Sept. 1, 1970 H. FLEISSNER 3,526,009

METHOD FOR TREATING TEXTILE FABRICS AND THE LIKE

Original Filed Aug. 25, 1964 4 Sheets-Sheet 1

Fig. 1

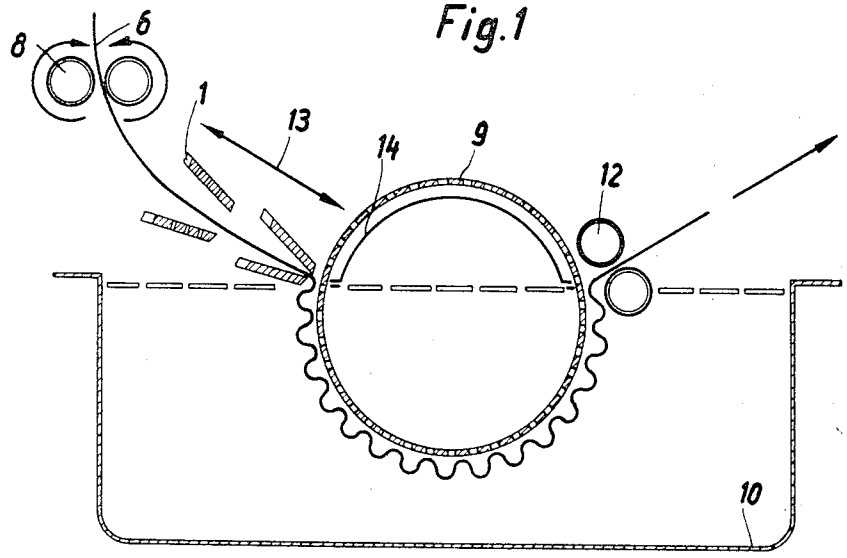

Fig. 2

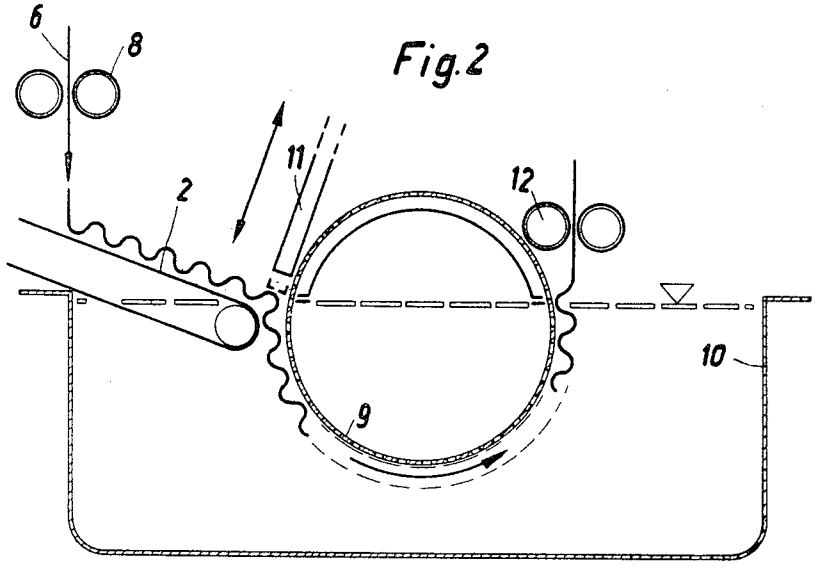

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Fig. 3

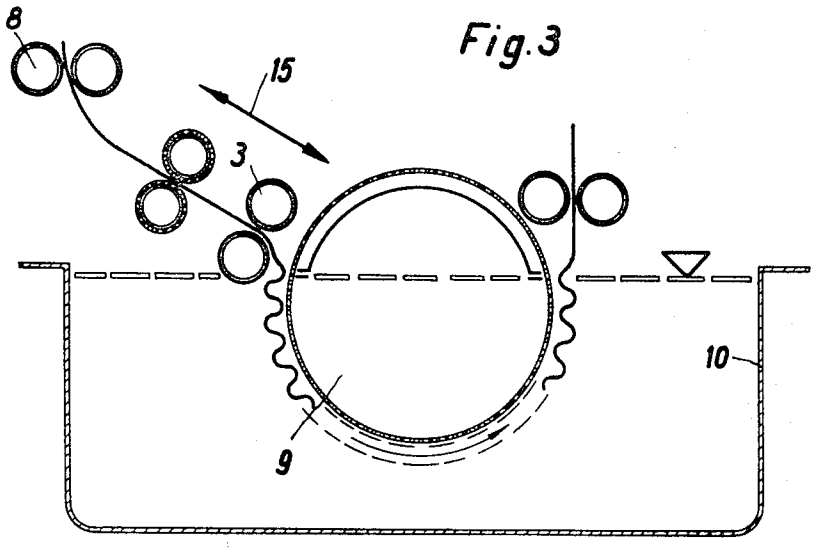

Fig. 4

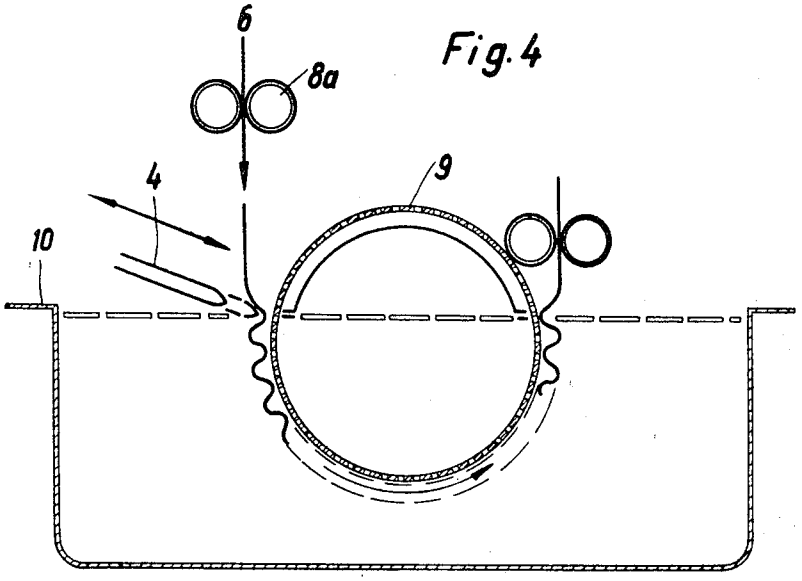

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Fig.5

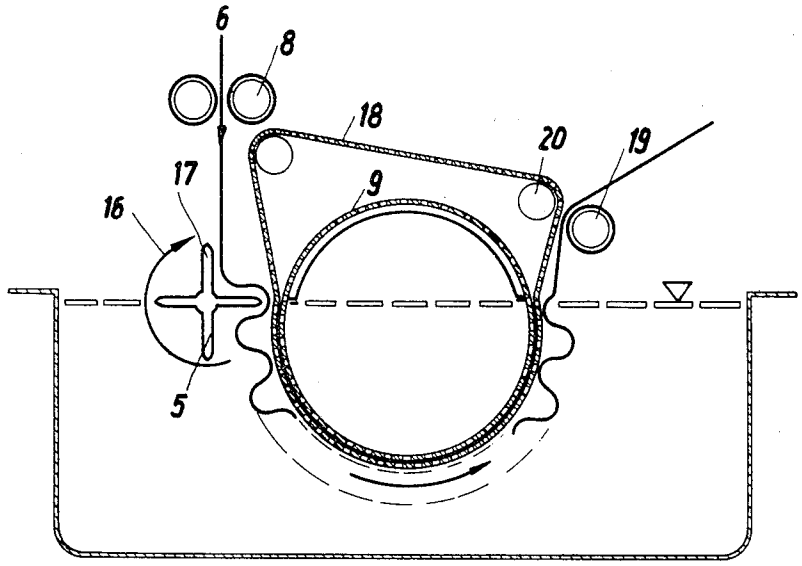

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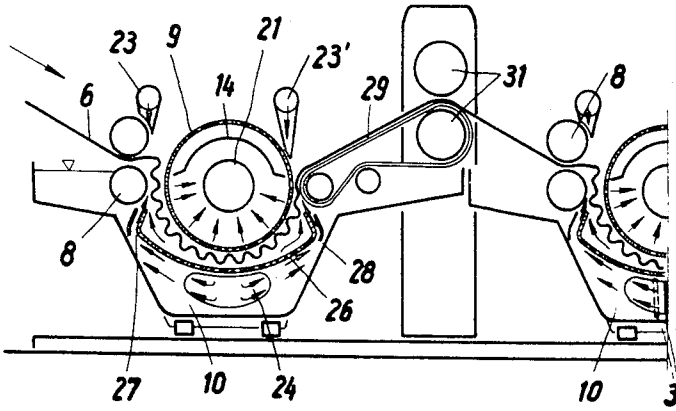
Fig.6



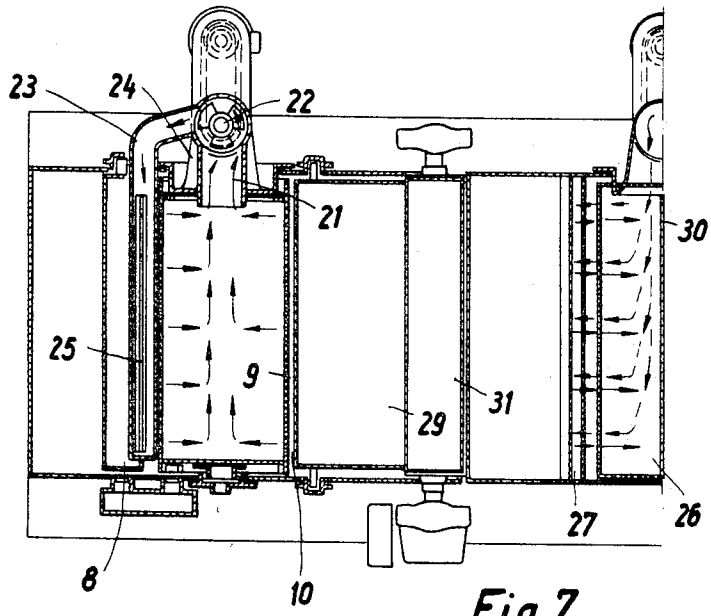


Fig. 7

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3,526,009

METHOD FOR TREATING TEXTILE FABRICS AND THE LIKE

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Original application Aug. 25, 1964, Ser. No. 391,994, now Patent No. 3,374,646, dated Mar. 26, 1968. Divided and this application Jan. 24, 1968, Ser. No. 729,832
Claims priority, application Switzerland, Aug. 26, 1963, 10,538/63
Int. Cl. D06f *17/02*; B05c *8/04*
U.S. Cl. 8—152 15 Claims

ABSTRACT OF THE DISCLOSURE

A rotating perforated sieve drum is partially disposed in a treatment bath with a suction pump connected to the interior thereof. Lengths of textile material are treated in the bath by feeding the material in wavy folds onto the surface of the drum.

This is a division of my copending application Ser. No. 391,994, filed Aug. 25, 1964 and now Patent. No. 3,374,-646.

The present invention relates to a method for treating great lengths of textile fabrics, yarns, ribbons, slivers, tops or the like, especially in a liquid and under suction.

In the manufacture of textile fabrics of natural fibers and also of synthetic fibers, for example, of a cellulose solution or the like it is necessary to subject the fabrics, yarns, threads, slivers and the like to washing and cleaning processes.

