

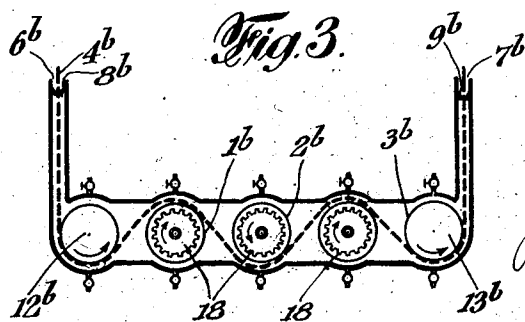
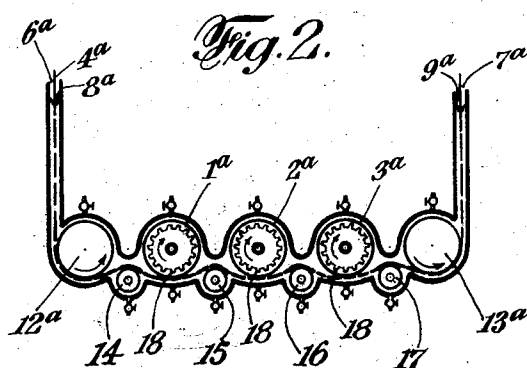
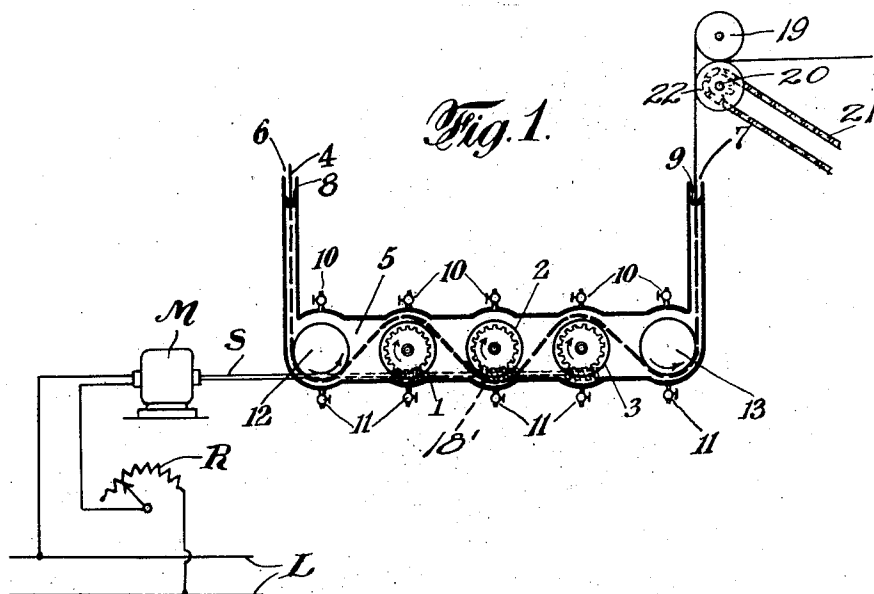
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MACHINE FOR AND METHOD OF DYEING CLOTH AND OTHERWISE TREATING TEXTILES

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MACHINE FOR AND METHOD OF DYEING CLOTH AND OTHERWISE TREATING TEXTILES.

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This invention relates to a method and machine for treating textiles or similar materials with a fluid and the general object thereof is to provide such a method and machine that textiles may be treated with the fluid more thoroughly and uniformly, as well as more quickly, than heretofore.

drawing and will be particularly pointed out in the claims.

The drawings illustrate types of a machine invented and adapted to carry out the process which I have invented.

In the drawings—

Fig. 1 illustrates a machine designed to treat textiles of heavy or medium weight, with all of the active rolls running in the same direction.

Fig. 2 illustrates a machine designed to treat textiles of medium or light weight.

Fig. 3 illustrates a machine similar to that shown in Fig. 1 except that the center active roll is moving in the direction opposite to the directions of movement of the other active rolls.

Each of the machines illustrated in the accompanying drawings was invented with a view to having a machine which is extremely simple and easily made, but one which will adequately accomplish the function of forcing a fluid such as dye liquor, through a textile such as cloth. In the machine I make use of the so called skin friction of a body moving in a fluid, a phenomenon which is extremely old, but which has never before been made use of in the treatment of a textile with a fluid.

It is well known that when a body is moving through a fluid, a layer of the fluid adjacent the body moves with the body, forming a moving stream of the fluid. This is due to the friction, called the skin friction, between the surface of the body and the fluid. The stream of fluid formed by a slowly moving body is negligible, but a rapidly moving body will impart considerable speed to quite a large mass of fluid which therefore possesses a large amount of kinetic energy. If an article is interposed in the path of this moving mass of fluid, pressure is exerted against the article which may be used to deflect and to direct the course of the stream to an extent depending upon the resistance which the article offers to the stream. If the rapidly moving stream is impeded its energy may be utilized to create a fluid pressure and if the stream is directed into an enclosure an appreciable fluid pressure is built up within the enclosure.

Thus, when a roll or similar element is rapidly revolving in a fluid, a layer of the fluid surrounds the roll due to the skin

As an example of the operation of the method and the machine, reference will be made to a method and machine for dyeing cloth. It is to be understood however, that the example is only illustrative of the many adaptations of the invention.

While studying and seeking to improve the methods now in use for dyeing cloth and otherwise treating textiles, I concluded that in order to secure uniform dyeing or treatment of the textile it is necessary for each individual fiber of the textile to be treated thoroughly with the dye or treating fluid, and in order to make such a treatment feasible for practical commercial operation some simple method, and apparatus for carrying out the method, would have to be invented. Therefore, I devised my new method and apparatus for treating textiles.

This method consists in part in continually changing the fluid in contact with the textile while it is undergoing treatment and one of the objects of my invention is the provision of a new method of circulating the fluid through the textile, so that the spent fluid is swept out of the textile and out of contact with the fibers and its place taken by fresh fluid.

Another object of the invention is to provide a machine of the above type which will so drive the fluid against the textile that the fluid will not only pass through the interstices of the textile, but penetrate and pass through the threads from which the textile is made so that the fluid in contact with the individual fibers is continually changed.

Another object of the invention is to provide a simple machine so designed that when operated as intended in conjunction with a textile to be treated, for instance with a cloth to be dyed, it will cause a circulation of the fluid, for instance the dye liquor, through the textile or cloth while the cloth is passed rapidly through the machine.

Other objects and features of the invention will more fully appear from the following description and the accompanying

friction and the greater the speed of revolution of the roll the greater will be the kinetic energy of the fluid and the force or pressure which the layer or stream of the fluid will exert.

Also if a continuous body or element such as a piece of textile is rapidly moved through a fluid, a layer of fluid is drawn with the body in the form of a stream which is similar to the stream formed by the revolution of the roll, except that in the case of the continuous body the stream may be moving in more or less of a straight line and not revolving. The stream of moving fluid in both cases however, possesses kinetic energy which may be utilized.

It will therefore be understood that if a piece of textile such as cloth is placed so closely adjacent to a roll which is rapidly revolving in a fluid, that the textile contacts with or interferes with the free movement of the layer or stream of fluid which is moving with the roll, then the fluid will be driven against and through the textile with great force due to the kinetic energy stored within the revolving fluid layer. Furthermore, if the textile is lead partially around the roll a pocket or enclosure is formed within which the stream of fluid builds up a very appreciable pressure which causes the fluid to pass through the textile.

It will also be understood that if a length of textile is drawn rapidly through the fluid, a body or element may be so placed in the path of the fluid stream drawn with the textile that the stream is directed or deflected against the textile and that the fluid stream may possess sufficient energy to force the fluid through the permeable textile.

Furthermore, the positions of the permeable or textile element and the other element or roll may be and in my machines and method preferably are, so correlated to each other and to the speed of the stream that the stream is so directed that part of the fluid passes through the permeable element and part passes between the elements to form a cushion on which the textile rides over the roll. In the machines which I have invented the stream of fluid is driven between the permeable element and other element (the textile and the roll) where its forward motion is somewhat checked and a pressure developed, which causes part of the fluid to pass through the textile while another part of the fluid passes on between the two elements to hold them apart. Preferably one element is run so fast that its skin friction creates the stream and the second element which is preferably the permeable element is so positioned that it interferes with the stream formed by the first element and is run at such a speed that it creates very little or no stream by itself but impedes the flow of the stream created by

the first element, thus creating a pressure between the elements and causing the fluid to be driven through the permeable element.

