

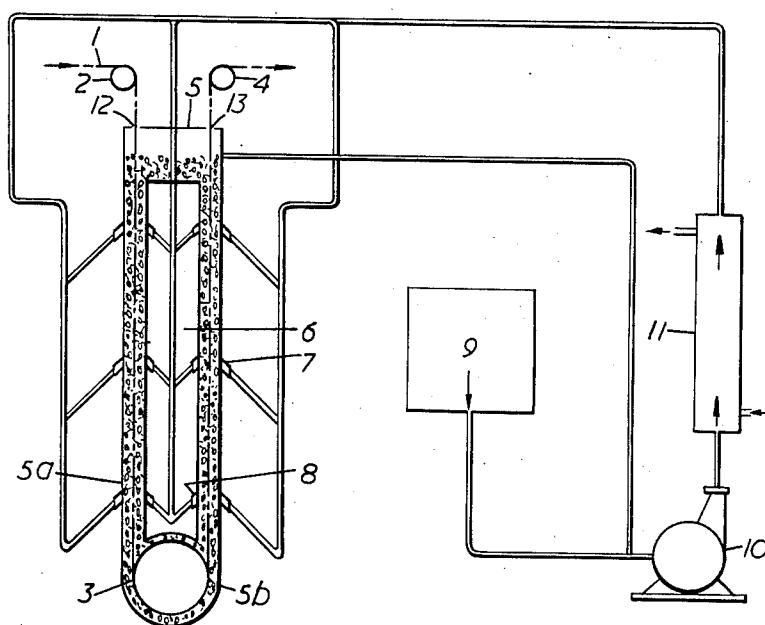
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V. B. CHIPALKATTI ETAL

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METHOD OF APPLICATION OF FLUIDS TO TEXTILE MATERIALS

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Vasant B. Chipalkatti & Shri K. Manivannan
Inventors

Pollard, Johnston, Smythe & Robertson
By

Attorneys

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METHOD OF APPLICATION OF FLUIDS TO TEXTILE MATERIALS

Vasant B. Chipalkatti and Krishnan Manivannan, Delhi, India, assignors to Shri Ram Institute for Industrial Research, Delhi, India, a society of India
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This invention relates to an improved method of and apparatus for application of fluids to textile and like materials. The term textile materials refers to and includes webs, yarns or fabrics made of natural or artificial (synthetic) fibres.

It is customary in many textile treatments to apply fluids to such materials with a view to obtain many effects. It has been known that the manner and efficiency of such application determines ultimately the efficiency and economy of the particular process. In the case of application of liquids to textiles the efficiency of agitation of the liquor and the desirability of having a low volume container for holding the impregnation liquors has been generally recognised in the industry for a long time and many devices have been suggested from time to time with varying degree of success.

The object of the present invention is to propose a method of and means for application of fluids to textile and like materials where the better intimate contact and penetration are attained in a novel manner.

According to this invention the method of application of fluids to textile materials consists in the passage of the said material and like through a column of solid discrete particles fluidised by means of the fluid which is to be applied to the said materials.

According to another embodiment of this invention, the material is passed through a fluidised bed of solid discrete particles by means of fluids wherein the fluids are adapted to impinge on the said material at an angle through nozzles, slits or the like, such angle may be 80 to 90°.

It has been found by experiments that better results are obtained if the material is passed through a column of sand, glass or porcelain beads, fluidised by means of the impregnating liquor, the movement of the material under treatment being from top to bottom of the column and upwards. The mechanical absorption of the liquor by the textile material as well as the extent of mass transfer of the dissolved chemicals such as dyes from the liquid to the textile materials are very much better than could be the case if the liquor was stationary or if it was agitated in the absence of the fluidised solid particles.

It has further been found that increase in temperature of the impregnating liquor, decrease in the particle size of the fluidised solid particles and increase in the liquor velocity are the factors which help in obtaining better mass transfer and absorption. We have particularly found the following ranges suitable for most textile impregnations:

- (i) Liquor velocity: 2 to 30 ft. per sec.
- (ii) Particle size: 5 to 80 mesh (3962 to 176 microns)
- (iii) Temperature: 20 to 95° C.

The invention will now be more fully described with reference to the accompanying drawing which shows schematically the apparatus for carrying out the invention.

Referring to the drawing of apparatus for carrying out the invention, in this the fabric 1 is passed over the guide roller 2, enters the fluidised bed unit 5 through a slit 12, down through the left hand column 5a, around the bottom guide roller 3, up through the right hand column 5b, leaving the fluidised bed unit 5 through a slit 13, and around the guide roller 4. The fluidising medium is supplied to the fluidised bed unit through banks of nozzles or slits 7 provided on the walls of the fluidised bed chamber, and

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through the banks of nozzles or slits 8 provided on the walls of the central hollow chamber 6. 9 is the fluid storage tank, 10 is the fluid recirculation pump and 11 is the heat exchanger either for cooling or for heating the fluid used for fluidisation.

In carrying out the process jets of fluidising medium supplied through the nozzle or slits strike the fabric nearly at right angles and hence the component of the velocity of these jets normal to the fabric is nearly equal to the full velocity of the jets and hence the velocity of the jets is better utilised in bringing about the contact between the textile material and the fluidising medium, which in turn effects reduction in the required time of contact, and hence effects reduction in the height of the fluidised bed unit followed by reduction in the quantities of the solid particles and the fluidising medium.

