United States Patent

[11] **3,600,731**

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[21] Appl. No. **780,805**
[22] Filed **Dec. 3, 1968**
[45] Patented **Aug. 24, 1971**

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[32] Priority **Dec. 13, 1967**
[33] **Sweden**
[31] **17,133/67**

[54] **METHOD FOR TREATING TEXTILES**
10 Claims, 1 Drawing Fig.

[52] **U.S. Cl.** **8/149.1,** 8/155.1, 68/183, 68/189
[51] **Int. Cl.** **B05c 8/02,** D06f 17/02
[50] **Field of Search** 8/149.1, 155.1; 68/183, 189

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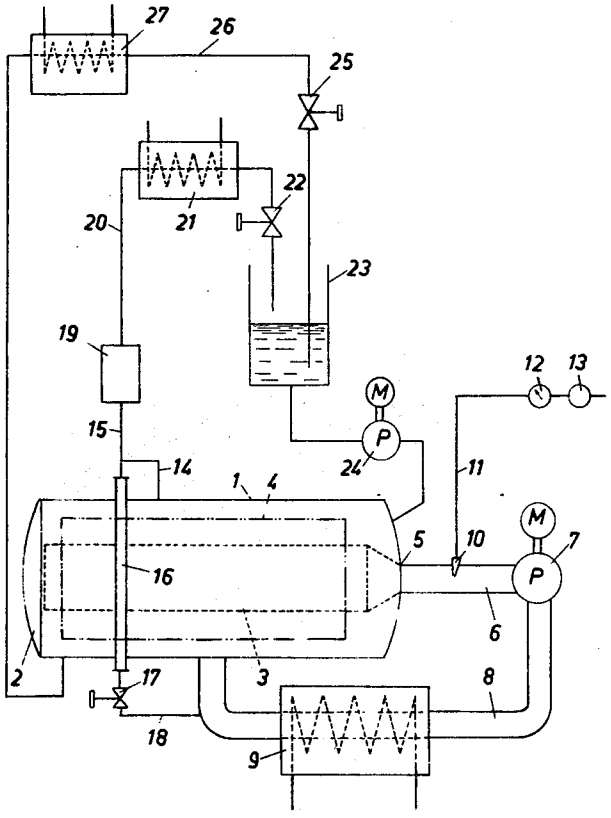
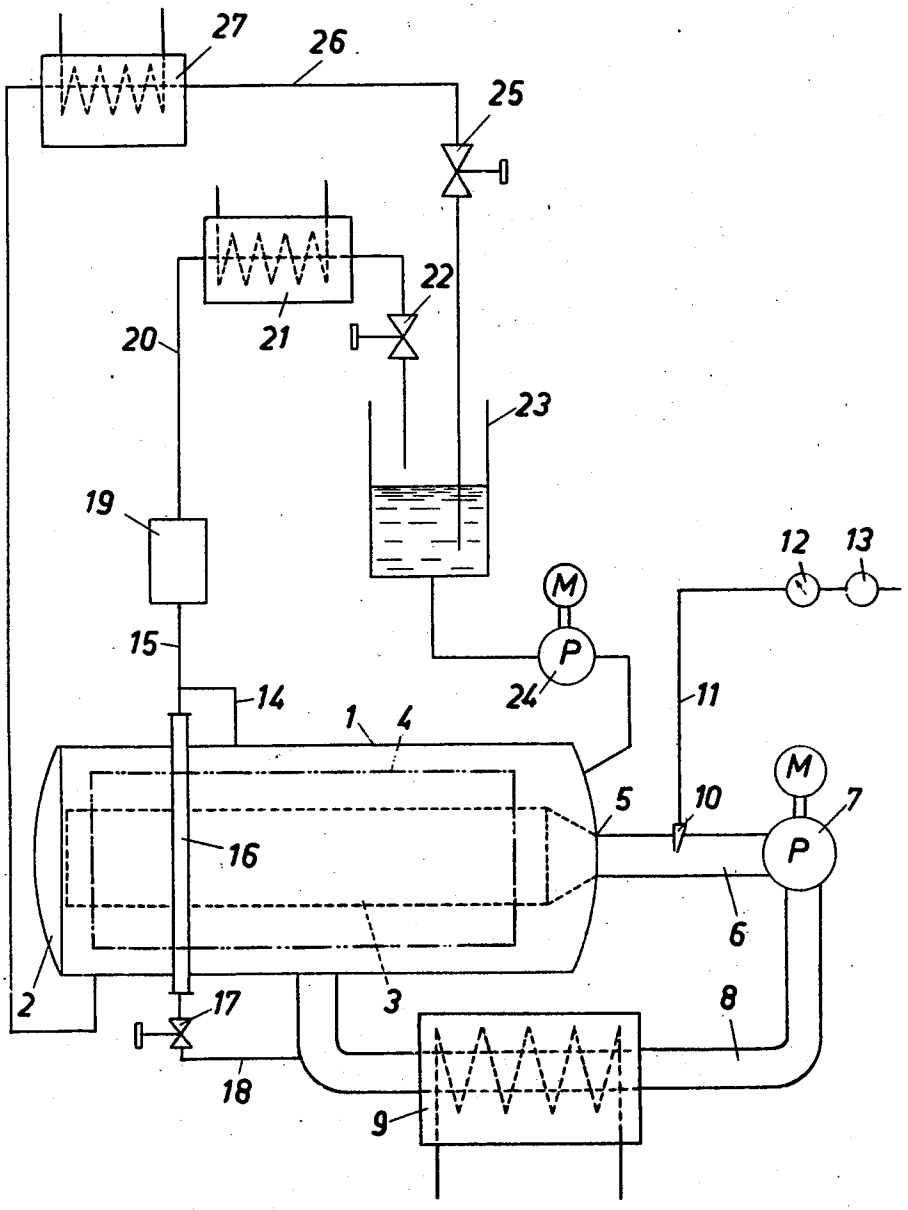
ABSTRACT: In a method for treating textile materials and in particular in a method of beam-dyeing fabrics, a pressurized gas in a finely divided state is introduced into the treating liquid in a ratio of 0.1–10 liters per minute for every 10,000 liters per minute of treating liquid. The size of the gas bubbles are maintained small enough so that they enter between and separate the filaments of the textile material. These gas bubbles, and the treating liquid, are forced through the textile material by a pump, and the surplus gas is removed from the top of the container housing the textile material.

