element is positioned between the legs of said U.
8. Fabric treating apparatus as defined in claim 1 wherein said fabric guides define a fabric path that makes more than one pass through said vessel.
9. Fabric treating apparatus as defined in claim 8 wherein a rotatable element is provided for each pass through said vessel.
10. Fabric treating apparatus as defined in claim 8 wherein a plurality of U shaped paths are defined by said guides and wherein further a triangular shaped rotatable element is provided between the legs of each U shaped path.
11. Fabric treating apparatus as defined in claim 1 wherein said vessel is further provided with liquid heating means.
12. Fabric treating apparatus as defined in claim 1 comprising further:
   d. fabric supply means; and
   e. fabric drying means.
13. Fabric treating apparatus as defined in claim 12 wherein said fabric supply means comprises a scray and a spreader roll mounted adjacent said vessel.
14. Fabric treating apparatus as defined in claim 12 wherein fabric supply means comprises a conveyor mounted adjacent said vessel.
15. Fabric treating apparatus comprising:
   a. fabric supply means;
   b. a first vessel adjacent said fabric supply means;
   c. a driven roll above said vessel for accepting fabric therefrom;
   d. fabric collection means adjacent said driven roll;
   e. fabric spreader means adjacent said fabric collection means; and
   f. a second treating vessel, said vessel having a plurality of fabric guides therein said guides being submerged in a treating liquid received in said vessel and defining a fabric path through said vessel, being positioned on both sides of said path, said vessel further having a rotatable element received therein adjacent at least certain of said guides, said element having positive and negative pressure producing areas thereon and cooperating during rotation with said guides to produce undulation of a fabric passing along said fabric path.
16. Fabric treating apparatus as defined in claim 15 wherein said fabric guides in said second vessel defined at least one U shaped path therethrough and wherein said rotatable element is triangular in shape and is positioned between the legs of said at least one U shaped path.
17. Fabric treating apparatus as defined in claim 1 wherein certain of said guides are positioned tangent to a circle around said rotatable element, said circle being positioned at a point just out of contact with said element.
18. Fabric treating apparatus as defined in claim 17 wherein said rotatable element is triangular in shape.

* * * * *
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,729,958 Dated May 1, 1973

Inventor(s) Donald K. Christian and Dennis L. Lomax

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 11, delete "causes" and insert therefor --cause--;
Col. 2, line 34, delete "The" and insert therefor --The--;
Col. 2, line 46, delete "triangle" and insert therefor --triangular--;

Col. 3, line 65, start a new paragraph beginning with "FIG. 6";
Col. 4, line 47, delete "liquid" and insert therefor --fluid--;
Col. 7, line 28, after "with" insert --a--;

Signed and sealed this 10th day of September 1974.

(SEAL)
Attest:

McCoy M. Gibson, Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents