June 11, 1940. W. DÜRSTELER 2,203,678

METHOD AND APPARATUS FOR THE THE CONTINUOUS WET TREATMENT OF WEBS OF TEXTILE MATERIAL

Filed Aug. 5, 1937 4 Sheets-Sheet 1

Fig. 1.

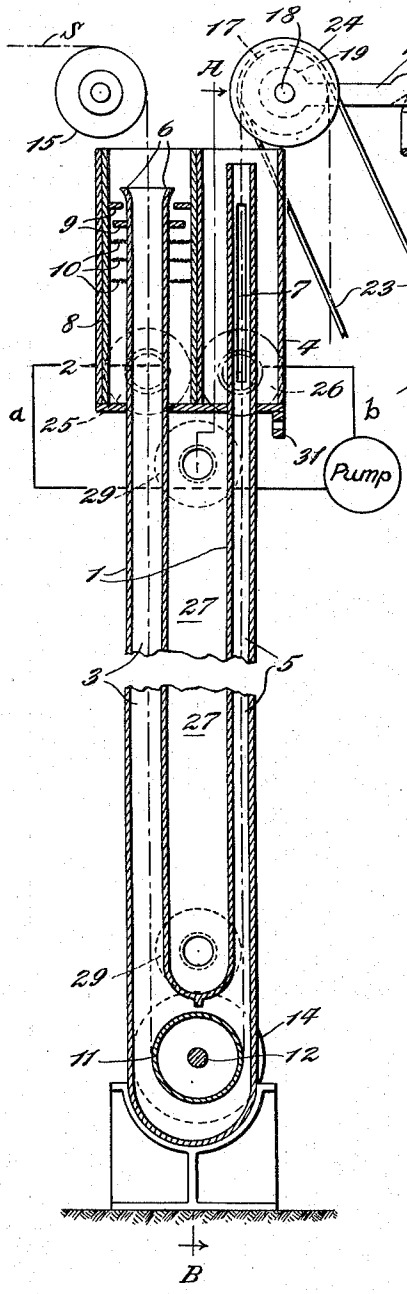
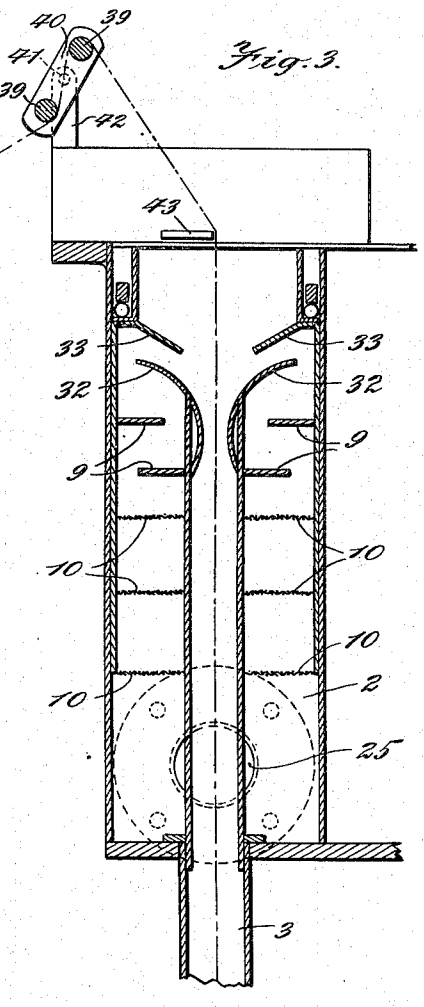


Fig. 3.



INVENTOR.
Wilhelm Dürsteler

BY Louis Burgess

ATTORNEY.

June 11, 1940. W. DÜRSTELER 2,203,678

METHOD AND APPARATUS FOR THE THE CONTINUOUS WET TREATMENT OF WEBS OF TEXTILE MATERIAL

Filed Aug. 5, 1937 4 Sheets-Sheet 2

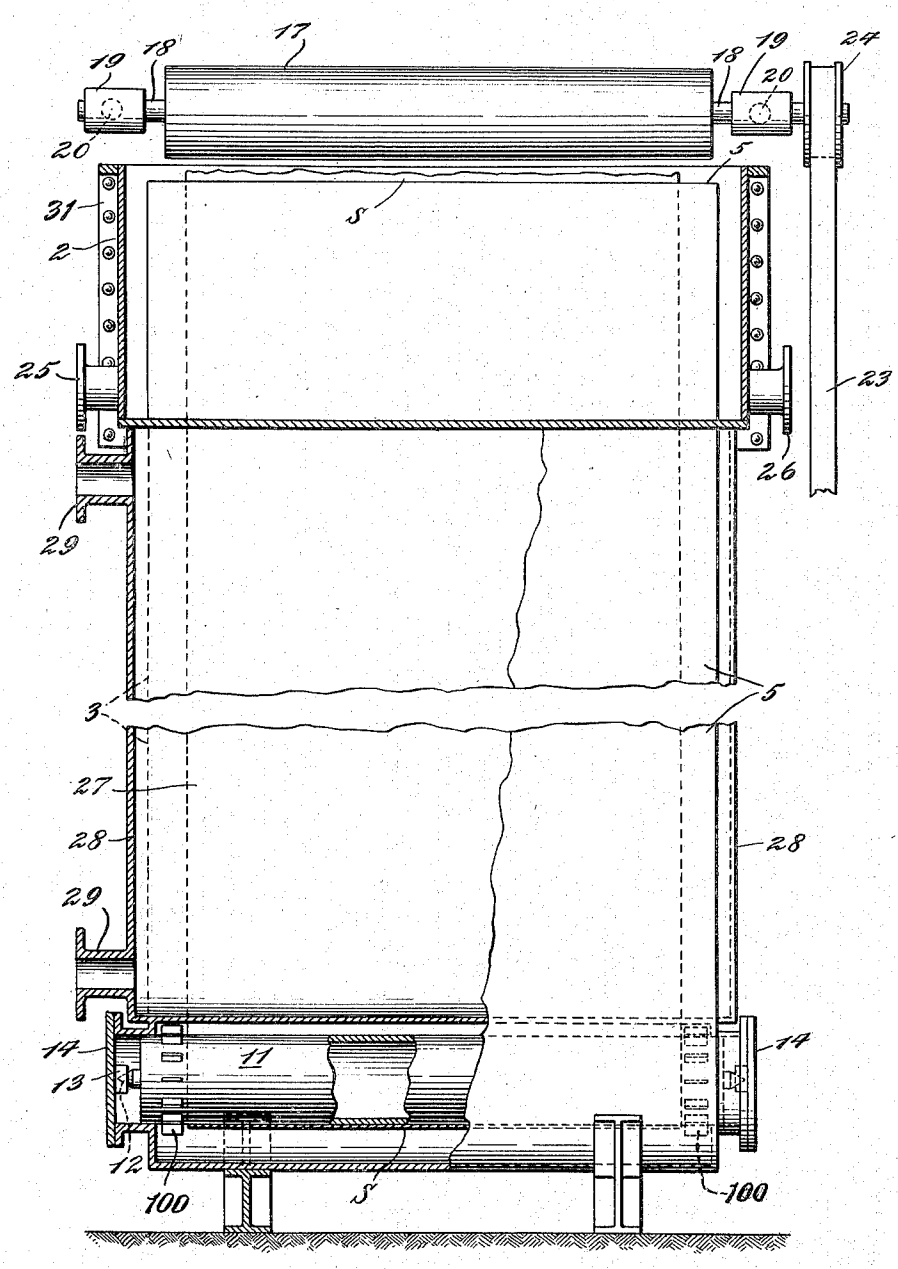


Fig. 2.

INVENTOR.
Wilhelm Dürsteler

BY Louis Burgess

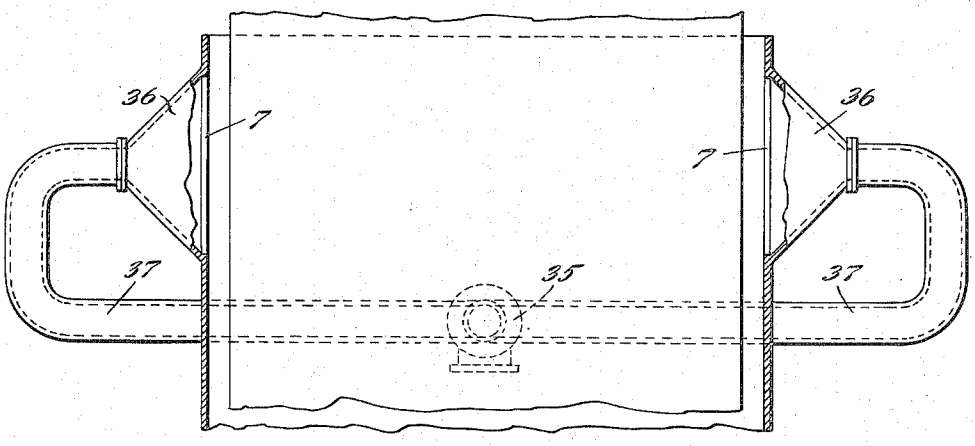
ATTORNEY.

June 11, 1940. W. DÜRSTELER 2,203,678

METHOD AND APPARATUS FOR THE THE CONTINUOUS WET TREATMENT OF WEBS OF TEXTILE MATERIAL

Filed Aug. 5, 1937 4 Sheets-Sheet 3

Fig. 4.



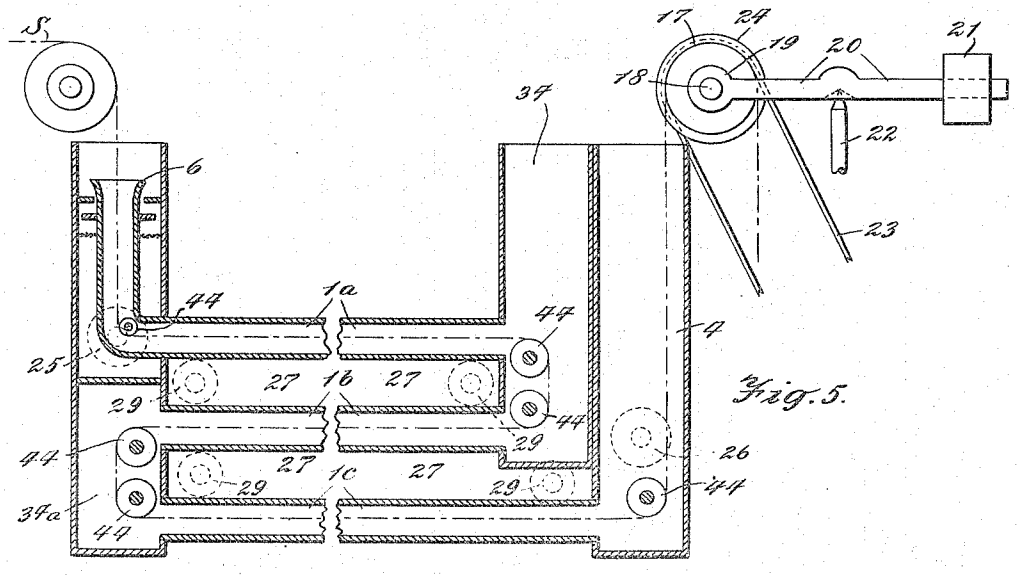


Fig. 5.

INVENTOR
Wilhelm Dürsteler

BY Louis Burgess

ATTORNEY.

