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(54) AIRFLOW ATOMIZATION DYEING MACHINE SYSTEM AND WATER-UTILIZATION METHOD THEREFOR

(57) The invention relates to an atomized airflow dyeing machine system and a method for wet processing thereof, wherein a partition is coordinately configured in the middle part of the vessel and divides the vessel into two sections, and a connection valve II is installed on the bottom of the vessel below the partition and configured to connect both sides of the vessel; a connection valve IV is installed and configured in the middle part of the master connection tube of the nozzle; the left end of the master connection tube of the nozzle is connected to an auxiliary pump on the left side of the vessel and coordinately configured via a connection valve III; a connection valve I is configured between the other end of the auxiliary pump and a drain valve I configured on the bottom of the vessel on the right side of the partition; a drain valve II is configured on the bottom of the vessel on the left side of the partition. The invention saves water resources effectively and improves working efficiency. The system and the method for wet processing thereof can be applied to two/four/six/eight-tube dyeing machines and the like, create less waste water, improve water utilization rate, have no effect on the quality of greige fabrics, and reduce production cost.

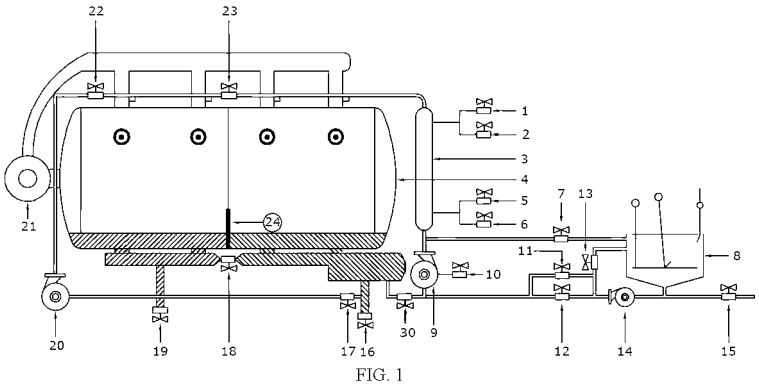

FIG. 1

EP 2 559 798 A1

Description

Field of the Invention

[0001] The invention relates to an atomized airflow dyeing machine system and method for wet processing thereof.

Background of the Invention

[0002] In prior art of airflow dyeing machines, greige fabric is transmitted by air flow through guide roller while preprocessing and dyeing. Liquor ratio is quite low, generally 1:3-4 for pure cotton greige fabric and 1:2-4 for polyester fabric. However, both preprocessing and washing after dyeing are two continuous washing and draining processes that use large amounts of water. As to the entire technological process of preprocessing and dyeing, processing and producing one ton of dark-color T/C cotton greige fabric uses a total of around 80 tons of water for the entire washing process of preprocessing and dyeing, which causes serious waste of water resources and increases production cost.

Summary of the Invention

[0003] The object of the invention is to provide in view of the problems in the prior art a technical program of an atomized airflow dyeing machine system and method for wet processing thereof.

[0004] The invention saves water resources effectively and improves working efficiency. To take a four-tube dyeing machine as an example, a partition is configured between a first tube, a second tube, a third tube and a fourth tube; and valves are added on corresponding tubes. In this way, washing water from the first and second tubes is pumped to the third and fourth tubes and recycled for washing throughout the washing process so as to recycle water for washing, reducing water consumption during the whole preprocessing, restoring and cleaning, cotton dyeing and soaping. The system and the method for wet processing thereof can be applied to two/four/six/eight-tube dyeing machines and the like, create less waste water, improve water utilization rate, have no effect on the quality of greige fabrics, and reduce production cost.

Brief description of the drawings

[0005] FIG. 1 is a structural diagram I of the invention.

[0006] FIG. 2 is a structural diagram II of the invention.