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METHOD FOR TREATING TEXTILES

BACKGROUND OF THE INVENTION

The present invention relates to a method for the treatment of textiles and like materials, materials consisting of or containing synthetic fibers, in bulk or in worked condition, during which treatment which may be washing, bleaching, dyeing or the like, liquid and gas, preferably in a closed circuit, is pressed through the material. The word "textile," as used throughout this disclosure is meant to means synthetic as well as natural fibers.

During the treatment of most textile materials according to previously known methods, it has proven impossible to retain the volume of the material. This is usually loosely wound on a perforated cylinder and is treated in a receptacle, such as autoclave. During this treatment, the material will be too easily packed, partly due to its own weight and partly due to the pressure of the treating liquid. A further important point is the strain which will appear in the material during its reeling onto the cylinder. If the material is too loosely wound passages will easily be formed through the material and via which the liquid will flow due to the lesser resistance therein. If the material, on the other hand, is too tightly wound, it will be compressed and a volume expansion, which may be desirable, is prevented. A further disadvantage with the prior method of treating textile material is the difficulty in removing air present in the material. Larger air bubbles, or collection of bubbles, will stay in the material and prevent the treating liquid from reaching all fibers therein such that during a dyeing operation unsatisfactorily dyed portions will occur.

The problem which is to be solved by the present invention consists in proposing a method for avoiding this undesired influence on the material. The method also will not detrimentally influence other necessary measures performed during the treatment, for instance the shrinking of the textile material in such a manner that this will obtain the desired voluminous character.

SUMMARY OF THE INVENTION

The present invention proposes a method of solving this problem and is essentially characterized by the treating liquid being continuously supplied with small amount of gas in a finely divided state in such a manner that the very small bubbles generated will penetrate the material thereby separating the filaments thereof.

Practical tests show that this theory, contrary to all established practice, is correct, which is proven by the excellent color uniformity which has been attained. When using dispersion dyes, the result possibly is further promoted by the air bubbles acting as carriers for the dyestuff as dispersion dyes are liable to surface activity. The method also shows advantages when used in connection with thermoplastic materials. The watering (more effect) is considerably retarded and an evener and smoother dyeing is obtained. A simplification of the work is also realized as fewer working operations are necessary, which means lower production costs and last but not least a reduction in time required.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention will below be described with reference to the attached drawing, in which one embodiment of an apparatus suitable for working the method is shown diagrammatically by way of example.