June 11, 1940. W. DÜRSTELER 2,203,678

METHOD AND APPARATUS FOR THE THE CONTINUOUS WET TREATMENT OF WEBS OF TEXTILE MATERIAL

Filed Aug. 5, 1937 4 Sheets-Sheet 4

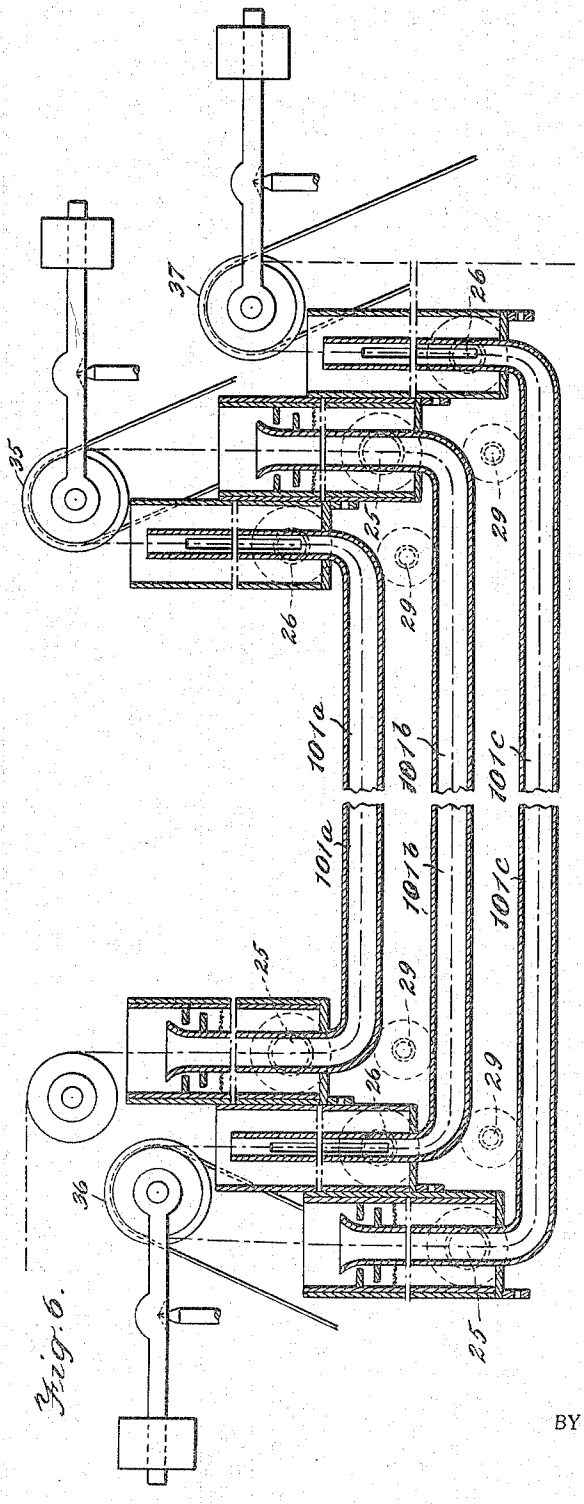


Fig. 6.

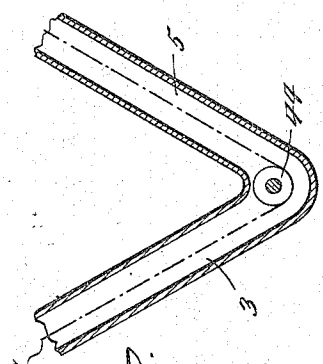


Fig. 7.

BY

INVENTOR.
Wilhelm Dürsteler
Louis Burgess
ATTORNEY.

Patented June 11, 1940 2,203,678

UNITED STATES PATENT OFFICE

2,203,678

METHOD AND APPARATUS FOR THE CONTINUOUS WET TREATMENT OF WEBS OF TEXTILE MATERIAL

Wilhelm Dürsteler, Thalwil, Switzerland

Application August 5, 1937, Serial No. 157,582
In Germany April 1, 1937

26 Claims. (Cl. 91—46)

This invention relates to a new method and apparatus for the continuous wet treatment of webs of textile material.

In the wet treatment of textile fabrics and particularly fabric webs the materials when in contact with the treating liquid undergo a certain amount of shrinkage which in most cases is the shrinkage inherent in the particular type of fabric or in some cases is a shrinkage intentionally produced and in excess of the normal degree of shrinkage of the particular fabric treated, as for example in the manufacture of creped goods. For the purpose of allowing for the necessary or desired degree of shrinking of textile materials when in contact with a treating liquid it is essential that the material, particularly when conveyed in web form in a continuous process through a treating bath, be substantially free from tension so as to avoid any deformation of the fabric texture.

In the wet treatment of textile materials in web form in accordance with my invention any tension of the fabric while passing through the treating bath is substantially avoided thereby eliminating any possibility of structural deformation as the result of shrinkage in the bath and my new procedure is far superior to any of the hitherto known practices and in addition will give results not attainable by present methods.

I have discovered that I can accomplish the desired result by passing the fabric web in open state into a conduit of comparatively small depth through which a steady stream of the treating liquor is passed in such manner and with such speed that it will grip the fabric web and convey the same through the entire length of the conduit without the necessity of mechanical conveying means.

The invention will be fully understood and further objects will appear from the following description read in conjunction with the drawings which illustrate the practical embodiments of my invention without however limiting the scope thereof and in which:

Fig. 1 shows a longitudinal cross section through one embodiment of the invention.

Fig. 2 shows a front view of the construction illustrated in Fig. 1 with parts cut away,

Fig. 3 is a cross section through part of an alternative embodiment of the invention showing a feeding compartment with outlets discharging downwardly into the conduit,

Fig. 4 is a cross section through an alternative form of a fabric discharge compartment showing details of construction,

Fig. 5 is a cross section through a further embodiment of the invention showing non-angular conduits in battery arrangement,

Fig. 6 is a cross section through an alternative form of the construction shown in Fig. 5,

Fig. 7 is a cross section through an embodiment of the invention showing V-shaped conduits.

With specific reference to Figs. 1 and 2, the apparatus as shown in the drawings includes a conduit 1 of U-shape comprising open ended side conduits 3 and 5; side conduit 3 extends with its end portion into a feeding compartment 2 while side conduit 5 extends with its end portion into a discharge compartment 4. The upper rim 6 of side conduit 3 is funnel shaped so as to form an overflow and serves as a treating liquid inlet.

