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Bergholtz

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[54] **METHOD FOR TREATING TEXTILE MATERIAL WITH A LIQUID**

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[52] **U.S. Cl.** **8/155.1,** 68/27, 68/189

[51] **Int. Cl.** **B05c 8/02**

[58] **Field of Search** 8/154, 155, 155.1, 8/155.2; 68/27, 189

[56] **References Cited**

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[57] **ABSTRACT**

In dyeing processes the velocity of the dyeing liquid when passing through the material to be treated is important. The forcing of the liquid through the material imposes a heavy load upon the pump, and it has been found, that a more uniform dyeing is obtained with less expenditure of power if the dyeing apparatus is provided with at least two compartments into which the bulk of material to be treated may be placed in two smaller batches. The two compartments are alternatingly connected to the pump, in such a manner that one compartment will always contain flowing liquid while the other contains liquid at rest. The term for switching over may be selected with respect to the material to be treated and the type of dyestuff, but each period of activity should be sufficient long to permit a complete substitution of the liquid within the compartment.

6 Claims, 6 Drawing Figures

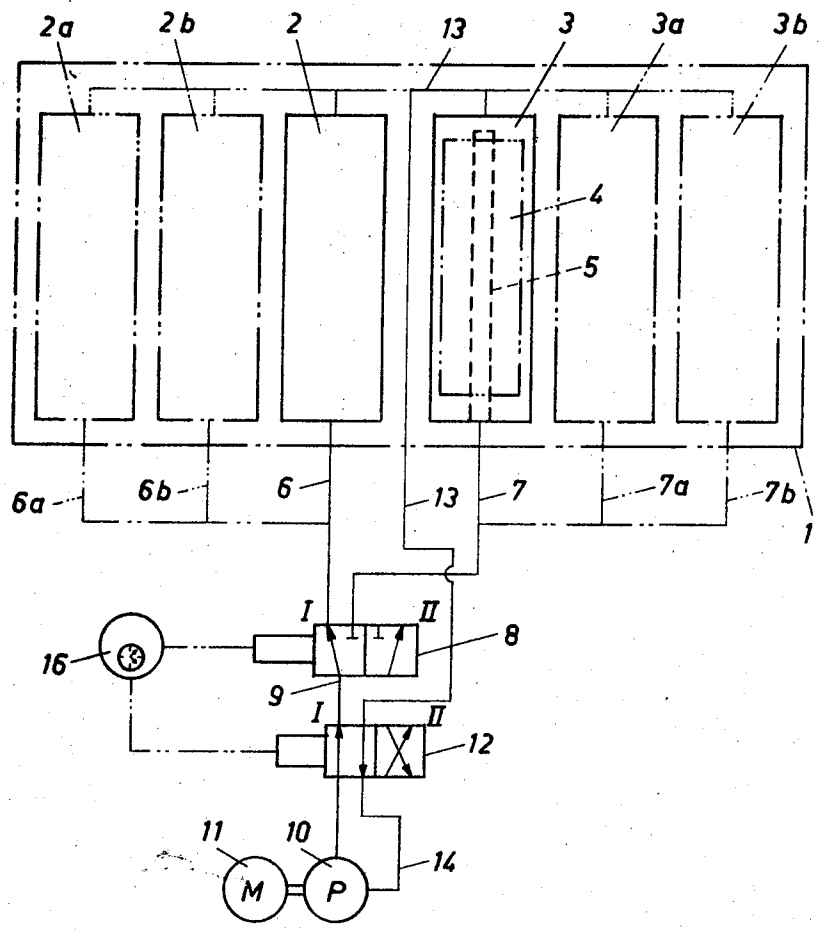


FIG. 1

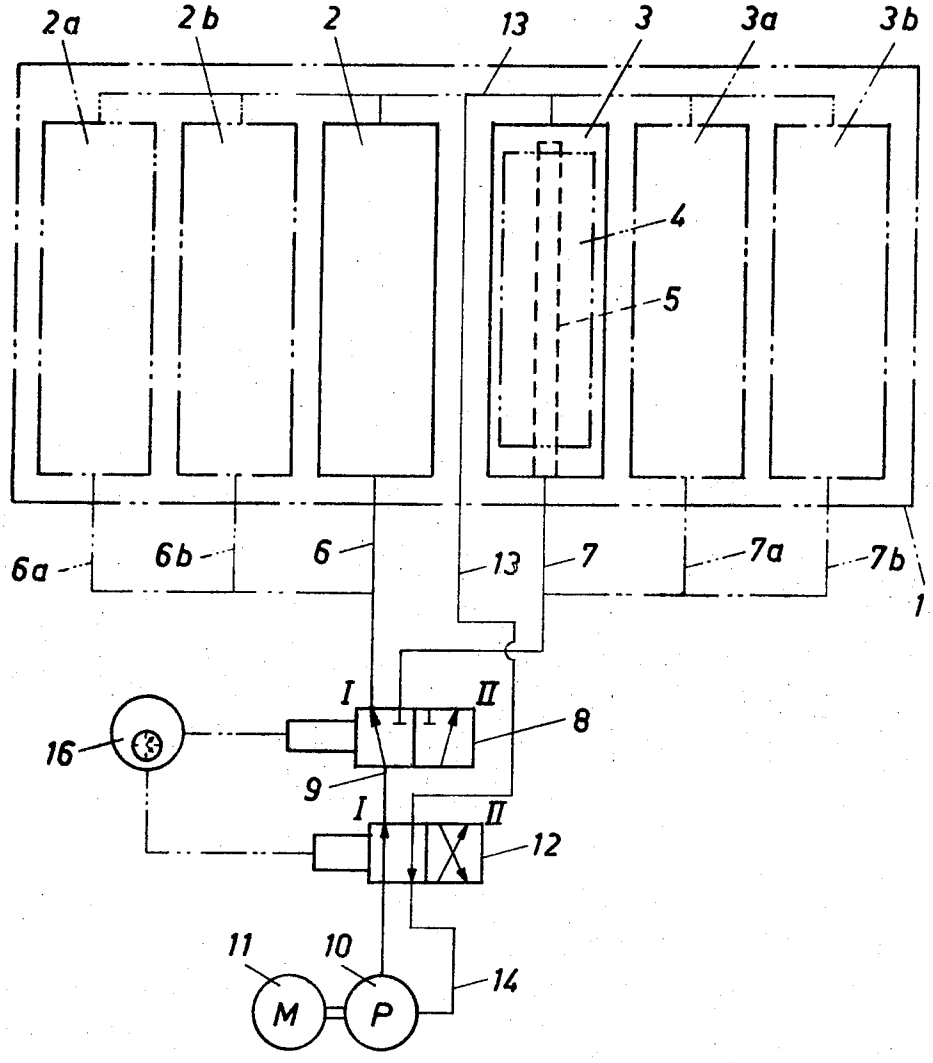


FIG.2

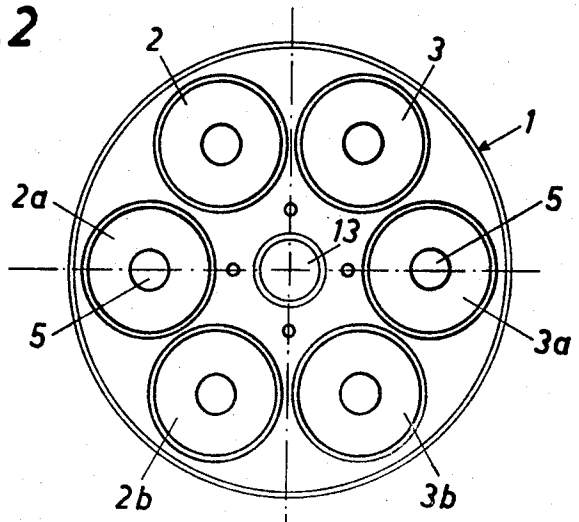
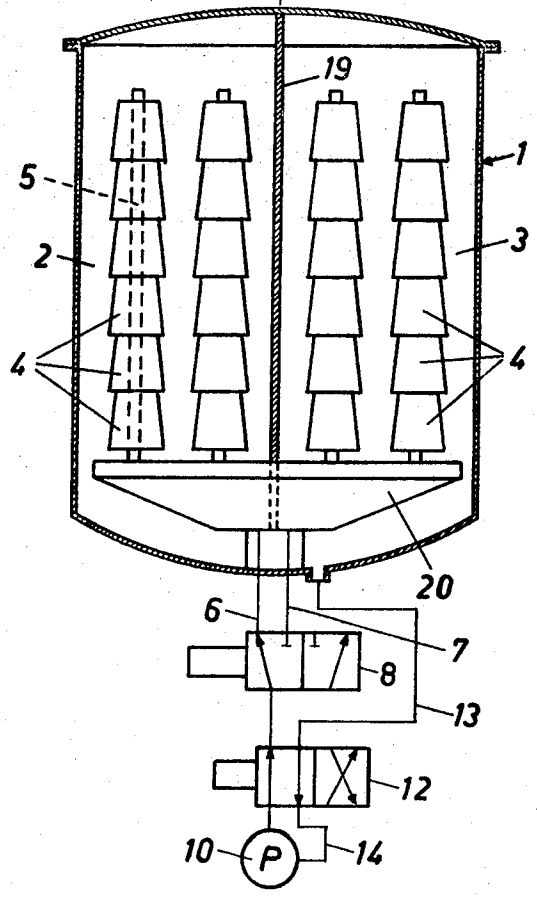