The conventional washing trains which are used for this purpose are very long and expensive and also have the disadvantage that no account can be taken of the shrinking of the material.

It is an object of the present invention to provide a method which operate more effectively and at a higher degree of efficiency than the method previously known for the mentioned purposes by permitting as much material as possible to be properly treated and especially to be passed through a bath within a certain period of time and to permit the necessary apparatus to be made of smaller dimensions and especially of a shorter length.

According to the invention, this object is attained by applying the material to be treated in a wavy or rippled condition upon the outer surface of a perforated suction drum, that is, of a drum the interior of which is connected to a suction pump or the like, and by passing the material in this condition through the treating medium, preferably in a bath. The waves or ripples in the material may be made of such a size that five to ten times the amount of material may be held on the available surface area of the suction drum as when the material is treated in the normal stretched condition in full engagement with the drum surface.

Accordingly the present invention provides that the material to be treated is to be fed by feed rollers toward the revolving suction drum at a speed several times, for example, five to ten times, as high as the peripheral speed of the drum, and that, if several suction drums are employed behind each other, the material is to be fed at a proportionate speed from one drum to the other.

The rate of flow of the treating medium through the material may in accordance with the invention be increased substantially in proportion with the relative decrease in speed of the suction drum, for example, by increasing the strength of the suction and/or by increasing the size or number of perforations in the wall of the suction drum. The suction may also be increased, especially within the first drum, by providing additional suction nozzles at the inside of the drum or by connecting the drum to two or more suction fans or by dividing the inside of the drum into different suction zones one of which exerts a stronger suction than the other.

For feeding the material to each suction drum and/or for squeezing the treating liquid out of the material, suitable feeding means such as endless conveyer belts, conveying rollers or the like, but also squeeze rollers may be employed. It is also possible according to the invention to provide an additional perforated conveyer belt or the like which moves around and at the same speed as the suction drum and facilitates the removal of the material from the drum and its passage to the subsequent squeeze rollers. A more preferred feature of the invention consists, however, in effecting an easy removal of the material from the suction drum or drums by directing one or more streams of the treating liquid upon the material and the conveying means subsequent to the drum.

The means for feeding and removing the material in the form of rollers, conveyer belts or the like may be driven at a peripheral speed equal to the speed of the material in the stretched condition.

Another preferred feature of the invention consists in changing the size and effectiveness of the perforations in the wall of the suction drum during its passage through the bath of treating liquid.

Another feature of the invention consists in considerably improving the delivery of the textile material from the feeding mechanism to the revolving suction drum by directing at least one stream of the treating liquid against the material and the feeding mechanism at or closely adjacent to the point of application of the material upon the suction drum.

When employing a pair of feed rollers or a conveyer belt, at least one stream of the treating liquid should be directed at least against one of the feed rollers or against the conveyer belt and also against the textile material in such a manner that the stream or streams of liquid will flow in a direction opposite to the direction of rotation of the feed roller or of the movement of the conveyer belt.

In a similar manner it is possible to loosen and remove the textile material from the suction drum or other suitable conveying means by directing at least one stream of the treating liquid against the point or removal. This facilitates the removal considerably and also effects the removal without any harm to the material.

For producing the stream or streams of treating liquid it is possible to employ the liquid which has been sucked out of the inside of the perforated drum and the suction pump which is used for this purpose. For this purpose, the invention further provides one or more channels for conducting the drawn-out liquid at least partly to the pair of feed rollers or to the feeding and delivery mechanisms. The stream of treating liquid which is directed from above upon the textile material may be produced by passing the liquid through a pipe which is connected to the pump and is located above the point of application or removal of the material on the suction drum, and is provided at its lower side with outlet holes or an outlet slot.

It is still more important, however, to direct at least one stream of treating liquid from below against the feeding mechanism and especially against the lower feed roller, and in a direction opposite to the direction of rotation of the lower feed roller so as to prevent the danger that the material might stick to the lower feed roller. Such a stream of the treating liquid may according to the invention be produced by providing at least one perforated guide plate underneath the suction drum but above the channel for returning the liquid which has been sucked

out of the drum to the bath. This perforated guide plate together with one or more additional parts forms a nozzle underneath the point of application of the textile material on the drum and possibly also underneath the point of removal of the material from the drum. This perforated guide plate has the further advantage that it only permits a substantially radial flow of liquid underneath the suction drum and that it prevents the bath from being stirred up by the liquid flowing back into the bath. It therefore prevents the returning liquid from producing any uncontrolled currents or eddies in the bath which might possibly loosen the textile material from the suction drum.

In connection with the means as last described, it is another feature of the invention to provide suitable means for varying the size of the perforations in the guide plate, for example, by the arrangement of a similar second guide plate which is adjustable relative to the first guide plate and permits the holes in the latter to be more or less covered up.

According to another feature of the invention, the mentioned guide plate may also be employed for directing a stream of treating liquid toward the points of application and removal of the textile material on the suction drum and to the feeding and removal or delivery mechanism. This may be carried out by providing at least one additional guide plate which preferably extends radially to the suction drum at the level of the liquid return channel. For varying the quantity of liquid which is to be supplied to the lower feed roller, this additional guide plate may be adjustable, for example, by being pivotably mounted or by being slidable in the conveying direction.

For applying the textile material upon the outer surface of the drum in a wavy or rippled condition, the invention further provides that instead of or in addition to a pair of rotating feed rollers which are mounted in a fixed position other suitable means may be provided, for example, a pair of gripping members which carries out reciprocating movements in the direction toward the drum surface or a conveyer belt on which the textile material is deposited in the rippled condition and which delivers it in this condition to the drum surface. In place of such feeding means it would also be possible to employ reciprocating rollers which draw off or feed the material at a uniform rate of speed but are given a positive or negative acceleration by a reciprocating movement. If the textile material runs off a pair of feed rollers continuously, it may also be pressed against the wall of the suction drum by a reciprocating applicating rod or surface which may be employed in place of or in addition to one or more streams of treating liquid. In place of such a reciprocating element it is also possible to employ a rotating star-shaped member or the like on which the material to be treated is deposited continuously and which curls the material in the desired waves or ripples and applies the rippled material upon the surface of the suction drum.

If the feeding mechanism according to the invention comprises a pair of reciprocating gripping members, the material, for example, a web of fabric, is passed downwardly to these gripping members, for example, by a pair of feed rollers, and it is then gripped by them and moved toward the perforated drum. At the end of this feeding stroke the gripping members are opened so as to release the material and are then moved back to their original position without engaging with the material. In this position they again grip the material and move it up to the drum. As already indicated, it is also possible to employ a pair of feed rollers in place of such gripping members and to move them back and fourth toward the drum. The speed of rotation as well as the size and speed of the reciprocating movements of these feed rollers may be adjusted by suitable means in relation to the peripheral speed of the suction drum.

The suction drum does not have to be cylindrical but it may also be star-shaped or be provided with suitable

receiving compartments or ribs around its periphery. The textile material will also be held on such a modified drum by the suction which is exerted upon the inside of the drum.

The aforementioned as well as additional features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying diagrammatic drawings in which—

FIG. 1 shows a longitudinal section of an apparatus according to the invention, in which the feeding mechanism comprises a pair of gripping members;

FIG. 2 shows a similar view of a modification of the invention, in which the feeding mechanism comprises a conveyor belt and a reciprocating slide member;

FIG. 3 shows a similar view of another modification of the invention, in which the feeding mechanism comprises a pair of reciprocating rollers;

FIG. 4 shows a similar view of another modification of the invention, in which the feeding mechanism comprises a pair of feed rollers and a reciprocating applicator member;

FIG. 5 shows a similar view of a further modification of the invention, in which the feeding mechanism comprises a pair of feed rollers and a star-shaped applicator;

FIG. 6 shows a longitudinal section of a further modification of the invention with two successive baths and a pair of feed rollers in front of each suction drum and with means for conducting a part of the treating liquid toward these feed rollers and toward the textile material at the point of its application to the drum; while

FIG. 7 shows a top view of the apparatus according to FIG. 6.