The upper end of side conduit 5 extends to adjacent the top of the discharge compartment and is provided with slots 7 on the narrow side of the conduit and arranged below the level indicated by the overflow rim 6 of side conduit 3 as to permit a difference in liquid level when the entire conduit is filled thus causing the treating liquid to flow at the desired rate of speed downwardly in conduit 3 and upwardly in side conduit 5. Feeding compartment 2 is provided with means 25 for feeding treating liquid to the compartment whereas discharge compartment 4 is provided with a liquid discharge outlet 26. A guide roll 15 for properly guiding the fabric web S into the upper end of side conduit 3 is arranged above the feeding compartment 2. On its travel through the conduit the fabric web S is preferably guided in the curved part of the U-shaped conduit over a freely movable guide roll 11 resting with the cone shaped end of its axis 12 in bearing 13 carried by front plate 14. A discharge wheel 24 is arranged on top of discharge compartment 4 to continuously remove the fabric web as it emerges from the upper part of side conduit 5.

In the practical operation of the apparatus as illustrated in Figs. 1 and 2, treating liquid, fed into compartment 2 through inlet 25, overflows rim 6 and passes downwardly through side conduit 3 and upwardly through side conduit 5 being discharged through slots 7. The fabric web S passing over guide roll 15 is passed into the open end of side conduit 3 and being gripped by the downwardly flowing treating liquid is conveyed together with the same through the conduit and discharged at the end of side conduit 5 by means of the discharge wheel 24.

Should it be desired to re-use the treating

liquid as for instance when using a costly treating bath, I have found it of advantage to connect the discharge outlet 26 by means of a suitable pipe line with the liquid inlet 25 in the feeding compartment 2. This arrangement will permit re-circulation of the treating liquid preferably with the aid of a pump or such similar means suitably inserted in the connecting line, thereby necessitating but a relatively small volume of treating liquid without sacrificing the intensity of treatment. Such arrangement is for instance schematically illustrated in Fig. 1 in which the lines marked *a* and *b* represent the recycling connecting lines to the pump. In this manner it has become possible for the first time to achieve economical large scale treatment of textile materials in comparatively expensive and costly treating baths thereby obtaining in many instances products which hitherto could not be manufactured on a commercial scale.

Inasmuch as the treating liquid as a rule is fed into the feeding compartment under a certain pressure, particularly when re-cycling the treating liquid, a certain turbulence is created in the feeding compartment; it is therefore of advantage to force the treating liquid prior to its discharge into the side conduit 3 through sieves 10 and baffles 9 so that the liquid layer reaching and overflowing rim 6 is substantially quiet and non-turbulent. For structural convenience I prefer to secure some of the baffles 9 to a removable tray 8 attached to the inside of the feeding compartment and to secure corresponding baffles to the outside of the upper portion of side conduit 3 thus forcing the liquid after it has passed the sieves and already quieted down to a considerable extent, through the tortuous passages formed by corresponding baffles.

The difference between the level of the overflow rim in the feeding compartment and the upper discharge level of the treating liquid discharged in compartment 4 determine the rate of speed with which the treating liquid passes through conduit 1. Instead of providing as the discharge outlet a slot 7 in the conduit 5 as it extends into compartment 4 it is of course possible to let the treating liquid be discharged through the open end of the side conduit 5 in which case the open discharge end should be arranged below the level of overflow rim 6. I prefer, however, the arrangement of discharge slots as shown in Fig. 1 as in this case the treating liquid being discharged fanwise will exert a desirable lateral stretching action upon the fabric web as it passes the slot.

For practical reasons the difference between the referred to levels responsible for the flow of the treating liquid through the conduit cannot be made very great as this would require a very long side conduit 3 and a relatively short side conduit 5 thereby making the apparatus unnecessarily high. Though in many instances a relatively small difference between these levels and thus a relatively small rate of flow surfaces it is often desirable to convey the fabric web through the apparatus at a comparatively high rate of speed for which reason it becomes necessary to increase the rate of flow of the treating liquid in the conduit. This increased rate of flow of the treating liquid may be accomplished by imparting to the treating liquid already at the point of entrance into the side conduit 3 a rate of flow somewhat higher than it normally possesses while overflowing into the conduit, which result for instance may be accomplished by injecting the treating liquid into the conduit and if desired under slight pressure. Such an arrangement is illustated in Fig. 3. As there shown the means for feeding the treating liquid into the side conduit comprise two opposing liquid discharge outlets having lower lips 32 and upper lips 33, the lower lips of both outlets are curved downwardly into the open end of side conduit 3 and are so spaced apart that they substantially form a slot capable of receiving and guiding a fabric web whereas the upper shorter lips may be arranged either substantially horizontal or at a downward slant and either straight or slightly curved; the opposing discharge outlets for the treating liquid as defined by the upper and lower lips will thus discharge downwardly the treating liquid fed to their common compartment 2 by means of liquid inlet 25.

Alternatively the rate of flow may be increased by removing the treating liquid as it is discharged from the side conduit 5 by suitable suction means such as pumps and the like. Such alternative arrangement is for instance shown in Fig. 4 in which in accordance with the preferred embodiment of a slotted discharge end, the treating liquid discharge pipes 37 connected to pump 35 are attached by means of connecting pieces 36 to slots 7. In this fashion treating liquid is forced out of the slots by means of the suction pump 35 which at the same time may be so constructed as to be capable of conveying the treating liquid sucked off from the slots to the feeding compartment for re-use. It is of course understood that still higher rates of flow may be obtained by combining the forced liquid feed construction referred to above and illustrated in Fig. 3 with the suction discharge illustrated in Fig. 4.