FIG.6



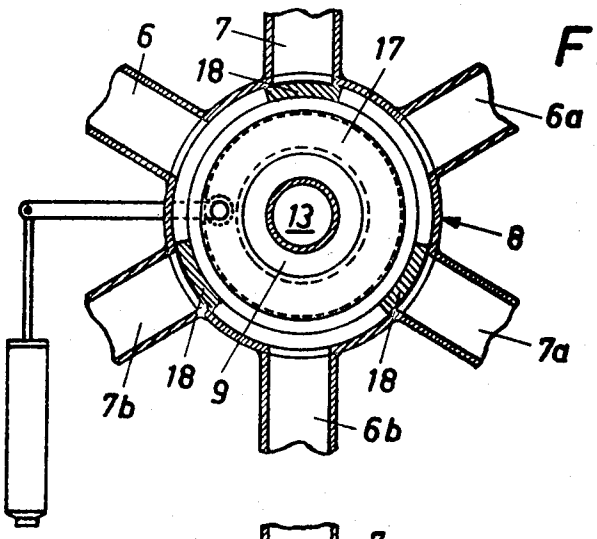


FIG. 3

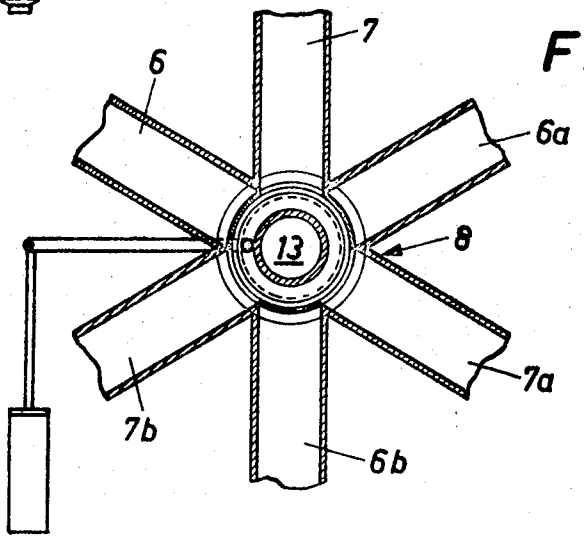


FIG. 4

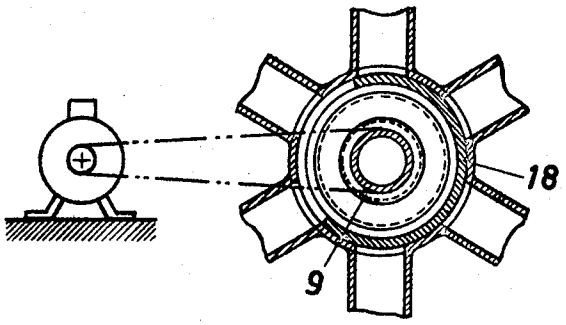


FIG. 5

METHOD FOR TREATING TEXTILE MATERIAL WITH A LIQUID

The present invention refers to a method for treating textile material with a liquid for washing, bleaching, dyeing, rinsing or similar purposes, the material which may be in loose or worked shape during the treatment being disposed in two compartments or series of compartments in a manner to be completely covered by the treating liquid which is made to flow through the material.

With earlier methods the material, which could be wound on perforated cylinders or be disposed in perforated baskets, was placed in an autoclave. When dyeing yarn the latter is wound upon perforated bobbins a series of which are secured on a rod or other core member. A number of such units are arranged within the autoclave in such a manner that the treating liquid may alternatingly be forced from within the bobbins outwards through the yarn, or from outside the yarn inwards to the bobbins. The volume of liquid which in this manner will flow through the material will in plants of conventional designs amount to 15 – 20 litres pr kg of material and minute which means that the liquid within the autoclave will be circulated through the material 1,5 – 2 times per minute.

When a treating liquid containing dyestuff is brought to flow through a textile material, for instance from the inside and outwards it will attain its highest velocity at the location where the roll of material has the smallest diameter. The velocity of the liquid will thus decrease with increasing diameter of the roll. The nature of the dye-stuff and the speed of reaction thereof with the textile material to be treated must also be taken into account. The speed of reaction depends upon the temperature and upon the kind of chemicals present. If the speed of reaction during a dyeing operation is too high the content of dyestuff in the treating liquid will fall off rapidly, which means that the dyeing of the material adjacent to the inlet for the liquid will be heavier than in the remainder of the ulk of material to be treated. An important factor further is the numer of times the liquid within the autoclave is exchanged during