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(54) **Process and machine for rope fabric treatment**

Verfahren und Maschine zur Behandlung von strangförmigen Textilgut

Procédé et machine pour le traitement des tissus sous forme de boyau

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(56) References cited:  
**EP-A- 0 443 978** **DE-A- 3 323 376**  
**US-A- 5 077 851**

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## Description

**[0001]** The present invention relates to a process and a machine for rope fabric treatment.

**[0002]** The process is of a type comprising all the features expressed in the preamble of claim 1.

**[0003]** The machine for treating rope fabrics is of a type comprising all the features expressed in the preamble of claim 5.

**[0004]** It is known that machines for carrying out dyeing and finish of fabrics, depending on the construction type, may submit the fabrics to two distinct treatments, technically known as "open-width" treatment and "rope" treatment.

**[0005]** In the first case, the fabric is loaded from bobbins around which it has been rolled and subsequently treated in appropriate machines while it constantly keeps the appearance of a well-flattened ribbon.

**[0006]** In the second case, the machines are provided with one or more substantially ring-shaped treatment vats, in each of which, through a loading porthole a rope fabric is admitted that is a fabric in the form of a twisted ribbon which is usually raw, that is in the state in which it comes from the weaving mill.

**[0007]** The operator, when loading of the fabric into a vat portion is over, joins the fabric ends by means of a seam so as to make it continuous in the form of a loop and he fits a small magnet into the junction region. Said magnet, at the end of treatment, through the use of an appropriate "seam-finding" detector enables the seam itself to be stopped exactly at the access porthole.

**[0008]** In this way the operator, as he can easily and quickly identify the seam position, will be able to open the loop-closed fabric again and begin the fabric-drawing-out step from the treatment vat.

**[0009]** For the purpose, an appropriate discharge reel on which one end of the fabric can be engaged, enables dragging of the fabric itself to the outside and storing of same into a collecting trolley.

**[0010]** Means for charging and evacuating the treatment bath into and from the vat enables a complete dyeing cycle to be carried out, which cycle consists of different steps involving preparation, scouring or bleaching, true dyeing and washing operations.

**[0011]** The rope fabric wound in a loop is caused to circulate within the treatment vat by the combined action of appropriate dragging means generally consisting of a powered drive reel and one or more hydraulic propelling devices.

**[0012]** Said propelling devices are part of circulation means for movement along the annular extension of the treatment bath vat and enable appropriate speed values (increasingly growing speeds, for example) of the bath and consequently the fabric to be achieved, depending on the desired type of treatment.

**[0013]** Processes can be conducted in the treatment vat both at atmospheric pressure with treatment bath temperatures approximately of 85-95°C and at a higher

pressure than the atmospheric one, generally of 3 bars at most, the bath temperatures being approximately 140°C.

**[0014]** Examples of processes and machines for rope fabric treatment are disclosed in the documents US 5 0778 051, EP 0 443 978, DE 3 323 376. EP 0 443 978 discloses the preamble of independent claims 1 & 5 and constitutes the closest prior art.

**[0015]** The dyeing cycle in accordance with known processes and machines, in addition to the preliminary preparation steps and true dyeing step, also includes a washing step, as already mentioned.

**[0016]** The washing step is required in order to remove the excess and unfixed dye from the fabric fibres and consists of successive cycles each of which is carried out by charging the machine with clean water, causing the fabric rope to circulate within the machine for a predetermined period of time and then evacuating the dirty water into appropriate collecting tanks.

**[0017]** According to the known technique, in order to achieve an optimal result from the point of view of dyeing, a high number of washing cycles for rope fabrics is provided. This involves some important drawbacks.

**[0018]** First of all, the overall duration of the washing step is long and the related costs are high, due both to the prolonged washing times and the large consumptions of electric energy and additional chemical products possibly required for each washing cycle during which the water temperature can reach the above mentioned temperature values.

**[0019]** On the other hand, in known treatments for cord fabrics, it has been impossible to improve the washing efficiency while reducing the amount of water retained by the fabric fibres between a washing cycle and the subsequent one, because it is known that the lower the amount of water retained by the fabric fibres between subsequent cycles is, the greater the washing effect is.

**[0020]** Use of squeezing devices, substantially consisting of rubber rollers between which the fabric is caused to pass would bring to improvement in the efficiency of each washing cycle; unfortunately, however, this technique cannot be proposed above all when delicate cord articles are to be treated, because the squeezing rollers would give rise to wrinkles, fibre breaking and similar faults, the final results being unacceptable in terms of quality of the finished fabric.

**[0021]** Under this situation, the technical task underlying the present invention is to devise a process and a machine for rope fabric treatment capable of substantially obviating the above mentioned drawbacks.

**[0022]** Within the scope of this technical task, it is an important aim of the invention to devise a process and a machine for rope fabric treatment which enable the number of washing cycles usually carried out to be reduced, the final result being the same, independently of the concerned fabric type.