In many cases where I utilize gravity flow and use but a comparatively low difference between the feed-in level in compartment 2 and the discharge level in compartment 4 I have found that the fabric not being thoroughly wetted as yet in its downward path through side conduit 3 but being thoroughly wetted in its upward path through side conduit 5 has picked up so much additional weight while moving upwardly that it will sometimes be retarded in its movements so that there is danger of an undesirable accumulation of fabric inside conduit 3 and especially in the curved central portion of conduit 1. I have discovered that I can substantially eliminate the objectionable effect of the unbalanced distribution of weight carried by the fabric due to absorbed treating liquid, by increasing the rate of flow of the liquid as it passes through side conduit 5. As illustrated in the drawings such result is for instance obtained by constructing the side conduit 5 with a smaller depth than the side conduit 3. In this manner the rate of flow of the treating liquid in side conduit 5 is greater than that in side conduit 3, thus compensating for the additional weight of treating liquid absorbed by the fabric in its upward passage.

The dimensions of the conduit are not critical though I prefer to use a conduit having a width slightly in excess of that of the fabric web to be treated and being just sufficiently high to permit the fabric web to be conveyed through the same without danger of accumulation and entanglement. The length of the conduit neces-

sarily depends upon the duration and type of treatment which it is desired to apply.

Whatever the apparatus is provided with one side conduit of smaller depth than the other so as to create a difference in the rate of flow of the treating liquid in both side conduits, though the relation between the dimensions of the two conduits is not critical, I have found it of advantage to maintain substantially a proportion of 3:2 between the depth of the conduits when feeding the fabric web into the apparatus for instance at a rate of speed substantially between 15 and 25 cm/sec.

The means for guiding the fabric into or through the apparatus as illustrated in the drawings in the form of guide rolls may be substituted if desired by other suitable guide means such as guide rods. Fig. 3 for example illustrates a feeding arrangement in which two guide rods 39 are carried by a common connecting piece 40 mounted on a support 42 and adapted to pivot around its centre-point 41; the fabric S is preferably further led over suitable means 43 so as to permit the same to be vertically fed into the side conduit 3. In this manner a breaking action may be applied should the fabric be drawn into the apparatus at too high a rate of speed.

When using guide wheels it is sometimes of advantage, especially when operating with a comparatively low rate of flow of the treating liquid in the conduits, in which case the gripping and conveying action exerted by the treating liquid upon the fabric is not very strong, to connect the feeding roll to suitable driving means such as a motor or the like adapted to rotate the roll at the desired rate of speed. The guide means for guiding the passage of the web within the conduit such as guide rolls or guide rods are not as a rule absolutely necessary to the successful conveyance of the web through the conduit and may be entirely omitted in many cases if desired as the treating liquid current guided by the walls of the conduit will propel the goods without difficulty through the same and even through the curved portion of a U-shaped conduit. This is especially true when the rate of flow with which the treating liquid passes through the conduit is relatively high. I prefer however to use suitable guide means as this will prevent undesirable friction between the fabric webs and the conduit walls thus eliminating substantially any objectionable slowing down of the passage of the goods. When using a guide wheel such as shown in Figs. 1 and 2 the same is preferably of hollow construction, being carried on both ends by axial cones resting in suitable bearings and of such weight and dimensions that it will possess a certain buoyancy in the treating liquid surrounding same. In this fashion the guide wheel will float in the treating liquid and will easily revolve by the slightest frictional contact with the moving fabric web. The ease with which the guide wheel turns may be still further facilitated by providing a suitable paddle arrangement or the like, such as paddles 100, circumferentially on either one or both ends of the guide wheel as for instance illustrated in Fig. 2. The guide wheel if desired may be connected to suitable driving means adapted to rotate the same at substantially the same rate of speed with which the fabric web is propelled through the conduit by means of the treating liquid current which arrangement still further facilitates the smooth passage of the goods. It is of course understood that the wheel in such case substantially retains its characteristic as guide wheel and does not serve as conveying means for the fabric since in accordance with the invention the fabric is at all times propelled through the treating bath by means of the current of treating liquid alone.

The wet treatment of textile fabrics in most cases is carried out at raised temperatures and for this reason it is desirable to effectuate the heating of the treating liquid while the same is in contact with the goods to be treated, that is while the same passes through the conduit. This can be accomplished by either the application of direct heat to the outside walls of the conduit or by the introduction of suitable heat conveying media, including hot gases and liquids, into the space 27 formed between the side conduits 3 and 5 as shown in Fig. 1. Suitable heating media are for instance hot gases such as steam, air, etc., or hot liquids such as oil, water, organic liquids, etc. When making use of organic liquids this arrangement has the additional advantage of permitting the maintenance of a better uniformity in treating temperature control.

In many instances as for example when the time of contact between the fabric web and the treating liquid in one passage through the conduit is insufficient or where it is desirable to carry out the application of a series of different treatments in succession, I have found it of advantage to use two or more of such conduits in battery arrangement. If the same treating liquid is prescribed for some or all of the conduits in the battery, corresponding treating liquid outlets and inlets may be connected so that the treating liquid discharged from the discharge compartment of the first conduit in the battery will be passed to the feeding compartment of the second and then discharged from the second to the feeding compartment of the third, etc., until finally the treating liquid from the discharge compartment of the last conduit in the battery is returned to the feeding compartment of the first. Of course when using the same temperature conditions for all conduits in a battery arrangement and regardless of whether different treating liquids in the various units are used or not the heating medium may be circulated through all of the heating spaces by means of suitable connections, as for instance the connections 29 illustrated in the drawings.

The arrangement of two or more conduits in battery fashion possesses the additional advantage of permitting a rearrangement of the material during its treatment. This may be accomplished by passing the goods after their discharge from one conduit and prior to their introduction into the next succeeding conduit over suitable means for re-arranging the fabric web, which means are preferably such that the re-arrangement is simultaneously coupled with a lateral stretching of the web as for instance illustrated in Fig. 6 by wheels 35, 36 and 37. In this manner a greater uniformity in completely re-immersing the goods with each passage into and through the next succeeding conduit is achieved and thus a greater uniformity in the application of the treating bath.