a treating period. In order to obtain an even dyeing of the material it is important that the speed of reaction is governed with respect to the flow velocity in such a manner that the content of dyestuff in the liquid, after the passage thereof through the material, has not sunk more than permitted, with respect to the flow velocity. If a rapid treatment is required the flow velocity or the exchange within the autoclave thus must be increased to correspond with the increased speed of reaction. This imposes a heavy load on the pump for circulating the liquid which means high costs for installation and running.

The aim of the present invention is to propose a method according to which these drawbacks are largely removed. The invention is characterized in that the liquid is made to flow through a first of the compartments or series of compartments, while the passage through the other compartment or series of compartments is being blocked, then opening up the passage through said other compartment or series of compartments while blocking the passage through the first mentioned compartment or series of compartments and continuously repeating this intermittent flow pattern during the time required for the treatment.

The treating liquid will thus flow intermittently through the material, and the length of the intervals

may be varied depending upon the type of material and the speed of reaction of the dyestuff. The flow velocity must be chosen in such a manner that the liquid enclosed within the textile material at the interuption of the circulation will be completely exchanged during the following flow period in such a manner that fresh liquid will be brought to the material to react therewith. It is further important that an even temperature is maintained within the bulk of textile material during the time liquid fows therethrough. The flow velocity must in the same manner as with conventional methods be chosen in such a manner that the speed of reaction of the dyestuff used will not cause an uneven dyeing. The dyestuff will react with the textile material also when at rest and as the speed of reaction is also dependent upon the temperature the length of rest period must be determined in such a manner that the rise in temperature will not be too high during each period.