Detailed Description of the preferred Embodiment

[0007] Referring now to the drawings, the invention is further described as:

[0008] An atomized airflow dyeing machine, comprising a vessel 4, a heat exchanger 3, a feeding vat 8, a main pump 9, an air blower 21, a fabric container 25, a guide roller 26, a nozzle 27, a filter 29, a charge pump 14, a steam heating valve 1, a cooling water inlet valve 2, a steam trap 5, a cooling water drain valve 6, a return valve 7, a water inlet valve 10, a direct feeding valve 11, a dosing valve 12, a feed return valve 13, a charge pump 14, a feeding vat drain valve 15, and a connection valve V 30, which are configured coordinately. A partition 24 is coordinately configured in the middle part of the vessel 4 and divides the vessel 4 into two sections, and a connection valve II 18 is installed on the bottom of the vessel 4 below the partition 24 and configured to connect both sides of the vessel 4; a connection valve IV 23 is installed and configured in the middle of the master connection tube of the nozzle 27; the left end of the master connection tube of the nozzle 27 is connected to an auxiliary pump 20 on the left side of the vessel 4 and coordinately configured via a connection valve III 22; a connection valve I 17 is configured between the other end of the auxiliary pump 20 and a drain valve I 16 configured on the bottom of the vessel 4 on the right side of the partition 24; a drain valve II 19 is configured on the bottom of the vessel 4 on the left side of the partition 24, the height of the partition 24 is one third of that of the fabric container 25, the auxiliary pump 20 and the main pump 9 are of the same model.

[0009] A method for wet processing of atomized dyeing machine system to process a T/C cotton fabric, comprising the processing steps of:

[0010] 1) Preprocessing: adding water and dyes and circulating the greige fabric at the temperature of 60°C; directly rising the temperature to 98°C and holding for 40~60min; directly dropping the temperature to 70°C; finishing preprocessing and draining water for one time; continuously adding 60°C hot water and washing for 15min; and then washing with neutralization water for 5min and deoxygenated water for 5min.

[0011] 2) Dyeing: adding water and dyes and circulating the greige fabric at the temperature of 60°C; rising the temperature to 130°C at a rate of 1~2°C /min and holding for 40-60min; and then directly dropping the temperature to below 80°C; finishing dyeing and draining water for one time.

[0012] 3) Restoring and cleaning: adding water and dyes and circulating the greige fabric at the temperature of 60°C; directly rising the temperature to 80°Cand holding for 10min; draining water for one time; continuously adding 60°C hot water and washing for 10min; washing with water for 10min.

[0013] 4) Dyeing cotton: adding water at the temperature of 60°C and dosing dyes; circulating the greige fabric; rising the temperature to 70°C at a rate of 1°C/min and holding for 30min; and then dosing dyes for the second time and holding the temperature for 30min; finishing dyeing and draining water for one time; continuously adding 60°C hot water and washing for 15min; washing with water for 10min.

[0014] 5) Soaping: adding water and dyes at the temperature of 60°C; circulating the greige fabric; directly

rising the temperature to 90°C and holding for 10min; finishing soaping and draining water for one time; continuously adding 60°C hot water and washing for 15min; washing with water for 10min.

[0015] When the dyeing machine circulates normally, the air blower 21 starts blowing; the dyeing machine transmits one end of each greige fabric 28 inside the dyeing machine through respective guide roller 26 and respective nozzle 27 into respective fabric container 25; as the greige fabric 28 is totally transmitted into the container, the head end and the tail end of the greige fabric 28 are connected to be like a rope, which keeps circulating and transmitting under the effect of the force of air flow generated by the air blower 21; at the same time, the water inlet valve 10, connection valve II 18, connection valve IV 23 and connection valve V 30 open. The drain valve I 16, drain valve II 19, connection valve I 17, connection valve III 22 and auxiliary pump 20 close. The main pump 9 starts. Water runs through the heat exchanger 3 and nozzle 27, continuously contacts the transmitting greige fabric 28, flows inside the vessel 4 and downwards to the bottom of the vessel 4, goes through the filter 29 and connection valve V 30, and at last returns back to the main pump 9 for water circulation. When the vessel 4 has a certain water level, the water inlet valve 10 closes.