Instead of using a U-shaped conduit as shown in Fig. 1 I may also use a V-shaped conduit as is shown in Fig. 7 or a non-angular straight conduit as shown in Figs. 5 and 6. In general any type of conduit is suitable in accordance with the invention and regardless of its shape or form

provided the conduit is of sufficient width and of sufficient comparatively small depth to permit the unimpaired conveyance of a web of textile material in open state by means of treating liquid flowing through the conduit.

Fig. 5 shows straight non-angular conduits in battery arrangement. The fabric S gripped by the treating liquid overflowing rim 6 and thus carried downwardly passes over suitable guide means 44 seriatim through conduits 1a, 1b and 1c and is finally discharged from a discharge compartment 4 over discharge wheel 24 which, if desired, may be of the lateral stretching type. In the arrangement is shown the fabric leaves conduit 1a and passes into a compartment 34 thence through conduit 1b into a compartment 34a and finally through conduit 1c into the discharge compartment 4. Instead of passing the goods from one conduit to the other without removing the same from the liquid it is of course possible to remove the material from the liquid after it has passed each of the conduits for the purpose of re-arranging and for laterally stretching the same and pass the same thereafter back into the same compartment from which it was previously removed and repeat the removal and re-insertion if desired in the next following compartment, etc., until the fabric is finally discharged. This arrangement of superimposing several horizontally situated non-angular conduits has the advantage that it facilitates the affectuation of a greater rate of flow of the treating liquid since in general the difference between the liquid level in the feeding compartment and that in the discharge compartment can be made greater more easily as a matter of practical plant and operating convenience than when using angular such as U-shaped or V-shaped conduits. Where it is necessary to prolong the contact between the goods and the treating liquid it is of course possible to procure such result by either increasing the length of the various conduits through which the goods and liquid pass or by permitting the goods to pass through one or more additional conduits added to or inserted in the conduit battery or by a combination of both these expedients. If the conduits are made comparatively long it is of advantage to arrange them in a downwardly sloping fashion so that the end of the conduit into which the fabric enters is at a higher level than the end of the conduit from which the fabric emerges. It is of course possible to arrange the conduits in such manner that their downward slope may be adjusted to any desired degree.

When using an arrangement as illustrated in Fig. 5 there is always one feeding compartment into which the fabric is fed and one discharge compartment from which it is finally discharged. There are, however, additionally intermediate compartments which form the connection for the treating liquid and fabric web conveyance between successive conduits and which preferably contain suitable guide means. The straight conduit arrangement has the further advantage that the travel of the material is not in any way impeded by the progressively increased weight of the fabric web as the result of absorbed treating liquid while the same moves through the various conduits. On the contrary in this arrangement and particularly when the conduits are slopingly arranged the progressively increased weight of the fabric web will tend to facilitate its passage.

Should it be desired, when using straight non-angular conduits in battery arrangement, to remove the fabric web from the treating liquid after its passage through each of the conduits, I may either utilize a construction in which the goods are re-immersed for their passage into and through the next succeeding compartment in the same compartment from which they are discharged or preferably a construction as illustrated in Fig. 6 in which each conduit extends separately into a feeding compartment at one end and into a discharge compartment at the other. In the latter arrangement the fabric web, being fed into and passing through the upper conduit 101a is discharged over the first discharge wheel 35 thence fed into and passed through the succeeding conduit 101b, from there discharged over discharge wheel 36 thence fed into and passed through the next lower conduit 101c and finally discharged over discharge wheel 37. Of course if the treatment requires passage through additional conduits the material may pass through these in the same manner. Also in this construction the conduits may be provided with a downward slope either in stationary or adjustable arrangement. Inasmuch as in each of the discharge compartments the end of the corresponding conduit extends upwardly there may be sometimes a slight impediment of the free upward motion of the fabric web as it is carried by the treating liquid current due to the progressively increasing liquid absorption. Though this is as a rule not as pronounced as in the case of U-shaped or V-shaped conduits with comparatively long side conduits, I prefer to construct the upwardly extending discharge end of each conduit with a depth smaller than that of the remainder of such conduit. This construction as illustrated in Fig. 6 has the advantage over that shown in Fig. 5 that the various conduit units may be charged with different treating liquids thus making each in and of itself an independent unit, permitting, however, at the same time by connecting successive discharge and feeding compartments and the last discharge with the first feeding compartment the adaption of this construction to the use of the same treating liquid in all units. As explained with reference to structures comprising U-shaped or V-shaped conduits in battery arrangement it is likewise of advantage in all other structures in accordance with the invention when using constructions of the battery type, as for instance, illustrated in Figs. 5 and 6, to utilize the space between adjacent conduits for heating purpose with suitable heating media that may be circulated through these spaces by means of suitable inlets and outlets 29.

It is often difficult to properly adjust the rotation of the discharge wheel to the rate of speed with which the fabric is discharged at any particular time and if the pick-up of the discharge wheel is at any particular time greater than the rate at which the fabric is discharged from the discharge compartment, an undue tension will result, which frequently causes a structural deformation of the fabric web. I have discovered as a further embodiment of my invention that I can substantially prevent the creation of any tension as the result of a too rapid pick-up of the discharge-wheel by automatically adjusting the same as shown in Figs. 1, 2, 5 and 6. In the arrangement there illustrated the pick-up of the discharge wheel will automatically decrease as soon as the rate of the fabric discharge decreases and increase as soon as the discharge rate increases, thus making

the pick-up of the discharge prevailing at any time. As illustrated in the drawings the discharge wheel 24 carries pulley 17 driven from a suitable source such as an electric motor by means of the endless belt 23. The axis 18 of discharge wheel 24 rests on bearing 19 attached to arm 20 and balanced on support 22. Arm 20 carries at its other end slidable weight 21. When the discharge wheel picks up the fabric web faster than it is discharged from the conduits, the ensuing pull will cause arm 20 to pivot on its support 22, thereby swinging the discharge wheel downwardly which results in a slackening of the belt 23 and thus a slowing down of the speed with which the discharge wheel picks up the fabric web from the conduit. Slide 21 may be so adjusted that it lifts the discharge wheel just sufficient to prevent a slackening of the discharged fabric web and must of course be adjusted for each particular kind or type of fabric dependent upon the pull exerted upon the discharge wheel by the weight of that piece of fabric web that has left the treating bath plus the absorbed treating liquid. Should conversely the fabric web be discharged faster than the pick-up of the discharge wheel the discharge wheel will swing upwardly thus causing belt 23 to tighten, which fact results in a speeding up of its pick-up capacity.