It could be expected that during the periods of stillstand of the liquid the peripheral portions of the roll of material should be more heavily dyed than the inner portions but that will not happen, as the liquid surrounding the material will have the same concentration as the liquid within the roll of material. It is, however, important that the liquid surrounding the material is kept at rest as a heavier dyeing of the peripheral portion otherwise may be brought about.

The invention will below be described with reference to the accompanying drawings, which show some embodiments of the invention.

FIG. **1** shows schematically a dyeing plant according to the invention.

FIG. **2** shows a section through an autoclave provided with six containers for reception of textile material to be treated.

FIGS. **3, 4** and **5** show sections through three different types of valves suited to govern the flow of liquid to the containers, and

FIG. **6** shows a section through a dyeing apparatus of conventional design rebuilt for utilizing the method according the invention.

In FIG. **1** an autoclave **1** is denoted by dash-dotted lines. This autoclave comprises two compartments **2** and **3** adapted to receive textile material **4.** The number of compartments is selected with respect to the desired capacity of the autoclave. FIG. **1** shows in dash-dotted lines four further compartments **2a**, **2*b*** and **3*a***, **3*b***. These are in the manner shown in FIG. **2** mounted as close together as possible. In each compartment there is a materials carrier **5** formed as a profiled rod, a perforated tube or the like upon which one or more bodies of the material to be treated may be mounted. The treating liquid is brought to flow through the material either from the inside of the bodies and outwards, or from outside the bodies and inwards and to that end each materials carrier **5** is connected to a conduit **6, 6*a***, **6*b*** and **7, 7*a***, **7*b*** respectively. The conduits **6** and **7** are each connected to a port in a threeway valve **8** having two positions. A third port in this valve is via a conduit **9** connected to a pump **10** driven by a suitable prime mover **11.** A twoway valve **12** having two positions is fitted in the conduit **9** between the valve **8** and the pump **10.** A return flow conduit **13** from a collecting header at the top of the autoclave is also connected to valve **12.** This conduit is downstream of valve **12** by way of a conduit **14** connected to the pump.

The valves **8** and **12** are designed in any known manner to be operated automatically by pneumatic, hydraulic or electric means.

The plant will operate in the following manner. The intervals between the resetting of the valves **8** and **12** respectively from position I to II and vice verse is chosen and entered into a monitoring device **16.** FIG. **1** shows how compartments **2**, **2***a* and **2**b are connected to pump **10**, while conduits **7**, **7***a* and **7***b* to compartments **3**, **3***a* and **3***b* are blocked. The liquid within last mentioned compartment, thus, is at rest and will not take part in the circulation. When valve **8** is reset into position II conduits **6**, **6***a* and **6***b* will be blocked, while compartments **3**, **3***a*, **3***b* will be connected to the pump and flow of liquid therethrough is brought about. On both occasions the liquid is transferred back to pump **10** by way of conduit **13**, valve **12** and conduit **14.** If a reversal of the direction of flow is desired in such a manner that the liquid will flow from outside the material and inwards valve **12** is reset from position I into position II. In this manner pump **10** will be connected to conduit **13** while either of conduit **6** or **7** is connected to conduit **14**, and pump **10.** As one of last mentioned conduits is always blocked return flow from one group of containers only can occur.

The autoclave is in its bottom wall provided with a number of openings for introduction of a temperature rising medium e.g., steam or hot water to the autoclave.

FIGS. **3**, **4** and **5** show three embodiments of valves **8** with the pertaining conduits **6**, **6***a*, **6***b* and **7**, **7***a*, **7***b*, to the compartments and a centrally arranged conduit **13.** In FIG. **3** the valve member is formed as a plate **17** carrying closing members **18**, on the drawing located opposite to the ports of conduits **7**, **7***a*, **7***b*. The distance between the ports and the extension of the closure members **18** is selected in such a manner that the latter can close openings **6**, **6***a*, **6***b* only when openings **7**, **7***a*, **7***b* are fully uncovered.