[0016] When temperature rising is needed during the processing steps, the steam heating valve 1 opens. Steam goes through the heat exchanger 3 and indirectly contacts the water inside the vessel 4, thus rising the temperature of the water inside the vessel 4. Steam then is changed to be water vapor and drained from the steam trap 5. When temperature dropping is needed, the steam heating valve 1 closes. The cooling water valve 2 opens. Cooling water goes through the heat exchanger 3 and indirectly contacts the water inside the vessel 4, thus dropping the temperature of the water inside the vessel 4. Cooling water then is changed to be hot water and drained from the cooling water drain valve 6. Through the process, the main pump 9 supplies power for water circulation inside the vessel 4.

[0017] When feeding is needed during the processing steps, additives or dyes are diluted in the feeding vat 8 in advance. The charge pump 14 starts while feeding. The feeding valve 12 opens if dosing is needed. At the same time, the feed return valve 13 opens to make sure the excessively-dosed dyes return back to the feeding vat 8; while directly feeding, the dosing valve 12 and feed return valve 13 close; the direct feeding valve 11 opens; when feeding is almost done, the return valve 7 opens to directly transmit the remains in the feeding vat 8 to the vessel 4 through the charge pump 14 via the direct feeding valve 11; the return valve 7 closes and all remains are pumped out; and then the feeding vat 8 is cleaned with water; the feed return valve 13 opens to circulate and clean the feeding vat 8, etc. with the charge pump 14; the charge pump 14 stops after circulation and cleaning; the feed return valve 13 closes; the feeding vat drain valve 15 opens; when the cleaning is done, the feeding vat drain valve 15 closes.

[0018] When washing is needed during the processing steps, firstly the main pump 9 stops; the drain valve I 16 opens; water on the bottom of the vessel 4 is drained out directly from the drain valve I 16, which takes 1 minute; and then the drain valve I 16, connection valve II 18, connection valve IV 23 and connection valve V 30 close; the connection valve I 17, drain valve II 19 and connection valve III 22 open; the water inlet valve 10 opens; the main pump 9 and auxiliary pump 20 start; the main pump 9 pumps water into the vessel 4 on the right of the partition 24; water flows to the bottom of the vessel 4 after washing the T/C cotton fabric in the vessel 4; when water goes through the filter 29 and connection valve I 17, the auxiliary pump 20 runs and pumps the water through the connection valve III 22 to the vessel 4 on the left of the partition 24; water after washing the T/C cotton fabric in the vessel 4 on the left of the partition 24 is drained out from the drain valve II 19. Then, washing is completed.

[0019] In the cotton dyeing process of step 4), dyes and anhydrous sodium sulphate are firstly dosed and fed, then soda ash.

[0020] To take a four-tube dyeing machine as an example which has four fabric containers inside the vessel, all liquors inside each vessel are communicated. A partition 24 is configured between a first tube, a second tube, a third tube and a fourth tube; a connection valve I 17, a connection valve II 18, a connection valve II 19, a connection valve III 22, a connection valve IV 23 and an auxiliary pump 20 are added on corresponding tubes. In this way, throughout the washing process of the entire dyeing process, washing water in the vessel 4 on the right of the partition 24 can be pumped by the auxiliary pump 20 from the first and second tubes to the third and fourth tubes in the vessel 4 on the left of the partition and recycled for washing. Thus, cycle use of water can be realized for the washing process, that means, the cycle use of water can be realized only when there are washing steps in above mentioned process; when washing is not needed, the dyeing machine works normally. The cycle use of water can reduce water consumption during the whole preprocessing, restoring and cleaning, cotton dyeing and soaping. The system and the method for wet processing thereof can be applied to two/four/six/eight-tube dyeing machines and the like, create less waste water, improve water utilization rate, have no effect on the quality of greige fabrics 28, and reduce production cost.