The apparatus includes a container **1** generally termed an autoclave, which at one end is provided with a removable lid or cover **2**. A perforated cylinder **3** is mounted within container and a material **4** to be treated is wound on the cylinder. The cylinder **3** is only supported at its end in such a manner that an annular space remains between the material and the inner wall of the container **1**. The end of the cylinder **3** remote from the lid **2** is sealingly affixed to an inlet **5** which is connected by a conduit **6** to a pump **7** having a comparatively high capacity. The perforations of cylinder **3** are so designed that the perforated part will be completely covered by the material. A return conduit **8** is connected to the lower part of the container **1** and passes through a heat exchanger **9** located between the container and the pump. The liquid is forced into the cylinder **3** and through the material **4**, uniformly flows back to the inlet of the pump **7** via the conduit **8**. A nozzle **10** is arranged in the feed conduit **6** from the pump **7** and a compressed air conduit **11** is connected to the nozzle. The conduit **11** is provided with a manometer **12** and a reducing valve **13**, and is connected to a suitable source of supply (not shown). The nozzle **10** has a very small outlet opening, and will impart a very high velocity to the air (up to 100–400 meters/sec.). It distributes the air, for example in the form of a cone. The reducing valve **13** will maintain a pressure in the conduit **11** of 1–5 atmospheres above the static pressure in the autoclave **1**. The capacity of the pump **7** is such that the volume enclosed in the autoclave **1** will be exchanged 1.5–2 times per minute.

To the stream of liquid issuing from the pump **7**, a quantity of very finely subdivided air is continuously added (the quantity of air will amount to about 0.1–10 liters per minute at 20° C. and 760 mm. Hg for a pump quantity of 10,000 liters per minute). The air introduced into the stream of liquid will be further subdivided and mixed therewith due to the turbulence, and the chemical compounds in the treating liquid will impart an emulsifying effect. The air has higher pressure that the liquid and furthermore, due to the difference in temperature between the air and liquid an expansion of the air will occur, which further subdivides the air bubbles. When the liquid passes through the material, the very small air bubbles will penetrate the different layers of material and separate the filaments thereof. The liquid will thus uniformly act upon the material. A compression of the material is avoided and a possible shrinking may occur to a desired extent. As the air bubbles will continuously pass through the material, the liquid must be steadily supplied with new air. The air is collected in the upper part of the container, above the liquid surface and is evacuated in any suitable manner.

This evacuation is effected by means of a conduit **14** which is connected to the upper part of the autoclave and is connected via branch conduit **15** to a glass tube **16** acting as a level indicator. This tube is, by way of a valve **17** and conduit **18**, in communication with the return conduit **8** to the pump **7**. The evacuation conduit is furthermore connected to an expansion vessel **19** from which a conduit **20**, by way of a cooler **21** and a valve **22** is connected to the upper part of an open receptacle **23**. The valve **17** is only open sufficiently to bring about a subpressure in the conduit **18** and glass tube **16** due to an ejector action. A further pump **24**, the inlet side of which is connected to receptacle **23** and the pressure side of which is connected to the autoclave **1**, maintains a static pressure and circulation through the latter. This static pressure in the autoclave is regulated by means of a valve **25** arranged in a conduit **26** between the receptacle **23** and lower part of the autoclave. A further cooler **27** is included in the conduit **26**.

As an example, and only in order to explain the invention, a report from the dyeing of yarn is shown.

Material: Acrylic 1/20 Ne. Color: Orange. Weight. 406 kgs., material, volume of liquor 4,500 liters. Working pressure (static pressure in the autoclave): 3.5 atmospheres. Pressure difference: 0.6 atmospheres. Air pressure: 8.5 atmospheres. Nozzle: MLS 1.000 = about 1200 cm^3/minute of air. Pump capacity 11,000 liters/min.

The dyeing liquid, including all necessary chemicals was heated in a preparator to 75° C. Air in a finely divided state was supplied to the liquid during the whole dyeing operation.