With the embodiment according to FIG. **4** the closing of ports **6**, **6***a*, **6***b* will occur simultaneously with the opening of ports **7**, **7***a*, **7***b*. The closure members **18** may, however, also be brought into an intermediate position in which both groups are partially open. With this type of valve a rapid shifting between the groups is obtainable, while with the embodiment according to FIG. **3** a somewhat slower and not so abrupt shifting occurs.

The shifting of the valve is in these embodiments effected by means of a pneumatic or hydraulic piston, which via a lever is connected to the valve member **17.**

FIG. **5** shows a valve having a rotatable sleeve shaed closure member. This may be designed to uncover one half of the number of ports, but is here shown to fully uncover two ports, or one port and parts of two surrounding ports, and the closure member is rotated by any suitable external mover, e.g., an electric motor.

When redesigning a conventional plant the existing autoclave by means of partitions **19** may be subdivided into two or more compartments. The liquid distributor **20** in the lower part of the autoclave is likewise subdivided in branches corresponding to the number of compartments. Valve **8** may be built into the distributor **20** or may as schematically denoted in FIG. **6** be located outside the autoclave. Conduit **13** is connected to the lower portion of each compartment and serves as inlet or outlet, respectively, for the liquid surrounding the material. The partition **19** are higher than the stacks of bodies of material in such a manner that the liquid one of the chambers **2** or **3**, respectively will remain at rest when the conduit **6** or **7**, respectively, leading thereto is being blocked.

The autoclave is in this design provided with not shown electrical heating coils for temperature adjustment purposes.

The time for redirecting the flow from conduit **6** to conduit **7** or vice verse, that is the time alloted for flow through the compartments of one of the groups will depend upon the speed of reaction of the dyestuff with respect to the textile material to be treated as well as of the treating temperature. It may happen that the time between the intervals will have to be changed during the treatment., for instance be shortened in order to be suited to a more rapid dyeing. Practical tests have shown that passage times of a second up to several minutes e.g. 1 or 2 minutes may be used.

Due to the intermittent flow during the treatment the following advantages are obtained. The velocity of the flowing liquid may be increased to twice that at a conventional plant, or even more, whereby the volume of liquid available for treating the material is increased corresponding to the number of compartments being blocked Due to the increased velocity a more rapid increase in the temperature may be permitted and thus a more rapid operation requiring a low capacity pump. With very big plants usually requiring extremely high power for driving the pump it is possible to maintain the velocity at the conventional level and instead to reduce the power consumption by the half or more corresponding to the subdivision of the autoclave.

Textile material of the high bulk type, such as polyacryl nitrile fibers, which usually is difficult to dye may advantageously be treated according to the invention, as the material will have a possibility to recuperate during the time when the treating liquid is at rest.

The invention is not limited to the embodiments shown but may be used also in plants where more than two groups of compartments are involved. On occasions it may be advantageous to fit a valve **8** in the inlet as well as in the outlet conduits if separate return flow conduits are provided.

I claim:

1. A method for treating textile material with a liquid in a plant comprising at least two compartments or groups of compartments in which the material is disposed in a manner to be completely covered by the treating liquid, making the liquid flow through a first of said compartments or groups of compartments while blocking the passage of liquid through the other compartment or groups of compartments then opening up the passage through said other compartment or groups of compartments while blocking the passage through the first mentioned compartment or groups of compartments, and continuously repeating this intermittent flow pattern during the time required for the treatment.

2. A method according to claim **1** in which the time for keeping the passage to one compartment or group of compartments open is sufficient to permit at least one exchange of treating liquid in the pertaining compartment.

3. A method according to claim **1**, in which both compartments, or series of compartments are open for a short interval when opening up one compartment or group of compartments while blocking the other.

4. A method according to claim **1**, in which the flow to one compartment or group of compartments is grad-

ually cut off while the passage to the other compartment or group of compartments is gradually opened.

5. A method according to claim 1 according to which the time alloted to passage is the same as that alloted for blocking.

6. A method according to claim 1 according to which the time alloted to passage varies with respect to the time alloted for blocking.

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