[0021] The dyeing machine while working is controlled via PLC program as per technological requirements for the preprocessing and dyeing of the greige fabric. The greige fabric in each fabric container is transmitted by the air from air blower and guide roller and continuously contacts the dye liquor in the vessel that is pumped by the main pump, atomized by the heat exchanger and sprayed out by the nozzle and circulate to finish the process of preprocessing, dyeing and washing, etc.

[0022] To take a four-tube atomized airflow dyeing machine that can dye 250kg cotton knitted fabrics in each tube as an example, that means, the machine has a total dyeing capacity of 1,000kg, the liquor ratio is configured as 1:3. In operation, the dyeing machine works in five steps: step one: adding water and dyes, finishing preprocessing and draining water for one time which is about one ton of water drained from the bottom of the vessel because general T/C cotton's water concentration in the vessel is 1:2, continuously adding and circulating hot water and washing for 15min, and then washing with neutralization water for 5min and deoxygenated water for 5min; step two: adding water and dyes, finishing dyeing and draining water for one time which is another one ton of water; step three: adding water and dyes, finishing restoring and cleaning and draining water for one time which is one ton of water as well, and then continuously adding and circulating hot water and washing for 10min, and washing with water for 10min; step four: adding water and dyes, finishing dyeing and draining water for one time which is again one ton of water, and then continuously adding and circulating hot water and washing for 15min, and washing with water for 10min; step five: adding water and dyes, finishing soaping and draining water for one time which is one ton of water, and then continuously adding and circulating hot water and washing for 15min, and washing with water for 10min. Given that the pump's power is the same as the main pump of the four-tube atomized airflow dyeing machine, that the pressure is water adding/pumping pressure, and that generally the volume of water pumped per minute is 400kg, the whole washing process takes 95 minutes to add and drain water. Then, the total water consumption for washing can be obtained by multiplying 400 with 95, that is 38,000kg or 38 tons. In addition, water drained five times in five steps is totally 5 tons; water contained in the T/C cotton fabric is 2 tons. In total, 45 tons of water is consumed. The use of the dyeing machine system and method for wet processing thereof in the invention can save 38 tons of water. This invention saves water and steam resources, discharges less waste water, has no effect on the quality of greige fabrics, and improves economic efficiency.

Claims

1. An atomized airflow dyeing machine system, comprising a vessel, a heat exchanger, a feeding vat, a main pump, an air blower, a fabric container, a guide roller, a nozzle, a filter, a charge pump, a steam heating valve, a cooling water inlet valve, a steam trap, a cooling water drain valve, a return valve, a water inlet valve, a direct feeding valve, a dosing valve, a feed return valve, a charge pump, a feeding vat drain valve, and a connection valve V, which are configured coordinately, wherein a partition is coordinately configured in the middle part of the vessel and divides the vessel into two sections, and a connection valve II is installed on the bottom of the vessel below the partition and configured to connect both sides of the vessel; a connection valve IV is installed and configured in the middle of the master connection tube of the nozzle; the left end of the master connection tube of the nozzle is connected to an auxiliary pump on the left side of the vessel and coordinately configured via a connection valve III; a connection valve I is configured between the other end of the auxiliary pump and a drain valve I configured on the bottom of the vessel on the right side of the partition; a drain valve II is configured on the bottom of the vessel on the left side of the partition.

2. The atomized airflow dyeing machine system as recited in claim 1, wherein the height of the partition is one third of that of the fabric container.

3. The atomized airflow dyeing machine system as recited in claim 1, wherein the auxiliary pump and the main pump are of the same model.