When the fluidising medium is a vapour or a gas, this method of supplying vapour or gas makes it possible to use any height to diameter ratio of the fluidised bed without any difficulty of slugging.

When the fluidising medium is a treating liquor, this means of supplying the treating liquor improves the penetration of the same in the textile or like material to be treated and effects a great reduction in the volume of the treating liquor in the treating unit, such as is well known, especially in the continuous wet treatment of textiles, to effect a great economy.

The method and means of impregnation described above have the following advantages:

(i) Due to the presence of the solid particles inside the impregnation chamber, the volume of liquor required is considerably reduced resulting in obvious economy.

(ii) The fluidised solid particles help agitation so that the contacting of the liquor with the textile material is more efficient.

(iii) The impregnation liquor itself serves as the fluidising medium, thus obviating the need for any external fluidising medium.

(iv) Due to the above factors, the time of impregnation is substantially reduced, thus giving greater production per unit time without affecting the quality of thoroughness or uniformity of impregnation.

(v) In processes such as dyeing, bleaching or scouring where the efficiency of the process depends on better diffusion or mass transfer of the dissolved particles of the treating chemical, this novel means of impregnation improve both efficiency as well as quality.

This invention can be used in all processes where a continuous web of textile or similar filament or sheet materials is to be impregnated with liquids. It includes processes such as dyeing, scouring, bleaching, finishing, mercerising etc. but does not exclude other similar processes.

Example 1

A cotton drill material (6 ozs. per yard), scoured, bleached and mercerised, was passed through the fluidised bed column containing solid discrete particles of quartz sand —20, 140 mesh (832–355 microns) fluidised by means of an aqueous solution (one percent) of dye Chlorazol Sky Blue FFS (Colour Index No. 518). The velocity of the dye liquor flowing through the nozzles was 15 ft. per second while it was maintained at 80° C. The time required for the material to pass through the column was only 1 second. This was given a cold water rinse and dried.

The dyeing thus obtained showed good penetration into the material and was uniform throughout. The fastness properties compared with the normal dyeing method.

Example 2

A cotton poplin material (3½ ozs. per yard) scoured bleached and mercerised, was passed through the fluidised

bed column containing solid discrete particles of quartz sand —20, 40, mesh (832–355 microns) fluidised by means of reduced vat dye solution (leuco) of one gramme per litre strength. The dye used was Caledon Jade Green XBN 2100 Powder fine which was reduced in the normal way and diluted to obtain 0.1 percent solution. The dye solution was fed through the nozzles at 10 ft. per second and the temperature of solution being 80° C. The cloth was given usual after-treatments and dried.

The dyeing thus obtained showed good penetration into the material and was even throughout. The other properties were comparable with the normally dyed sample.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. An improved method of treating textile material which comprises continuously passing a length of the material through a vertically elongated column containing a bed of fluidizable discrete solid particles while continuously flowing a textile treating fluid into and through said column at a velocity sufficient to overcome the gravitational force on said particles and maintain them in a fluidized state, said fluid being injected into said column in the form of jets directed oppositely into said bed, each with an upward component of motion, and impinging oppositely against opposite sides of the material in the column at an angle to the material.
2. A method as claimed in claim 1, said fluid being a gaseous textile treating agent.
3. A method as claimed in claim 1, said fluid being a liquid textile treating agent.
4. A method as claimed in claim 1, said angle being nearly a right angle.
5. A method as claimed in claim 1, said angle being one of approximately 80° to 90°.
6. A method as claimed in claim 1, and continuously taking off said fluid from an upper region of said column and circulating said fluid back into said column in said jets.
7. A method as claimed in claim 6, and continuously recirculating into said column with said fluid particles taken off by said fluid from said bed.
8. A method as claimed in claim 1, said fluid being injected in said jets at a velocity of between 2 and 30 feet per second.
9. A method as claimed in claim 1, said fluid being injected at a temperature in the range of about 20° to about 180° C.
10. An improved method of treating textile material which comprises continuously passing a length of the material through a vertically elongated column contain-

ing a bed of fluidizable discrete solid particles while continuously flowing a textile treating fluid into and through said column at a velocity sufficient to overcome the gravitational force on said particles and maintain them in a fluidized state, said fluid being injected into said column at each of a plurality of vertically spaced levels in said column in the form of jets directed oppositely into said bed, each with an upward component of motion, and impinging oppositely against opposite sides of the material in the column at an angle to the material, whereby said particles are kept fluidized and the material is intimately treated by said fluid in a plurality of superposed zones encompassing the effective height of said column.

11. A method of treating textile material which comprises continuously passing a length of the material through a vertically elongated column containing a bed of fluidizable discrete solid particles of a substance selected from a group consisting of glass, ceramics and silica, the sizes of said particles being in the range of 3692 and 176 microns, and continuously flowing a textile treating liquid into and through said column at a velocity sufficient to overcome the gravitational force on said particles and maintain them in a fluidizable state, said liquid being injected into said column at each of a plurality of vertically spaced levels in said column in the form of jets directed oppositely into said bed at a velocity of between 2 and 30 feet per second, each of said jets being introduced with an upward component of motion, said jets at each level being impinged oppositely against opposite sides of the material in the column at an angle of approximately 80° to 90° to the material, and continuously taking off said liquid from a region of said column above the levels of said jets and circulating said liquid back into said column in said jets, whereby said particles are kept fluidized and the material is intimately treated by said liquid in a plurality of superposed zones encompassing the effective height of said column.

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