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Amended claims in accordance with Rule 137(2) EPC.

(54) A conveyor drive fabric dyeing machine equiped with seam detector

(57) A conveyor drive dyeing machine includes a fabric seam detection device arranged in the dyeing machine. The detection device functions to detect a fabric leading end and detect, display, record fabric circulation time and the number of cycles of circulation of fabric 3 and outputting signals. When the detection device outputs signals, the following effects can be achieved: (1) automatically searching the fabric leading end and then automatically shutting down the machine to save the time for searching the fabric leading end; (2) monitoring and detecting and recording the time of previous circulation of the fabric 3 and the time of current progress; (3) counting the number of cycles of circulation of the fabric 3; (4) providing synchronization and correction control of the conveyor speed and the fabric circulation speed; and (5) providing synchronization and correction control of the speed of a fabric guide roller 4 and the fabric circulation speed.

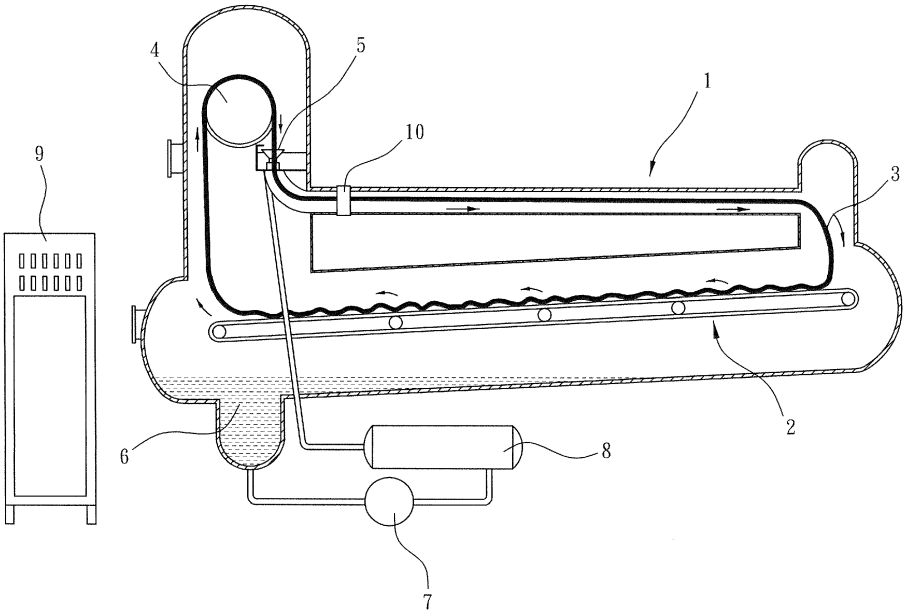


FIG. 3

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Description

(a) Technical Field of the Invention

[0001] The present invention generally relates to a conveyor drive fabric dyeing machine equipped with seam detector that is capable of monitoring and recording the movement of fabric and detecting the leading end of fabrics, the cycle time, and the number of cycles of circulation of the fabric in order to control a dyeing process.

(b) Description of the Prior Art

[0002] FIG 1 is a schematic view illustrating the dyeing circulation of fabric in a conventional dyeing machine. The operation principle is that dye liquid F is pressurized by a pump D2 and passes through a heat exchanger C (for increasing or decreasing temperature) into a nozzle A4 to generate a jetting or overflowing liquid flow and then returns to a fabric accumulation tankA1 of a dyeing machine A. Fabric B is driven by a fabric roller A3 (or alternatively using no fabric roller) into the nozzle A4 so that the fabric B is driven by the force induced by the jetting or overflowing liquid flow from the nozzle A5 to circulate. Dye liquid and chemical agents are supplied from a service tank E and pressurized by a pump D1 to inject into the dyeing machine A. During the circulation, the dye liquid F and the fabric B undergoes a process including heating, temperature-holding, cooling achieved with the heat exchanger C to have the dye absorbed by the fabric and achieving the effects of scouring, dyeing, and water washing. Uniformity of dyeing (levelness) is determined by the number of cycles of circulation of the fabric during the dyeing process, namely the number of interactions between the fabric B and the dye liquid in the nozzle A4 and the dyeing tube A2. A great number of cycles of circulation indicates a great number of interactions and thus better uniformity of dyeing, as well as the extent of water rinsing and dyeing fastness.