4. A method for wet processing of atomized dyeing machine system as recited in claim 1, wherein the T/C cotton fabric is processed by the processing steps of:

   1) Preprocessing: adding water and dyes and circulating the greige fabric at the temperature of 60°C; directly rising the temperature to 98°C and holding for 40~60min; directly dropping the temperature to 70°C; finishing preprocessing and draining water for one time; continuously adding 60°C hot water and washing for 15min; and then washing with neutralization water for 5min and deoxygenated water for 5min; 2) Dyeing: adding water and dyes and circulating the greige fabric at the temperature of 60°C; rising the temperature to 130°C at a rate of 1~2°C/min and holding for 40-60min; and then directly dropping the temperature to below 80°C; finishing dyeing and draining water for one time; 3) Restoring and cleaning: adding water and dyes and circulating the greige fabric at the temperature of 60°C; directly rising the temperature to 80°Cand holding for 10min; draining water for one time; continuously adding 60°C hot water and washing for 10min; washing with water for 10min; 4) Dyeing cotton: adding water at the temperature of 60°C and dosing dyes; circulating the greige fabric; rising the temperature to 70°C at a rate of 1°C/min and holding for 30min; and then dosing dyes for the second time and holding the temperature for 30min; finishing dyeing and draining water for one time; continuously adding 60°C hot water and washing for 15min; washing with water for 10min; 5) Soaping: adding water and dyes at the temperature of 60°C;

circulating the greige fabric; directly rising the temperature to 90°C and holding for 10min; finishing soaping and draining water for one time; continuously adding 60°C hot water and washing for 15min; washing with water for 10min; when the dyeing machine circulates normally, the air blower starts blowing; the dyeing machine transmits one end of each greige fabric inside the dyeing machine through respective guide roller and respective nozzle into respective fabric container; as the greige fabric is totally transmitted into the container, the head end and the tail end of the greige fabric are connected to be like a rope, which keeps circulating and transmitting under the effect of the force of air flow generated by the air blower; at the same time, the water inlet valve, connection valve II, connection valve IV and connection valve V open. The drain valve I, drain valve II, connection valve I, connection valve III and auxiliary pump close. The main pump starts. Water runs through the heat exchanger and nozzle, continuously contacts the transmitting greige fabric, flows inside the vessel and downwards to the bottom of the vessel, goes through the filter and connection valve V, and at last returns back to the main pump for water circulation. When the vessel has a certain water level, the water inlet valve closes; when temperature rising is needed during the processing steps, the steam heating valve opens. Steam goes through the heat exchanger and indirectly contacts the water inside the vessel, thus rising the temperature of the water inside the vessel. Steam then is changed to be water vapor and drained from the steam trap. When temperature dropping is needed, the steam heating valve closes. The cooling water valve opens. Cooling water goes through the heat exchanger and indirectly contacts the water inside the vessel, thus dropping the temperature of the water inside the vessel. Cooling water then is changed to be hot water and drained from the cooling water drain valve. Through the process, the main pump supplies power for water circulation inside the vessel; when feeding is needed during the processing steps, additives or dyes are diluted in the feeding vat 8 in advance. The charge pump starts while feeding. The feeding valve opens if dosing is needed. At the same time, the feed return valve opens to make sure the excessively-dosed dyes return back to the feeding vat; while directly feeding, the dosing valve and feed return valve close; the direct feeding valve opens; when feeding is almost done, the return valve opens to directly transmit the remains in the feeding vat to the vessel with the charge pump via the direct feeding valve; the return valve closes and all remains are pumped out; and then the feeding vat is cleaned with water; the feed return valve opens to circulate and clean the feeding vat, etc. with the charge pump; the charge pump stops after circulation and cleaning; the feed return valve closes; the feeding vat drain valve opens; when the cleaning is done, the feeding vat drain valve closes; when washing is needed during the processing steps, firstly the main pump stops; the drain valve I opens; water on the bottom of the vessel is drained out directly from the drain valve I, which takes 1 minute; and then the drain valve I, connection valve II, connection valve IV and connection valve V close; the connection valve I, drain valve II and connection valve III open; the water inlet valve opens; the main pump and auxiliary pump start; the main pump pumps water into the vessel on the right of the partition; water flows to the bottom of the vessel after washing the T/C cotton fabric in the vessel; when water goes through the filter and connection valve I, the auxiliary pump runs and pumps the water through the connection valve III to the vessel on the left of the partition; water after washing the T/C cotton fabric in the vessel on the left of the partition is drained out from the drain valve II. Then, washing is completed.