The present method offers the following advantages:

a. The addition of air will increase the volume of the material to be treated, which will bring about a higher velocity of the liquid when passing through the material.

b. Alternatively, and depending upon the type of material to be treated, the dyestuff absorption may be kept at normal value compared to previously known methods, if the flow

Time	Temperature	Dyestuff percentage in liquid
0 min. liquid transferred from preparator to apparatus, injection of air begins	75°	100
2 min. heating of the apparatus		
4 min. liquid transfer completed		
5 min. pressure maintaining pump (24) started	80°	
10 min.	93°	
13 min.	97°	
15 min	100°	70
16.5 min.	102°	60
19.5 min.	102°	55
22 min.	102°	50
24 min.	102°	35
26 min.	102°	20
29 min.	108°	10
31.5 min	110°	5
33 min.	114°	
38 min. cooling	114°	
43 min	100°	
48 min. washing	85°	
53 min. drawing of the liquid		
57 min. treatment finished		

velocity is decreased. This will diminish the pressure drop through the material, whereby the volume and the consistency of the material will be influenced. Especially with texturized or thermoplastic materials this will be of importance as such materials usually will flatten due to the liquid passing through the material. c. By a suitable choice of the air bubbles and the quantity thereof it is possible to, when forcing the liquid from inside a cylinder outwards through the material wound thereon, to obtain an intermittent retarding action of the dyestuff. This means that the dyestuff, carried by air (already made) bubbles–flows along the fibers of the material intermittently. This retarding action is decreased as the size of the body of material increases. d. As the material is bellowed and expanded by the air and thereby becomes more voluminous the following operations will be favorably influenced. The time required for washing and drying operations have been considerably decreased.

The embodiment of the invention described above employs a horizontal autoclave or may be effected by atmospheric pressure with or without a rotating material support It is not essential, when employing the invention, to employ an autoclave, or to rotate the material support. The invention may, with the same advantage, be utilized with horizontal as well as with vertical containers. These may or may not be subjected to a static pressure, and they may be designed in such a manner that material is still or will be kept in movement during the treatment. The values indicated in the example cited above refer to a specific material will of course vary somewhat with other materials and dyestuff.

Instead of introducing air into the liquid by means of a nozzle, the same effect may be brought about by introducing chemical compounds into the liquid, which when contacting the same will generate a certain amount of gas.

I claim:

1. In a method for treating textile material wherein the material is introduced into and during the treatment is maintained in a container such that treating liquid may be uniformly circulated through the textile material for treatment thereof, the improvement comprising the steps of:

a. continuously adding pressurized gas in a finely divided state to the treating liquid prior to the treating liquid contacting the textile material, the quantity of gas being from 0.1–10liters/min. for 10,000liters/min. of treating liquid;

b. controlling the size of the gas bubbles and maintaining them small enough so that they enter between and separate the filaments of the textile material;

c. forcing the treating liquids and the gas bubbles by means of a pump trough the textile material; and

d. removing the surplus gas from the container after it has passed through the textile material at least once.

2. The method as claimed in claim 1 wherein the treatment is textile dyeing; the gas is air; and the small air bubbles increase the gross volume of the textile material as they separate the filaments thereof.

3. The method as claimed in claim 1 wherein the container is substantially closed, the pressurized gas is air, and comprising the further steps of recirculating the treating liquid; and injecting the air to add same to the treating liquid at a pressure of from 1–5 atmospheres above the pressure in the substantially closed container.

4. The method as claimed in claim 3 wherein the pressurized air is injected through at least one nozzle at an injection velocity of from 100–400meters/sec.

5. The method as claimed in claim 3 comprising the further step of maintaining a static pressure within the substantially closed container and controlling the flow velocity such that the pressure drop in the treating fluid after it has passed through the textile material is small.

6. The method as claimed in claim 3 comprising the further step of imparting a turbulence to the treating liquid and thereby obtaining a homogeneous mixture of the air bubbles and the liquid.

7. The method as claimed in claim 1 comprising the further step of exchanging the treating liquid in the container 1.5–2times every minute.

8. The method as claimed in claim 1 comprising the further step of heating the treating liquid to a temperature of at least about 75° C. before introducing the treating liquid into the container.

9. The method as claimed in claim 1 comprising the further steps of winding the textile material onto a perforated cylinder in layers, which cylinder is horizontally mounted in the container; flowing the treating liquid containing the gas radially outward from the inside of the cylinder through the textile material; removing the surplus gas from the top of the container; and rotating the perforated cylinder.

10. The method as claimed in claim 9 wherein the gas bubbles separate the filaments and in so doing they separate the layers of the textile material and increase the gross volume thereof to permit the treating liquid to uniformly pass through the material and contact all of the filaments.