As illustrated in FIGS. 1 to 6, the treatment of the textile material **6** is carried out by passing it in a radially wavy or rippled condition on a rotating perforated suction drum **9** through a bath **10**.

According to the embodiment of the invention as shown in FIG. 1, the textile material **6** is fed toward the drum **9** by means of a pair of feed rollers **8**. A pair of gripping members **1** which carry out reciprocating movements in accordance with the double-arrow **13** lays the material in a radially wavy or rippled condition upon the outer surface of the perforated drum the inside of which is connected to a suitable suction pump. The upper part of drum **9** which is not covered by the material **6** is covered at the inside by a cover plate **14**.

The feed rollers **8** may either be freely rotatable and be driven by the movement of the material in accordance with the downward movement of the gripping members **1** or they may be positively and continuously driven by suitable driving means, not shown.

Due to the suction in the perforated drum **9**, the material is held on the drum and passed on the latter through the bath **10**. Upon leaving the bath, the material is gripped by a pair of rollers **12** and deposited, for example, upon an endless conveyor belt, not shown. The rollers **12** may, however, also act at the same time as squeeze rollers or the material may be passed to a separate pair of squeeze rollers for squeezing out the excess liquid from the material.

Another possibility of feeding the material in accordance with the invention to the perforated suction drum **9** is illustrated in FIG. 2. A pair of feed rollers **6** and **8** deposit the material **6** in wavy conditions upon an endless conveyor belt **2** the forward turning point of which is loacted adjacent the perforated drum **9** and feeds the wavy material to the intake side of the drum. For applying the material more densely upon the drum **9**, the individual waves or ripples of the material are pushed more closely together by a slide member **11** which carries out reciprocating movements in the direction as shown by the double-arrow. The surface of the drum is thereby better utilized. At this point it should once more be re-

marked that the individual operating elements of any of the embodiments of the invention as illustrated in the drawings may also be substituted for the elements in other embodiments which are intended to achieve the same purpose or may be applied therein in addition to or in combination with such elements. Thus, for example, the slide member **11** as shown in FIG. 2 may also be installed in the apparatus according to FIG. 1 or in an appropriate manner in any of the other apparatus as hereafter described.

FIG. 3 illustrates an apparatus according to the invention which is provided with a pair of feed rollers **3** which may be rotated continuously but are also reciprocated in the direction of the arrow **15**. As those rollers **3** are moving away from the drum **9**, they roll back along the web of material in the direction toward the pair of rollers **8**. When these rollers **3** are moving toward the perforated drum, they continue to rotate at the same speed and thereby push the material forwardly so as to form a wave or ripple which is then caught by the suction at the intake side of the drum. Also in this case, a slide member **11** as shown in FIG. 2 could be additionally provided for applying the individual waves more densely upon the drum surface.

Instead of a single perforated drum as shown in the drawings, it is, of course, also possible to pass the material successively over several such drums either in the same or different baths.

A further feeding mechanism according to the invention which is of a very simple structure is illustrated in FIG. 4. The material **6** to be treated is fed continuously downward by a pair of driven feed rollers **8** and it is then pressed against the perforated suction drum **9** by at least one rod or board **4** or the like which preferably has rounded edges and is moved back and forth in such a rhythm that the material is provided with radial waves or ripples of a predetermined size.

FIG. 5 illustrates another very suitable mechanism for applying the material in a wavy condition upon a suction drum. The rollers **8** convey the material in the direction toward the star-shaped applicator **5** which rotates continuously in the direction as shown by the arrow. The material which is deposited upon the arms of the applicator **5** is thereby provided with the desired ripples which are applied by the edges **17** upon the suction drum **9** and are held thereon by the suction.