In the particular type of machine which I have chosen for the purposes of illustrating in this instance the practice of my method, I provide one or more rolls which contact with the fluid and the textile or cloth to be treated is lead over or under or adjacent the rolls. The rolls are then revolved at such a speed that due to the skin friction, each of the revolving rolls draws a film of the fluid around with it and forms a film of the fluid on the roll between the surface of the roll and the textile. Pressure is preferably exerted on the textile tending to force it toward the surface of the adjacent roll and the roll may be and preferably is revolved so fast that there is always a film of fluid between the surface of the roll and the textile which prevents the textile from touching the roll. Under these conditions the textile is always riding on and enclosing a mass of fluid which is under pressure and which is trying to pass through the textile due to the kinetic energy of the revolving fluid layer. Thus the roll acts as a pump which forces liquid through the textile.

It will be appreciated that there are many speeds at which the rolls may be operated to force the fluid through the textile, which speeds depend upon several varying factors such as the resistance of the textile to the passage of the fluid, the viscosity of the fluid and the smoothness of the surface of the rolls.

Preferably the textile and rolls do not move in the same direction with the same speed so that there is a differential motion between the textile and the adjacent roll which tends to decrease the speed of the fluid stream and builds up a pressure which forces the fluid through the textile. It has been found to be desirable to drive the rolls so fast that their peripheral speed is greater than the speed of the textile in which case the textile causes the decrease in speed of the fluid stream and the consequent building up of the fluid pressure. It has also been found to be desirable in some instances to run the textile and rolls in opposite directions in which case there is obviously a much greater differential motion than where the roll and textile run in the same direction. In this latter case the textile exerts an exceptionally strong retarding effect on the fluid stream.

It may be desirable in some instances to have the cloth touch lightly on the surface of the roll along one line of contact. If this is desired, the rolls may be run more slowly than usual and advantage taken of the fact that the fluid will keep the textile separated from the roll where the fluid first contacts

with the textile, but as the fluid gradually passes through the textile a point is reached, provided the rolls are run slow enough and the textile forced toward the rolls with sufficient pressure, where there is no more fluid to form the fluid layer, it all having been lost by the slowing down effect of its contact with the textile and its leakage there-through. At the point where the fluid has all been lost, the textile will touch the roll.

The fluid may be circulated through the textile in various ways depending upon the course in which the textile is passed adjacent to the rolls and the speed at which the rolls are rotated. The effect of changing the speed of the rolls has been noted above. It is desired to note here that if the textile is run over and under alternative rolls, the fluid may be forced through the textile first from one side and then from the other.

In Fig. 1 of the drawings, three active or pumping rolls, 1, 2 and 3 are shown although any number may be used. They may be driven in either direction, or some of the rolls may be driven in opposite directions, but as illustrated, in this figure, they are all driven clock-wise. The cloth 4, however, is passed over the first of the pumping rolls, under the second roll and over the third roll with the result that the fluid is forced from below the cloth upwardly through it by rolls 1 and 3 and downwardly through the cloth by roll number 2. Thus the direction of the fluid through the textile is reversed during the treatment.

The rolls are preferably mounted in a container 5 totally enclosed except for the openings 6 and 7 through which the textile respectively enters and leaves the container. These openings are preferably of a size only sufficient to permit the free passage of the textile and thus the fluid only contacts with the air at the small openings. To prevent as far as possible the entrance of air into the container flexible closures 8 and 9 may be provided to rest lightly against the moving textile. The prevention of the contact of the air with the fluid may be extremely desirable where the fluid used in the machine is such as would be damaged by contact with the air.

It has been found that in the normal operation of the machine with a fluid such as a water solution of a dye, there is a difference in the head of the fluid of about 6 inches between the openings 6 and 7. The walls of the container at the openings may be extended as far upward as desired and the container filled until the fluid stands in the openings well above the top of the rolls, thus causing the treatment of the textile with the fluid to take place under pressure.

Cocks 10 may be provided to permit the escape of gas entrapped during the filling of the container or the operation of the ma-

chine, or to permit the addition of fluid should such be desired. Cocks 11 are provided for draining the container. Guide rolls 12 and 13 are shown on the machines illustrated in the drawings. They may be used or not as desired, but when used they assist in keeping the textile straight and smooth on the pumping rolls.