[0003] Referring to FIG 2, which shows a curve of a typical dyeing process employed in a conventional dyeing machine, theoretically or empirically, the conventional dyeing machine uses "time" as a control unit (denominator) to carry out treatments of fabrics dyeing, including, in sequence, chemicals adding, heating, temperature holding, heating, temperature holding, cooling, water rinsing, chemicals adding, heating, temperature holding, cooling, and hot water rinsing. Control is generally achieved with a computer or a programmable logic controller (PLC).

[0004] Since the conventional dyeing machine uses "time" as a control unit, it generally takes the same amount of time to complete a dyeing process regardless the actual length or weight of the fabrics being dyed. However, in an actual dyeing process, due to the fabric that are being dyed having different weights or the thicknesses of the fabrics being different, the lengths of fabrics in each batch, each tube may be different. Although the fabrics may be of the same type, adopting a dyeing process of the same amount of dyeing time is generally a waste of time. Further, during the entire dyeing process of fabrics, due to the actual amount (length) of fabric to be dyed in each batch or each tube of the dyeing machine being different, the number of cycles of circulation is different. Consequently, even though the dyeing time is identical, the extent of dyeing so obtained is different, leading to issues regarding tube deviation or batch deviation, inconsistent dyeing fastness, and poor reproductivity. As such, re-dyeing is necessary and the quality and efficiency of productions are poor. A great amount of energy and human labor are wasted and additional environmental pollution may result. Such a reproductivity issue is a long existing problem of the dyeing workshops and has not yet been overcome.

SUMMARY OF THE INVENTION

[0005] An object of the present invention is to overcome the problems occurring in a dyeing process of a conventional dyeing machine that uses time as a control unit so that the same amount of time is taken in carrying out the dyeing process regardless the actual lengths of fabrics that are dyed so that even though the dyeing time is identical, the results of the dyeing operations are different thereby leading to the problems of batch deviation or tube deviation, inconsistent fastness, poor reproductivity, and waste of time.

[0006] To overcome such problems, the present invention is made to change the way of control of the conventional dyeing machine by using the number of cycles of circulation of fabric as a control unit (denominator). In other words, the horizontal axis of the plot shown in FIG 2 is changed from "time" to "number of cycles of circulation of fabric". As such, regardless the actual length of fabric introduced, the dyeing process is controlled on the basis of the number of cycles of circulation of fabric. In other words, for a rope of fabric having a great length, the time required for the entire dyeing process is long; for a rope of fabric having a small length, the time required for the entire dyeing process is short. Thus, since the number of cycles of circulation for each dyeing tube or each batch of the dyeing operations of fabric is all the same, the degree of dyeing and the extent of water rinsing are all identical. This ensures zero tube deviation or zero batch deviation, consistent fastness, and one hundred percent of reproductivity and greatly improves the quality and efficiency of production and also greatly reduces the dyeing cost and achieves environmental protection through saving energy and reducing carbon.

[0007] The technical solution of the present invention is to arrange a conveyor in a machine body of a dyeing machine to forward the fabric that is in a circulating process in the machine body of the dyeing machine from the rear end of the machine body to the front end so that there is no need to use the floating or push force of a liquid flow or an air flow that is employed in the conven-

tional dyeing machine to drive the fabric. The speed of the conveyor is controlled with a controller, such as a computer or a programmable logic controller (PLC) to be in synchronization with the circulation speed of the fabric so that the circulation speed of the fabric is made stable and constant, making the time of each cycle of circulation identical. Based on such a constant speed characteristic, the present invention arranges a fabric seam detection device (seam detector) at a suitable location in the dyeing machine, whereby with signals output from the fabric seam detector by means of the use of the controller for example a computer or a programmable logic controller (PLC), the number of cycles of circulation of fabric can be identified and used as a control unit for the dyeing process. This ensures, as mentioned above, shortening of dyeing time, no color deviation, no batch deviation, consistent fastness, and one hundred percent of reproductivity, and also improve product quality, improves production efficiency, lowers down manufacturing cost, saves energy and reduce carbon, and enhances environmental protection.