For facilitating the removal of the material from the suction drum, the apparatus according to FIG. 5 is further provided with a perforated conveyor belt **18** which also moves in the direction of rotation of drum **9** as shown by the arrow. At the outlet side of the suction drum **9** this perforated belt **18** disengages from the outer surface of the drum together with the rippled material and then runs with the latter ot a pair of rollers **19** and **20** which may also serve as pressure or squeeze rollers.

FIGS. 6 and 7 finally show an especially advantageous apparatus which handles the material very carefully. The pair of feed rollers **8** of this apparatus is mounted closely adjacent to the suction drum **9** near the intake point thereof and is driven at a considerably higher speed than the drum **9**.

The material is thereby pushed together so as to form radial wavy folds or ripples between the rollers **8** and the suction drum **9** and due to the suction this wavy material is then held in this position on the suction drum. Because of the relatively small diameter of the rollers **8** and their considerably higher feeding speed than that of drum **9**, the material tends to adhere especially to the lower roller **8** and thereby tends to disengage from the suction drum. Such adhering of the material to the lower roller **8** is prevented according to the invention in a very simple manner by directing at least one stream of the treating liquid against the lower roller **8** and the material at the point of application thereof, and against the direction of rotation of the roller. It is also advisable to supply the treating liquid also to the upper roller **8** since this permits a denser arrangement of ripples on the suction drum **9**.

In the apparatus according to FIGS. 6 and 7, a suction channel **21** which is connected to a pump **22** is provided at one side of drum **9** for drawing the liquid from the inside of the drum and for passing it back into the bath through channels **23** and **24**. Channel **23** is located above the intake point of the drum. The liquid then passes through a slot **25** in the pipe **23** and flows over the upper roller **8**.

At the same time, the liquid falling upon the material pushes the individual wavy folds more closely together. Underneath the suction drum **9** but above the channel **24** a preferred guide plate **26** is mounted in the bath. This guide plate **26** is bent over at both sides toward the conveying mechanism and, together with additional plates, forms nozzles **27** and **28** through which a stream of treating liquid is sprayed against the lower roller **8** and against the conveyer belt **29**. The strength of this stream depends upon the amount of liquid circulated and the size of the perforations in the guide plate **26**. This guide plate serves at the same time for quieting the bath underneath the suction drum. Due to the guide plate **26**, the axial flow of the liquid occurs only in the lower part of the bath and not in the part above the guide plate. It also avoids the danger that, due to the liquid flowing back into the bath through the channel **24** the wavy material which is held on the suction drum might be flushed off the latter. By varying the size of the perforations in the guide plate it is also possible to vary the amount of liquid flowing through the nozzles in an inverse relation to the amount passing through the perforations. The size of the perforations may be varied in a simple manner by the provision of a similar second guide plate which is adjustable relative to the first guide plate. By the adjustment of this second guide plate the perforations in the two plates through which the liquid flows are shifted relative to each other and are partly covered up thereby. For removing the material more carefully from the suction drum, the apparatus according to FIGS. 6 and 7 is also porvided with nozzles for directing the liquid also against the delivery mechanism and the material at the outlet point of the apparatus.

The supply of liquid to the delivery mechanism, that is, to the conveyer belt **29** may be carried out through the nozzle **28** and/or through an additional pipe **23** which is mounted above the outlet point of the suction drum.

For regulating the quantity of liquid which is required between the feeding and delivery mechanisms, a further guide plate **30** may be provided which preferably extends radially to the suction drum **9** at the level of the channel for returning the liquid to the bath. Such a guide plate **30** may be seen in the second washing apparatus which is only partly shown at the right side of FIGS. 6 and 7. By adjusting, swiveling or sliding this guide plate **30**, it is possible to conduct the liquid coming from channel **24** either more strongly to the feeding mechanism or to the delivery mechanism.