Fig. 2 illustrates a machine having the auxiliary guide rolls 14, 15, 16 and 17, which may be used where it is desired to have the liquor pass through the textile in only one direction. The auxiliary rolls may, if desired, be of relatively small diameter as illustrated, so that the textile passes adjacent to only a small part of the circumference of the active or pumping rolls. This arrangement of rolls may be particularly desirable where the textile is very thin, such as chiffon which might be torn if it were passed adjacent to too large a portion of a roll operating at a high speed.

Fig. 3 illustrates a machine which is substantially the same as that shown in Fig. 1 except that the center pumping roll 2^b is revolved counter clock-wise, that is opposite to the pumping rolls 1^b and 3^b. This machine is designed to change the direction of flow of the fluid through the textile but as the textile travels in the same direction as the portion of the roll adjacent which it passes the retarding effect of the textile is not as great adjacent to roll 2^b in Fig. 3 as it is adjacent roll 2 in Fig. 1.

To illustrate the operation of machines of the type disclosed above, I will state that cloth has been dyed, washed, soaped and otherwise treated while passing through the machines at the rate of 34 yards per minute with the rolls, which were 6 inches in diameter, revolving at a speed of 1000 revolutions per minute. The kinetic energy of the fluid stream formed by rolls driven at this speed is enormous and the force with which the fluid is driven against the textile is sufficient to circulate the fluid through the threads which compose the textile and thus secure the treatment of the individual fibers with the fluid.

The rolls may be revolved by any suitable means. For the purposes of illustration the rolls are diagrammatically shown as revolved by gears 18 which are meshed with worm gears 18' which in turn are driven by means of shaft S rotated by motor M. The rheostat R is used for controlling the motor and the power is obtained from the line L. Obviously by selecting the gears any roll may be driven faster or slower than any other roll.

The textile may be drawn through the machine by the rolls 19 and 20. As illustrated, only the bottom roll, which has the greater area of frictional contact with the textile, need be driven and the roll may

conveniently be rotated by the chain 21 and sprocket 22 thus assuring an even and positive tension on the textile.

It has been found that the revolving rolls both stir the fluid and cause its circulation within the container. When the rolls are operated at a high speed the stirring of the fluid is violent. Obviously this stirring and circulation maintains the chemicals, such as the dye, or soaping substances or fillers, very uniformly distributed in the fluid so that the bath contains no localities where the concentration of the chemicals is high nor where the concentration is low. It has been found that in instances where fresh dye, or other chemicals or substances are introduced at one end of the container to make up for those absorbed by the textile, they are almost instantly distributed throughout the entire fluid. The fluid within the container circulates in the direction of revolution of the largest uncovered area of the rolls, provided the rolls are revolved at the same speed. For example, in Fig. 1 the fluid would circulate from right to left along the bottom of the container and from left to right along the top of the container because the two pumping rolls numbered 1 and 3 have their uncovered portions moving from right to left at the bottom of the container and the single roll numbered 2 has its uncovered portion moving from left to right along the top of the container. Guide rolls usually do not operate at a speed which is high enough to affect materially the action of the pumping rolls in circulating the fluid. In Fig. 2 the circulation of the fluid obviously would be from right to left along the bottom of the container and from left to right along the top of the container for the same reasons as stated above and in Fig. 3 the circulation would be of the same directions.

Preferably when the machine is operated for the purpose of dyeing cloth the container is completely filled with the dye liquor. Such a condition is not absolutely necessary however, as the rolls will pick up a film of fluid providing they contact at any point with the fluid.

By the words "fluid stream" occurring in the specification and claims I mean such a stream as is set up by a body moving through the fluid at a high rate of speed and not at the usual speeds at which cloth is moved through jigs etc. in the usual processes of dyeing or otherwise treating a textile with a fluid.

In using the word "textile" throughout the specification and claims I have had in mind the definition of the word appearing in Webster's International Dictionary, namely, "that which is, or may be woven, a woven fabric or a material for weaving," because the machine and process are appli-

cable not only to the handling and treating of woven, knitted, or braided fabrics, but also a series of warps of other suitable yarns from a beam, thus treating the yarns in a similar manner to fabrics.

By the term "roll" as used in the specification and claims, I mean to include a smooth or substantially smooth roll which, when rotated in a fluid at a relatively high rate of speed, forms a stream of the fluid next to the surface of the roll primarily by friction, and to exclude paddle wheels or similar devices which are driven at the usual relatively slow speed to splash the fluid or move it due to the pushing action of the impellers.