[0008] The advantages of the present invention includes:

(1) The dyeing time can be shortened according to the length of a rope of fabric that is dyed.
(2) Regardless the actual lengths of the fabrics dyed, the number of cycles of circulation is made same so that the interaction degree of dyeing is identical and the reproductivity of dyeing is one hundred percent and there is no tube deviation and no batch deviation, and no concern about fastness difference.
(3) Regardless the actual lengths of the fabrics dyed, the number of cycles of circulation is the same and the number of contacts between a fabric and the dyeing machine (friction and stretching) is the same, so that the quality of the fabric is consistent.

[0009] The foregoing objectives and summary provide only a brief introduction to the present invention. To fully appreciate these and other objects of the present invention as well as the invention itself, all of which will become apparent to those skilled in the art, the following detailed description of the invention and the claims should be read in conjunction with the accompanying drawings. Throughout the specification and drawings identical reference numerals refer to identical or similar parts.

[0010] Many other advantages and features of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG 1 is a schematic view illustrating a cycle of circulation of dyeing fabric in a conventional dyeing machine.
FIG 2 is a plot showing a dyeing process of the conventional dyeing machine.
FIG 3 is a schematic view showing a conveyor drive fabric dyeing machine equipped with seam detector according to the present invention.
FIG 4 is a plot showing a dyeing process of the dyeing machine according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The following descriptions are exemplary embodiments only, and are not intended to limit the scope, applicability or configuration of the invention in any way. Rather, the following description provides a convenient illustration for implementing exemplary embodiments of the invention. Various changes to the described embodiments may be made in the function and arrangement of the elements described without departing from the scope of the invention as set forth in the appended claims.

[0013] As shown in FIG 3, the present invention provides a fabric dyeing machine equipped with seam detector, which comprises a machine body 1 in which a conveyor 2 is arranged for conveying a rope of fabric 3 from a rear end of the machine body 1 to a front end. The fabric 3 is then driven by a fabric guide roller 4 into a nozzle 5. Dye liquid 6 is pressurized by a pump 7 and subjected to temperature control by a heat exchanger 8 to be then sprayed from the nozzle 5 onto the fabric to induce a dyeing effect and also to drive the fabric 3 to enter a fabric guide tube to subsequently fall down to the conveyor 2 for being further conveyed to the front end of the machine body and the seam detector 10 is equipped to detect the seam or leading end of the fabric rope and count the cycles of the fabric circulation. The effectiveness of dyeing is determined by the number of interactions between the fabric and the dye liquid in the nozzle and a dyeing tube A2.

[0014] The operation speed of the conveyor 2 is controlled by a control box 9 in order to be in synchronization with the circulation speed of the fabric and the speed can be adjusted as desired, but becomes a constant and fixed speed after being set. In other words, the circulation speed of the fabric is fixed and the time required to go through a cycle of circulation is constant for each cycle. The dyeing process is carried out in such a way that the number of cycles of circulation of the fabric is used as a control unit and control is carried out with a controller, such as a computer or a programmable logic controller (PLC) of the control box 9 in order to carry out the dyeing process illustrated in FIG 4.

[0015] It can be appreciated from the above description that the actual dyeing effect obtained with the fabric seam detection device included conveyor drive fabric dyeing machine is primarily and directly determined by the

number of interactions between the fabric and the dye liquid in the nozzle and dyeing tube. In other words, the essential factor is the number of cycles of circulation of the fabric, not the length of time (namely an absolute relationship being had with respect to the number of cycles of circulation, while a relative relationship is had with respect to time). Thus, when the fabric speed in each tube or each batch of the dyeing machine is the same, if the time used is the same, then the number of cycles of circulation is less for fabric to be dyed having a greater length and the number of cycles of circulation is greater for fabric to be dyed having a shorter length. Thus, even though time is the same, the degree of dyeing is different and the result of dyeing is also different, leading to issues of tube deviation, batch deviation, inconsistent fastness, and inconsistent reproductivity Thus, to have consistent result of dyeing, the number of cycles of circulation must be the same regardless the actual length of fabric dyed. In other words, for fabric that is short, the time can be shortened correspondingly This can shorten the time for the entire dyeing operation and since the number of cycles of circulation is the same regardless the length of the fabric, the degree of dyeing is the same and one hundred percent of reproductivity of dyeing can be achieved. Thus, there will be no need for re-dyeing due to tube deviation or batch deviation and inconsistency of fastness.