The foregoing description is by way of illustration and not of limitation and I am not to be limited by any of the details but only by the appended claims in which I have endeavoured to claim broadly all inherent novelty.

I claim:

1. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising means for continuously feeding treating liquid into said conduit, means for continuously discharging treating liquid from said conduit so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

2. Apparatus in accordance with claim 1 in which said means for continuously discharging treating liquid from said conduit are connected to said means for continuously feeding treating liquid to said conduit so as to return treating liquid from the discharge means to the feeding means.

3. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a treating liquid inlet at one end of said conduit, a compartment surrounding said treating liquid inlet and adapted to continuously feed treating liquid into said conduit through said inlet, means for continuously feeding treating liquid to said compartment and means for continuously discharging treating liquid from the other end of said conduit so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

4. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a compartment surrounding said first opening and adapted to continuously feed treating liquid into said conduit through said first opening, said first opening forming a treating liquid overflow on said conduit, means for continuously feeding treating liquid into said compartment and means for continuously discharging treating liquid from the other end of said conduit so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

5. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a compartment surrounding said first opening, two opposing treating liquid discharge ducts in said compartment extending with their lower portion downwardly into said conduit through said first opening and forming a slot adapted to receive and guide a web of textile material in extended state, each of said discharge ducts being adapted to continuously inject a separate stream of treating liquid downwardly into said conduit through said opening, means for continuously feeding treating liquid to said compartment and means for continuously discharging treating liquid from the other end of said conduit so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

6. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously

discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a treating liquid inlet at one end of said conduit, a first compartment surrounding said treating liquid inlet and adapted to continuously feed treating liquid into said conduit through said inlet, means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit, a second compartment surrounding said outlet and adapted to receive treating liquid discharged from said conduit through said outlet and means for continuously removing treating liquid from said second compartment, said treating liquid outlet being on a lower horizontal plane than said treating liquid inlet so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

7. Apparatus in accordance with claim 6 in which said means for continuously removing treating liquid from said second compartment are connected to said means for continuously feeding treating liquid into said first compartment so as to return treating liquid from said second to said first compartment.

8. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a first compartment surrounding said first opening and adapted to continuously feed treating liquid into said conduit through said first opening, said first opening forming a treating liquid overflow on said conduit, means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit, a second compartment surrounding said outlet and adapted to receive treating liquid discharged from said conduit through said outlet and means for continuously removing treating liquid from said second compartment, said treating liquid outlet being on a lower horizontal plane than said treating liquid inlet so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

9. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a first compartment surrounding said first opening, two opposing treating liquid discharge ducts in said first compartment extending with their lower portion downwardly into said conduit through said first opening and forming a slot adapted to receive and guide a web of textile material in extended state, each of said discharge ducts being adapted to continuously inject a separate stream of treating liquid downwardly into said conduit through said first opening means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit, a second compartment surrounding said outlet and adapted to receive treating liquid discharged from said conduit through said outlet and means for continuously removing treating liquid from said second compartment, said treating liquid outlet being on a lower horizontal plane than said treating liquid inlet so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

10. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a treating liquid inlet at one end of said conduit, a first compartment surrounding said treating liquid inlet and adapted to continuously feed treating liquid into said conduit through said inlet, means for continuously feeding treating liquid into said compartment, a treating liquid outlet at the other end of said conduit, suction means connected to said outlet for continuously removing treating liquid from said conduit through said outlet so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

11. Apparatus in accordance with claim 10 in which said suction means are connected to said means for continuously feeding treating liquid into said compartment so as to return treating liquid from said suction means to said compartment.

12. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a compartment surrounding said first opening and adapted to continuously feed treating liquid into said con-

duit through said first opening, said first opening forming a treating liquid overflow on said conduit, means for continuously feeding treating liquid into said compartment, a treating liquid outlet at the other end of said conduit, suction means connected to said outlet for continuously removing treating liquid from said conduit through said outlet so as to create a treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

13. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a compartment surrounding said first opening, two opposing treating liquid discharge ducts in said first compartment extending with their lower portion downwardly into said conduit through said first opening and forming a slot adapted to receive and guide a web of textile material in extended state, each of said discharge ducts being adapted to continuously inject a separate stream of treating liquid downwardly into said conduit through said opening, means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit, suction means connected to said outlet for continuously removing treating liquid from said conduit through said outlet so as to create a treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

14. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width and having a first upwardly extending open end and a second upwardly extending open end, guide means for guiding a web of textile material in extended state into said first open end, web removal means for continuously removing a web of textile material from said second open end and means for continuously passing a web of textile material in extended state into said first open end, through said conduit and out of said second open end comprising a compartment surrounding said first open end and adapted to continuously feed treating liquid into said conduit through said first open end, means for continuously feeding treating liquid to said compartment and means for continuously discharging treating liquid from said second open end so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

15. Apparatus in accordance with claim 14 in which said second open end is of smaller cross section than said first open end.

16. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width and having a first upwardly extending open end and a second upwardly extending open end, guide means for guiding a web of textile material in extended state into said first open end, web removal means for continuously removing a web of textile material from said second open end, means for automatically adjusting the web removal by said web removal means to the rate with which a web of textile material continuously passing through said conduit is discharged at said second open end and means for continuously passing a web of textile material in extended state into said first open end, through said conduit and out of said second open end comprising a compartment surrounding said first open end and adapted to continuously feed treating liquid into said conduit through said first open end, means for continuously feeding treating liquid to said compartment and means for continuously discharging treating liquid from said second open end so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

17. Apparatus in accordance with claim 16 in which said second open end is of smaller cross section than said first open end.

18. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width and having a first upwardly extending open end and a second upwardly extending open end, guide means for guiding a web of textile material in extended state into said first open end, a web removal wheel above said second open end, driving means for said removal wheel, a pivotally mounted arm, one end of said arm carrying a slidable weight, the other end of said arm carrying rotatably mounted thereon said removal wheel and means for continuously passing a web of textile material in extended state into said first open end, through said conduit and out of said second open end and comprising a compartment surrounding said first open end and adapted to continuously feed treating liquid into said conduit through said first open end, means for continuously feeding treating liquid into said compartment and means for continuously discharging treating liquid from said second open end so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

19. Apparatus in accordance with claim 18 in which said second open end is of smaller cross section than said first open end, in which said first open end carries on top a funnel shaped overflow rim and in which said means for continuously discharging treating liquid from said conduit are connected to said means for continuously feeding treating liquid to said compartment so as to return treating liquid from the discharge means to said compartment.

20. Apparatus for the continuous wet treatment of textile material in web form comprising a

conduit possessing a small depth in relation to its width and having a first upwardly extending open end and a second upwardly extending open end, guide means for guiding a web of textile material in extended state into said first open end, and a web removal wheel above said second open end, driving means for said removal wheel, a pivotally mounted arm, one end of said arm carrying a slidable weight, the other end of said arm carrying rotatably mounted thereon said removal wheel, a heating space at least in part bound by said conduit and said first and second open end, means for circulating a heating medium through said heating space and means for continuously passing a web of textile material in extended state into said first open end, through said conduit and out of said second open end comprising a compartment surrounding said first open end and adapted to continuously feed treating liquid into said conduit through said first open end, means for continuously feeding treating liquid to said compartment and means for continuously discharging treating liquid from said second open end so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit.

21. Apparatus in accordance with claim 20 in which said second open end is of smaller cross section than said first open end, in which said first open end carries on top a funnel shaped overflow rim and in which said means for continuously discharging treating liquid from said conduit are connected to said means for continuously feeding treating liquid to said compartment so as to return treating liquid from the discharge means to said compartment.

22. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a first compartment surrounding said first opening and adapted to continuously feed treating liquid into said conduit through said first opening, said first opening forming a treating liquid overflow on said conduit, means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit and comprising two opposing slots, one on each of the small sides of said conduit, a second compartment surrounding said outlet and adapted to receive treating liquid discharged from said conduit through said slots and means for continuously removing treating liquid from said second compartment, said treating liquid outlet being on a lower horizontal plane than said treating liquid inlet so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit, said means for continuously removing treating liquid from said second compartment being connected to said means for continuously feeding treating liquid into said first compartment so as to return treating liquid from said second to said first compartment.

23. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through, and out of said conduit, said means comprising a first compartment surrounding said first opening, two opposing treating liquid discharge ducts in said first compartment extending with their lower portion downwardly into said conduit through said first opening and forming a slot adapted to receive and guide a web of textile material in extended state, each of said discharge ducts being adapted to continuously inject a separate stream of treating liquid downwardly into said conduit through said first opening, means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit and comprising two opposing slots, one on each of the small sides of said conduit, a second compartment surrounding said outlet and adapted to receive treating liquid discharged from said conduit through said outlet slots and means for continuously removing treating liquid from said second compartment, said treating liquid outlet being on a lower horizontal plane than said treating liquid inlet so as to create a continuous treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit, said means for continuously removing treating liquid from said second compartment being connected to said means for continuously feeding treating liquid into said first compartment so as to return treating liquid from said second to said first compartment.

24. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through and out of said conduit, said means comprising a compartment surrounding said first opening and adapted to continuously feed treating liquid into said conduit through said first opening, said first opening forming a treating liquid overflow into said conduit, means for continuously feeding treating liquid into said compartment, a treating liquid outlet at the other end of said conduit and comprising two opposing slots, one on each of the small sides of said conduit, suction means connected to said outlet slots for continuously removing treating liquid from said conduit through said slots so as to create a treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in

extended state and continuously propel the same through said conduit, said suction means being connected to said means for continuously feeding treating liquid into said compartment so as to return treating liquid from said suction means to said compartment.

25. Apparatus for the continuous wet treatment of textile materials in web form comprising a conduit possessing a small depth in relation to its width, a first opening at one end of said conduit for continuously admitting a web of textile material in extended state, a second opening at the other end of said conduit for continuously discharging a web of textile material in extended state and means for continuously passing a web of textile material in extended state into, through, and out of said conduit, said means comprising a compartment surrounding said first opening, two opposing treating liquid discharge ducts in said first compartment extending with their lower portion downwardly into said conduit through said first opening and forming a slot adapted to receive and guide a web of textile material in extended state, each of said discharge ducts being adapted to continuously inject a separate stream of treating liquid downwardly into said conduit through said opening, means for continuously feeding treating liquid into said first compartment, a treating liquid outlet at the other end of said conduit and comprising two opposing slots, one on each of the small sides of said conduit, suction means connected to said outlet slots for continuously removing treating liquid from said conduit through said slots so as to create a treating liquid current in said conduit, said conduit being so dimensioned in its proportions of depth to width that said treating liquid current is sufficient to frictionally engage a web of textile material in extended state and continuously propel the same through said conduit, said suction means being connected to said means for continuously feeding treating liquid into said compartment so as to return treating liquid from said suction means to said compartment.

26. Method for the continuous wet treatment of textile materials in web form comprising continuously contacting a web of textile material in extended state in frictional engagement with treating liquid continuously flowing in a narrowly confined stream in one direction, thereby continuously propelling said web of textile material in extended state in frictional engagement with and substantially immersed in said treating liquid and substantially continuously removing said web of textile material from said treating liquid.

WILH. DÜRSTELER.