Although a particular and preferred form of the invention has been described, it is recognized that modifications may be made and it is distinctly to be understood that the invention is to be construed as broadly as the limitations in the claims taken in conjunction with the prior art may allow.

I claim:

1. In a method of dyeing a textile with a fluid dye, the step which includes passing the textile adjacent a roll contacting with the dye, said roll having such a movement that there is differential motion between the roll and the textile sufficient to force the fluid against the textile.

2. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid, said roll having a greater peripheral speed than the speed at which the textile is moving and sufficient to force the fluid against the textile.

3. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and revolving the roll at such a rate of speed that a film of the fluid is maintained between the roll and the textile.

4. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and revolving the roll at such a rate of speed that a fluid film is maintained on the surface of the roll and is of sufficient thickness to prevent the textile from touching the roll.

5. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and revolving the roll at such a rate of speed that the fluid is forced through the textile.

6. In a method of treating a textile with a fluid the step which includes passing the textile adjacent a roll contacting with the fluid and revolving the roll at such a rate of speed that the fluid is forced against the textile.

7. In a method of treating a textile with a fluid, the step which includes passing the

textile adjacent a roll contacting with the fluid and so revolving the roll with regard to speed and direction of motion relative to the fabric that a fluid film is maintained on the surface of the roll, and that a portion of the fluid is forced through the textile.

8. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and so revolving the roll with regard to speed and direction of motion relative to the fabric that a fluid film is maintained on the surface of the roll, which film is of sufficient thickness to prevent the textile from touching the roll, and that a portion of the fluid is forced through the textile.

9. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and revolving the roll at such a rate of speed that a fluid film is maintained on the surface of the roll which film is of sufficient thickness to prevent the textile from touching the roll, and that a portion of the fluid from the film is forced through the textile.

10. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and revolving the roll at such a rate of speed that a fluid film is maintained between the roll and the textile and a portion of the fluid from the film is continually forced through the textile.

11. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and moving the surface of the roll in the direction different from the direction of movement of the textile with sufficient speed to force the fluid against the textile.

12. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a roll contacting with the fluid and moving the surface of the roll in a direction opposite to the direction of movement of the textile and at such a rate of speed that a film of the fluid is maintained between the roll and the textile.

13. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a plurality of rolls contacting with the fluid, at least one of the rolls revolving in a direction different from the direction of movement of the textile and at such a speed as to force the fluid against the textile.

14. In a method of treating a textile with a fluid, a step which includes passing the textile adjacent a plurality of rolls contacting with the fluid, the surface of at least one of the rolls having a greater speed than the speed at which the textile is moved and sufficient to force the fluid against the textile.

15. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent a plurality of rolls contacting with the fluid, at least one of the rolls revolving in a direction opposite from another and at a speed sufficient to force the fluid through the textile.

16. The method of circulating a fluid through a permeable element which includes providing two elements one of which is permeable to the fluid, moving one of the elements in the fluid with sufficient speed to draw with it by friction sufficient fluid to form a moving stream, and so interposing the other element in the path of said stream that the fluid is directed against the permeable element.

17. The method of circulating a fluid through a permeable element which includes providing two elements one of which is permeable to the fluid, pressing one of the elements toward the other, and moving one of the elements in the fluid and adjacent the other element with sufficient speed to draw with it by friction sufficient fluid to form a continuous moving stream tending to hold the elements apart.

18. The method of circulating a fluid through a permeable element which includes providing two adjacent elements one of which is permeable to the fluid, and moving one of the elements in the fluid with sufficient speed to draw with it by friction sufficient fluid to form a continuous moving stream exerting pressure on the elements.

19. A machine for treating a textile with a fluid comprising a container for the fluid, a roll within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container and means adapted to so drive the roll that there is such differential movement between the textile and the periphery of said roll as to force the fluid against the textile.

20. A machine for treating a textile with a fluid comprising a container for the fluid, rolls within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container and means adapted to so drive the rolls that there is such differential movement between the textile and the periphery of an adjacent roll as to force the fluid against the textile.

21. A machine for treating a textile with a fluid comprising a container for the fluid, a roll within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container and means adapted to so drive the roll that the textile and the periphery of the roll move in opposite directions at such speed as to force the fluid against the textile.