[0016] It will be understood that each of the elements described above, or two or more together may also find a useful application in other types of methods differing from the type described above.

[0017] While certain novel features of this invention have been shown and described and are pointed out in the annexed claim, it is not intended to be limited to the details above, since it will be understood that various omissions, modifications, substitutions and changes in the forms and details of the device illustrated and in its operation can be made by those skilled in the art without departing in any way from the spirit of the present invention.

Claims

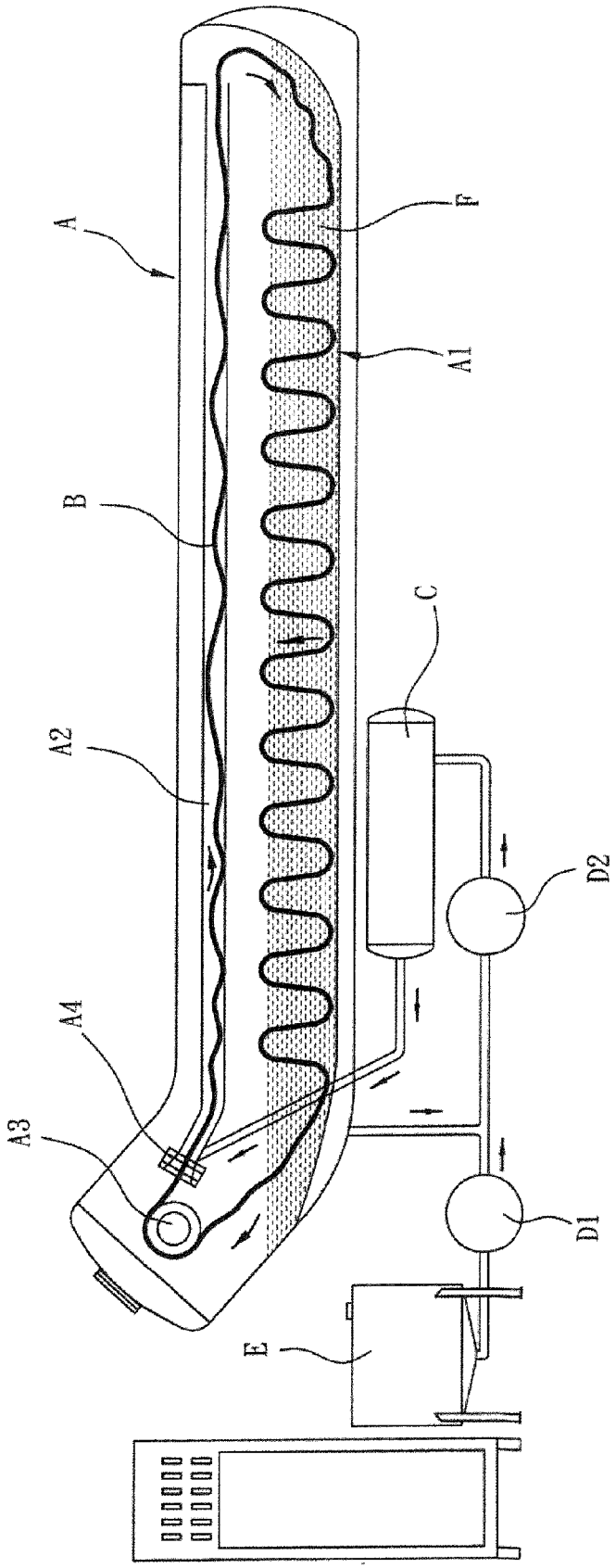
1. A fabric seam detection device included conveyor drive fabric dyeing machine, which comprises a conveyor 2 arranged in a machine body 1 of a dyeing machine for conveying fabric 3 from a rear end of the machine body 1 to a front end without being driven by a driving force induced by liquid or air, a fabric seam detection device being arranged at a suitable location of the dyeing machine.

2. The fabric seam detection device included conveyor drive fabric dyeing machine according to claim 1, wherein the fabric seam detection device detects, records, displays, and outputs signals indicating a fabric leading end and the number of cycles of circulation, whereby the dyeing process is controlled by a computer or a programmable controller with the number of cycles of circulation of fabric 3 as a control unit.