**[0023]** Another important aim of the invention is to de-

vises a process and a machine capable of improving the true dyeing step by eliminating or at least reducing the oxidation processes during this step.

**[0024]** A further aim of the invention is to devise a process and a machine enabling the rope fabric to be discharged, after the final washing step, with a low moisture content, without resorting to squeezing or similar operations.

**[0025]** The technical task mentioned and the aims specified are substantially achieved by a process which is characterized in that it comprises the features expressed in the characterising portion of claim 1.

**[0026]** The technical task mentioned and the aims specified are also substantially achieved by a machine for treating rope fabrics which is characterized in that it comprises the features expressed in the characterising portion of claim 5.

**[0027]** The description of a preferred but non-exclusive embodiment of a machine for rope fabric treatment is now given hereinafter by way of non-limiting example and illustrated in the accompanying drawing in which the only figure diagrammatically shows the main components of the machine in accordance with the invention.

**[0028]** With reference to the drawing, the process for rope fabric treatment in accordance with the invention first of all consists in loading a rope-wound fabric into a vat of substantially annular conformation and engaging the fabric end in a manner known per se so that said fabric takes a closed-loop configuration and is disposed partly internally of a vat portion and partly externally thereof, thereby being able to be wound on a powered reel provided for dragging said fabric loop along.

**[0029]** After the preparation processes and bleaching operations typical of this treatment, and after carrying out the true dyeing step, the rope fabric is submitted to a washing step made up of several treatment cycles each comprising charging of a treatment bath into the vat, which bath consists of clean water or optionally water added with appropriate chemical products, and evacuation of said treatment bath.

**[0030]** In an original manner, at the end of each washing cycle, after the dirty water has been discharged and before a subsequent filling of the vat, a vacuum of an amount at least corresponding to the boiling temperature of the treatment bath or the washing temperature still present in the fabric is carried out within said vat; obviously, the boiling temperature of the bath corresponds to the temperature of the bath itself.

**[0031]** By way of example, if the washing bath temperature before discharging were about 54°C, which value is the one generally adopted, the vacuum to be created within the vat should not be lower than about 150 millibars, to enable boiling of most of the liquid still impregnating the fabric.

**[0032]** In any case it is pointed out that the above operation can be reasonably carried out until the liquid temperature which is still impregnating the fabric, has reached about 30°C.

**[0033]** The formed steam as a result of the vacuum is then drawn out of the vat and condensed before being sent to a recovery tank.

**[0034]** Advantageously, before the true dyeing step, accomplishment of another vacuum-creating operation is provided by the process, which operation is adapted to draw out the air contained in the vat and to admit inert gases or antioxidants thereto which are adapted to avoid oxidation of some dyeing baths or in any case to eliminate or reduce addition of antioxidant substances directly into the dyeing baths.

**[0035]** These gases can be stored in gas bottles or containers connected to vat 2 through appropriate valve means, not shown as known per se and conventional.

**[0036]** With reference to the cited figure, the machine for treating rope fabrics in accordance with the invention is generally identified by reference numeral 1. It comprises one or more treatment vats 2 disposed side by side, each of them being substantially in the form of a ring and suitably sized from a mechanical point of view in order to withstand stresses caused both by the inner pressure and outer atmospheric pressure.

**[0037]** Vat 2 has a filler or porthole 3 for loading and unloading a loop-closed rope fabric 4.

**[0038]** The fabric loop 4 in addition to occupying a portion of vat 2, mainly a lower one, also extends externally of said vat, being wound on dragging means 5 consisting of a powered reel located at the outside and at the upper part of vat 2. The powered reel 5 is held in a casing 6 from which two channels 6a and 6b extend for holding and enabling passage of the fabric 4 between the reel 5 and vat 2.

**[0039]** Connected to said vat is charging means for a treatment bath (not shown in the accompanying drawing) and evacuation means 7 comprised of a discharge pipe 7a and an automatic exhaust valve 7b.

**[0040]** The treatment bath is circulated within vat 2 by circulation means 8 consisting of a hydraulic circuit comprising a suction duct 9, a filter 10, a circulation pump 11, a heat exchanger 12 to be selectively activated as a heater and as a condenser, and a pair of admission pipes, i.e. a first pipe 13a and a second pipe 13b disposed in parallel and connected to channel 6b.

**[0041]** Provided downstream of the circulation pump 11 is a first automatic shutoff valve 14, whereas disposed in pipes 13a and 13b respectively is a second automatic shutoff and delivery-adjusting valve 15 and a third automatic shutoff and adjusting valve 15b.

**[0042]** The first 13a and second 13b pipes open into channel 6b, each by means of a propelling device of their own, 16a and 16b respectively, of a conventional type and known per se, substantially consisting of a fixed- or variable-section nozzle.

**[0043]** For example, device 16a is of a type adapted to obtain a moderate speed of the bath to push the fabric 4 delicately.