22. A machine for treating a textile with a fluid comprising a container for the fluid, rolls within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the machine and means adapted to so drive the rolls that the periphery of at least one roll moves in the direction opposite to the direction of movement of the textile and at such a speed as to force the fluid against the textile.

23. A machine for treating a textile with a fluid comprising a fluid container, a roll within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container, and means adapted to drive the roll at a peripheral speed greater than the speed at which the textile moves and sufficient to force the fluid against the textile.

24. A machine for treating a textile with a fluid comprising a container for the fluid, a roll within the container in contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container, and means adapted to move the roll at such a rate of speed that a film of the fluid is maintained between the roll and the textile.

25. A machine for treating a textile with a fluid comprising a container for the fluid, a roll within the container in contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container, and means adapted to move the roll at such a rate of speed that a film of the fluid is maintained between the roll and the textile and is of sufficient thickness to prevent the textile from touching the roll.

26. A machine for treating a textile with a fluid comprising a container for the fluid, a roll within the container in contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container and means adapted to move the roll at such a rate of speed that the fluid is forced through the textile.

27. A machine for treating a textile with a fluid comprising a container for the fluid, rolls within the container in contact with the fluid and adjacent which the textile passes with different sides of the textile next to different rolls, means adapted to pass the textile through the container, and means adapted to move the rolls in opposite directions at such rates of speed that the fluid is passed through the fabric first in one direction and then in another.

28. The method of treating a penetrable element with a fluid which includes providing two elements, one of which is penetrable by the fluid, moving one of the elements in the fluid with sufficient speed to draw with it by friction sufficient fluid to form a moving

stream, and so interposing the other element in the path of said stream that the fluid is directed against the penetrable element.

29. The method of treating a penetrable element with a fluid which includes providing two adjacent elements one of which is penetrable by the fluid, and moving one of the elements in the fluid with sufficient speed to draw with it by friction sufficient fluid to form a continuous moving stream exerting pressure on the elements.

30. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent to a roll contacting with the fluid and revolving the roll at such a rate of speed that the roll draws with it by friction a sufficient film of fluid to maintain the film between the textile and the roll throughout the area where the textile is adjacent to the roll.

31. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent to a roll contacting with the fluid and revolving the roll at such a rate of speed as to create a sufficient stream of fluid substantially parallel to the surface of the roll to maintain a film of the fluid between the textile and the roll throughout the area where the textile is adjacent to the roll.

32. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent to a roll contacting with the fluid and revolving the roll at such a rate of speed that the roll draws with it by friction a film of fluid having sufficient force to penetrate the textile.

33. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent to a roll contacting with the fluid and revolving the roll at such a rate of speed that the roll draws with it by friction a film of fluid having sufficient force to permeate the textile.

34. In a method of treating a textile with a fluid, the step which includes passing the textile adjacent to a roll contacting with the fluid and revolving the roll at such a rate of speed as to create a stream of fluid substantially parallel to the surface of the roll and having sufficient force to permeate the textile.

35. A machine for treating a textile with a fluid, including a fluid container, a roll within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container, and means adapted to revolve the roll at such a rate of speed that the roll draws with it by friction a sufficient film of fluid to maintain the film between the textile and the roll throughout the area where the textile is adjacent the roll.

36. A machine for treating a textile with a fluid including a fluid container, a roll

within the container for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the machine and means adapted to revolve the roll at such a rate of speed as to create a sufficient stream of fluid substantially parallel to the surface of the roll to maintain a film of fluid between the textile and the roll throughout the area where the textile is adjacent to the roll.

37. A machine for treating a textile with a fluid including a fluid container, a roll for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the machine and means adapted to revolve the roll at such a rate of speed that the roll draws with it by friction a film of fluid having sufficient force to penetrate the textile.

38. A machine for treating a textile with a fluid, including a fluid container, a roll

for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the container, and means adapted to revolve the roll at such a rate of speed that the roll draws with it by friction a film of fluid having sufficient force to permeate the textile.

39. A machine for treating a textile with a fluid including a fluid container a roll for contact with the fluid and adjacent which the textile passes, means adapted to pass the textile through the machine and means adapted to revolve the roll at such a rate of speed as to create a stream of fluid substantially parallel to the surface of the roll and having sufficient force to permeate the textile.

In testimony that I claim the foregoing, I have hereunto set my hand this 17th day of December 1925.

WALLACE PATTEN COHOE.