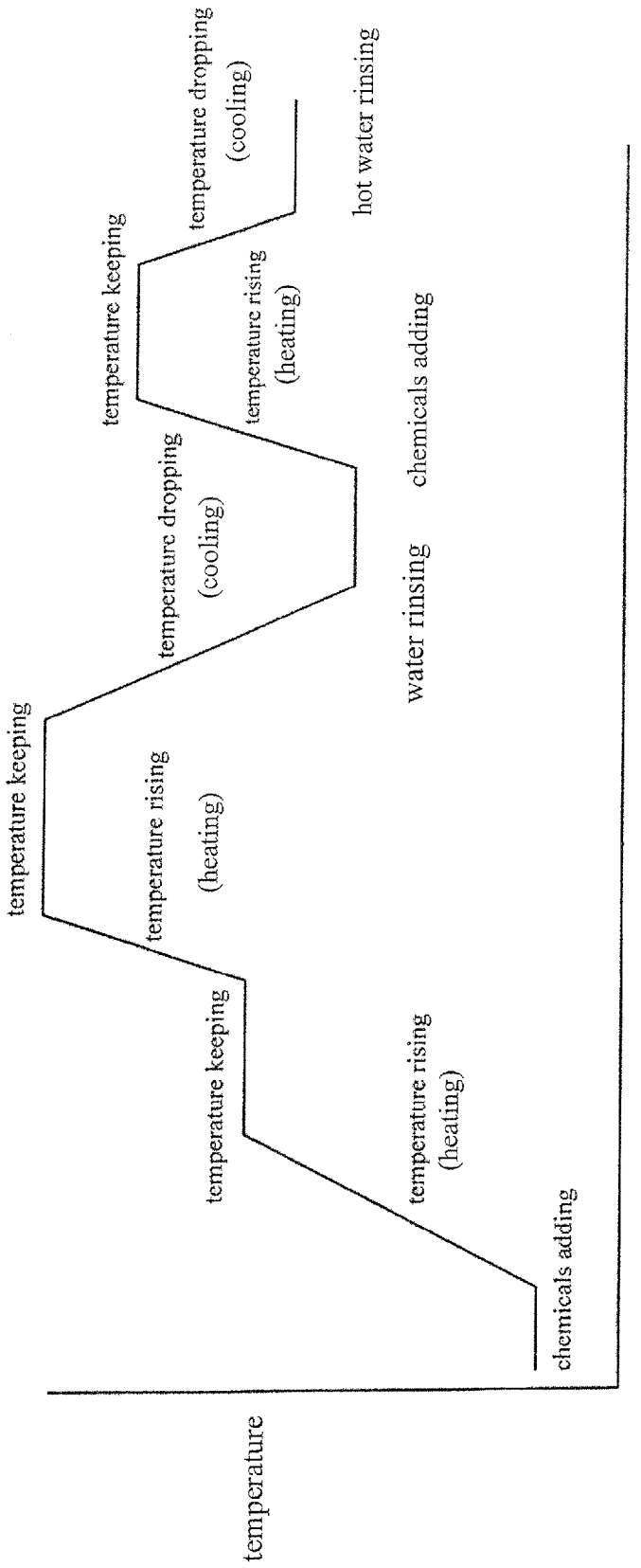
Amended claims in accordance with Rule 137(2) EPC.

1. A fabric dyeing machine, which comprises a machine body 1 and a fabric guide roller 4 that drives fabric 3 into a nozzle 5 in which dye liquid 6 is sprayed onto the fabric 3 for dyeing the fabric 3, **characterized in that** a conveyor 2 is arranged in the machine body 1 for conveying fabric 3 through the machine body 1 to allow the fabric 3 to be further driven by the fabric guide roller 4 into the nozzle 5 to have the fabric 3 further driven into a fabric guide tube for subsequently falling down back onto the conveyor 2, a fabric seam detection device 10 being arranged at a suitable location of the dyeing machine to detect a seam of a leading end of the fabric 3 and to determine the number of cycles of circulation of the fabric 3, wherein a dyeing process is conducted in the dyeing machine by a control box 9 in such a way that the number of cycles of circulation of the fabric 3 is used as a control unit.