5. The method for wet processing of the atomized airflow dyeing machine system as recited in claim 4, wherein dyes and anhydrous sodium sulphate are firstly dosed and fed, then soda ash. during the cotton dyeing process in the step 4).

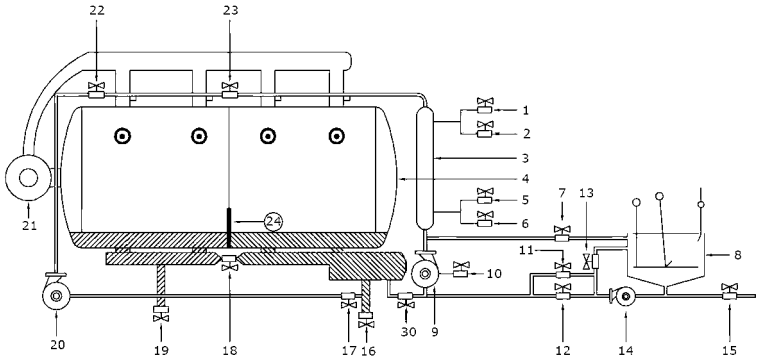
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FIG. 1

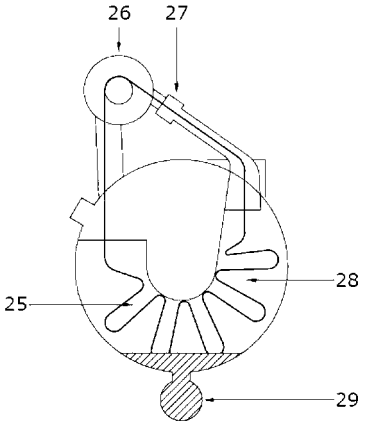
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FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/000226

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: D06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNKI, VEN, air stream, vapor, dye+, dying, pump?, valve?, air+, pulverize+, atomiz+, spray+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 102182026 A (ZHEJIANG YINHE PRINTING & DYEING CO., LTD.), 14 September 2011 (14.09.2011), claims 1-5	1-5
PX	CN 202099568 U (ZHEJIANG YINHE PRINTING & DYEING CO., LTD.), 04 January 2012 (04.01.2012), claims 1-3, and description, paragraphs [0011]-[0022]	1-5
A	CN 201158750 Y (TIANJIN TEXTILE ENGINEERING RESEARCH INSTITUTE), 03 December 2008 (03.12.2008), claims 1 and 2, and description, particular embodiments	1-5
A	CN 1368574 A (DENG, Jinlin), 11 September 2002 (11.09.2002), the whole document	1-5
A	CN 1358897 A (GUANGDONG ESQUEL TEXTILE CO., LTD.), 17 July 2002 (17.07.2002), the whole document	1-5
A	JP 2002339225 A (TOU, J.L.), 27 November 2002 (27.11.2002), the whole document	1-5
A	GB 1513887 A (TEXTILE PROCESSING), 14 June 1978 (14.06.1978), the whole document	1-5

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 May 2012 (17.05.2012)	**31 May 2012 (31.05.2012)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **SONG, Lin** Telephone No.: (86-10) **62084562**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/000226

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 102182026 A	14.09.2011	None	
CN 202099568 U	04.01.2012	None	
CN 201158750 Y	03.12.2008	None	
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Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
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CONTINUATION OF SECOND SHEET

A. CLASSIFICATION OF SUBJECT MATTER

D06B 23/00 (2006.01) i

D06B 1/02 (2006.01) i

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