Between the two belts a pair of squeeze rollers **31** is provided which are adjustable in a conventonal manner so as to vary their pressure upon the material.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A method of treating textile materials which comprises introducing the material to be treated in wavy

folds by feeding means onto the surface of at least one rotating perforated sieve drum means subjected to a suction draft, said folds being produced by reciprocating movements imparted to the material directed towards and away from the drum surface, said sieve drum means being partially disposed in a treatment liquid, said folded material being introduced onto the surface of said sieve drum at about the point where the material being treated enters the treatment liquid, holding the folded material to the drum means by said suction draft, thereby drawing the treatment liquid through the material being treated, conveying the folded material on said sieve drum means through the treatment liquid and recovering the treated product.

2. The method of claim 1 wherein the folds extend substantially radially from the surface of the sieve drum means.

3. The method of claim 1 wherein the material to be treated is conveyed to the surface of the sieve drum means at a speed several times faster than the peripheral speed of the drum.

4. A method as defined in claim 3, wherein said textile material is fed toward said suction drum by feed rollers rotating at a rate of speed several times as high as the peripheral speed of said drum.

5. The method of claim 3 wherein said speed is about 5 to 10 times faster than the peripheral speed of the drum.

6. A method as defined in claim 1, wherein the rate of flow of said liquid through said textile material to the inside of said drum is increased substantially in proportion with the decrease in speed of said drum relative to the feeding speed.

7. A method as defined in claim 1, wherein the means for feeding the material to the drum and for withdrawing it from the drum are driven at a rate of speed corresponding to the speed of the textile material in the stretched condition.

8. A method as defined in claim 1, wherein at least one stream of the treatment liquid is directed upon said textile material and the feeding means from a point below the level of the treatment liquid and closely adjacent to the point of application of said material upon said drum.

9. A method as defined in claim 1 wherein said feeding means comprises a pair of feed rollers and at least one stream of said liquid is directed upon the lower feed roller and said textile material from a point below the level of the treatment liquid.

10. A method of treating textile materials which comprises introducing the material to be treated in wavy folds onto the surface of at least one rotating perforated sieve drum means subjected to a suction draft, said material being folded to its wavy condition and applied in said condition upon said sieve drum means by feed rollers, said sieve drum means being partially disposed in a treatment liquid, said folded material being introduced into the surface of said sieve drum at about the point where the material being treated enters the treatment liquid, holding

the folded material to the sieve drum means by said suction draft, thereby drawing the treatment liquid through the material being treated, conveying the folded material in said sieve drum means through the treatment liquid, wherein at least one stream of said liquid is directed upon said feeder rollers in a direction opposite to their direction of rotation from a point below the level of the treatment liquid and recovering the treated product.

11. The method of claim 10 wherein at least one stream of said liquid is directed upon said feed rollers and the material to be treated from a point above the level of the treatment liquid.

12. The method of claim 11 wherein the liquid falls upon the material folded on the surface of the sieve drum means thus pushing the individual folds more closely together.

13. The method of claim 10 wherein after the material is introduced in wavy folds onto the surface of the perforated sieve drum means the individual folds are pushed more closely together by reciprocating movements imparted to the material.

14. The method of claim 13 wherein the reciprocating movements are directed toward the folds in a direction substantially tangential to a point on the surface of the sieve drum means.

15. A method of treating textile materials which comprises introducing the material to be treated in wavy folds onto the surface of at least one rotating perforated sieve drum means subjected to a suction draft, said folds being produced and applied to said surface by a cross-shaped member rotating continuously in the opposite direction of rotation as said sieve drum, said sieve drum means being partially disposed in a treatment liquid, said folded material being introduced onto the surface of said sieve drum at about the point where the material being treated enters the treatment liquid, holding the folded material to the sieve drum means by said suction draft, thereby drawing the treatment liquid through the material being treated, conveying the folded material on said sieve drum means through the treatment liquid and recovering the treated product.

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WILLIAM I. PRICE, Primary Examiner

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