2. The fabric dyeing machine according to claim 1, wherein the fabric seam detection device detects, records, displays, and outputs signals indicating the number of cycles of circulation of the fabric 3.



PRIOR ART
FIG.1



PRIOR ART
FIG.2

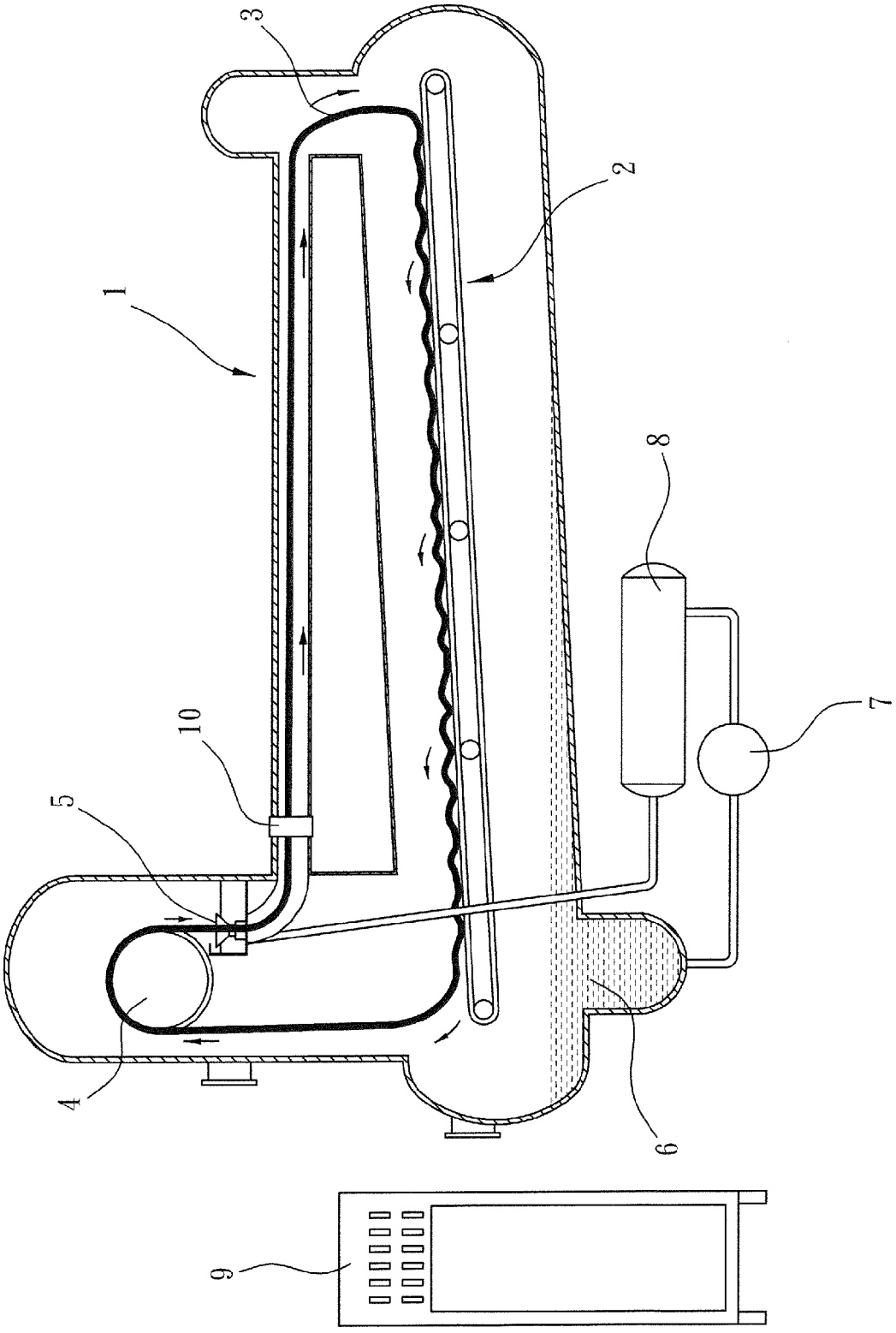


FIG. 3

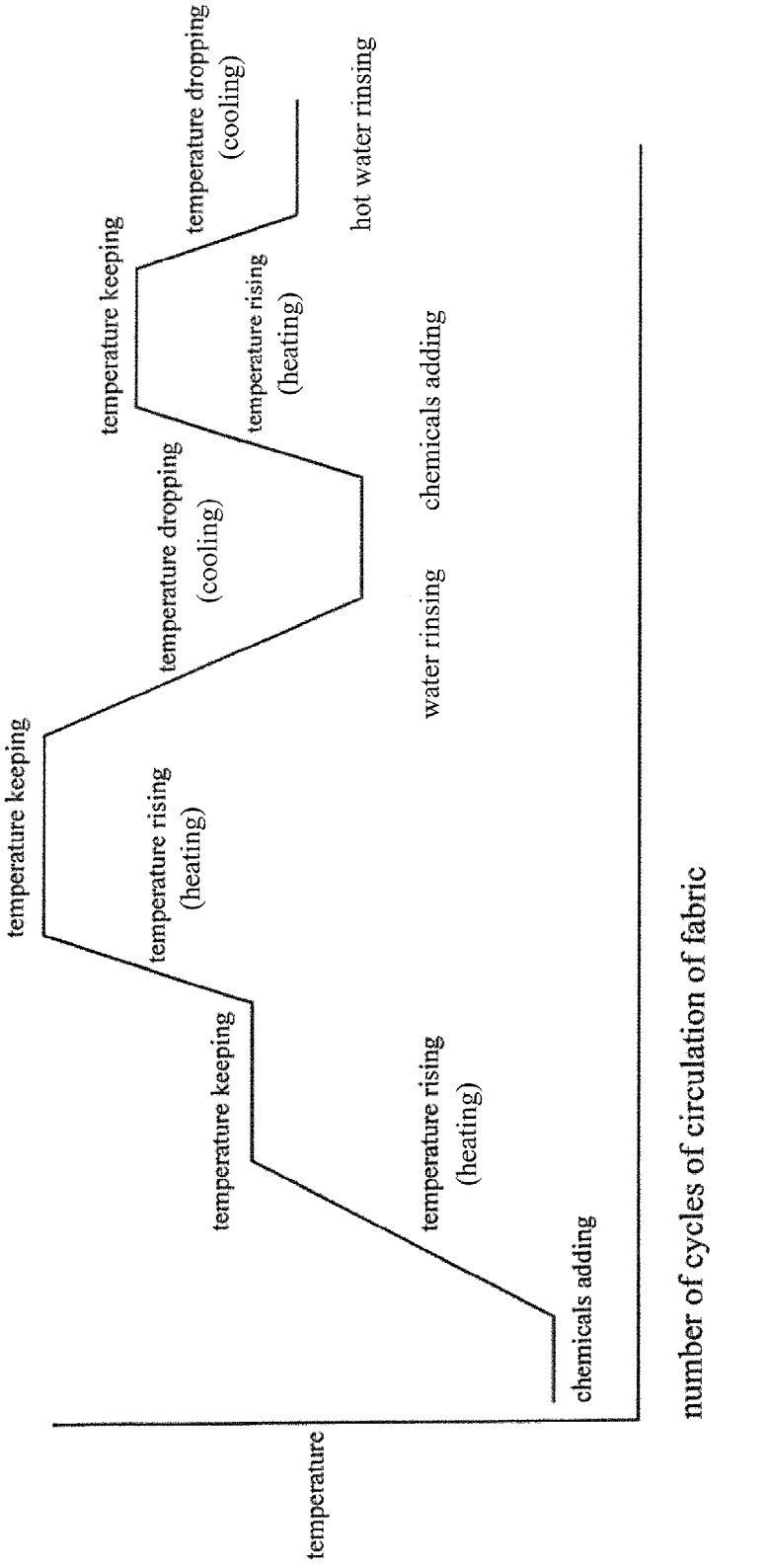

temperature
number of cycles of circulation of fabric
chemicals adding
temperature rising
(heating)
temperature keeping
temperature rising
(heating)
temperature keeping
water rinsing
temperature dropping
(cooling)
chemicals adding
temperature rising
(heating)
temperature keeping
hot water rinsing
temperature dropping
(cooling)

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 1074

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TECHNICAL FIELDS SEARCHED (IPC)

D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 November 2014	Bichi, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 17 1074

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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