**[0044]** Device 16b, on the contrary, enables a higher speed of the bath to be achieved so that the fabric can

be dragged along at higher velocities.

**[0045]** One of the above mentioned devices may also be replaced by another device (not shown in the drawing) in which the nozzle through which the treatment bath passes is of a variable section to conform the liquid outlet speed to the type of fabric to be treated.

**[0046]** By intervening on the shutoff valves 15a and 15b either of the two propelling devices 16a and 16b can be activated so that the most appropriate velocity of the treatment bath and fabric can be selected.

**[0047]** An unloading reel 17 is also provided at the vat 2 region where the porthole 3 is located, which reel has the function of dragging the fabric rope along from the machine inside to the outside, when treatment is over.

**[0048]** In an original manner the machine of the invention comprises vacuum-creating means 18 to create a vacuum of a controlled amount in vat 2, which vacuum is adapted to enable quick evaporation (boiling) of the treatment bath which is still present in the fabric, subsequently to evacuation of the treatment cycle.

**[0049]** The vacuum-creating means 18 comprises a vacuum pump 19 disposed in a first drawing pipe 20 which fits in the hydraulic circuit 8 between the first valve 14 and the heat exchanger 12. Disposed upstream of the vacuum pump 19 is a fourth automatic shutoff valve 21.

**[0050]** A second drawing pipe 22, in which a fifth automatic shutoff valve 23 is located is inserted at an upper region of vat 2 and fits in the hydraulic circuit 8 downstream of the heat exchanger 12, taking into account, in respect of said exchanger, the travel direction of the liquid imposed by the circulation pump 11.

**[0051]** The heat exchanger 12 is connected to a heating circuit when the circulation pump 11 is activated, whereas it is connected to a cooling circuit to condense steam drawn out of vat 2, when the vacuum pump 19 is activated.

**[0052]** Finally, provided downstream of the vacuum pump 19 is a liquid-gas separator adapted to collect the sucked bath and send it to a recovery tank.

**[0053]** Operation of a machine for rope fabric treatment, described above mainly as regards structure is as follows.

**[0054]** During the preparation steps of the dyeing cycle, in the true dyeing step and during the washing cycles, valves 21 and 23 are disposed in a closed position so that the circuit in which said vacuum-creating means 18 is located is excluded.

**[0055]** When a vacuum is to be created within vat 2, that is possibly before the true dyeing step in order that an inert gas or an antioxidant may be admitted thereto and in any case after discharging of at least one washing cycle, valves 14, 15a and 15b are brought to a closed position, whereas valves 21 and 23 disposed in the drawing pipes 20 and 22 are opened.

**[0056]** If the second possibility, i.e. a vacuum created between the subsequent washing cycles, is taken into account, the vacuum pump 19 is operated for a given

time that will be determined by the typology of the fabric to be treated and the vacuum degree corresponding to the boiling temperature of the bath still present in the fabric.

**[0057]** The drawn out steam is condensed through heat exchanger 12, thus avoiding use of a vacuum pump having a great delivery and consequently a great absorbed power.

**[0058]** Then, separator 24 carries out separation of possible gaseous components from the liquid phase and sends the latter to a recovery tank.

**[0059]** By so doing, the residual water amount present in the fabric after each vacuum operation and corresponding steam drawing operation subsequent to each washing cycle is drastically reduced.

**[0060]** The invention achieves important advantages.

**[0061]** First of all by the above described process and machine an important improvement of the washing step in all fabric types is achieved because each washing cycle is more efficient since it can take place after an important reduction has occurred in the residual water amounts present in the rope fabric fibres after evacuation of the preceding washing cycle.

**[0062]** The increased efficiency of each washing cycle enables the number of said cycles to be reduced while keeping the quality of the achieved result unchanged.

**[0063]** Therefore, a great reduction in the overall time of the treatment cycle for rope fabrics is achieved and, as a result, a cost reduction, also due to the lower energy consumption and lower consumption of the chemical additives used in each washing cycle.

**[0064]** In addition, the low moisture amount present in the fabric after the last washing cycle facilitates the subsequent treatment steps of the fabric itself, i.e. opening of the rope and optional impregnation with chemical products before drying.

**[0065]** Finally, since the air present in the treatment vat can be drawn out before the true dyeing step, oxidation of the dyeing bath can be avoided or reduced and consequently the quality of the achieved results in this operating step can be greatly improved.

## Claims

1. A process for rope fabric treatment of a type at least consisting in;

loading a rope-wound fabric (4) into a vat of substantially annular conformation (2);  
engaging the ends of said rope fabric (4) so that the fabric takes an endless (loop-shaped) extension occupying at least one portion of said vat (2);  
making said fabric (4) circulate within the vat (2) and submitting said rope fabric (4) to at least one dyeing step and one subsequent washing

step, each step comprising at least one cycle consisting in charging and discharging a treatment bath into and from said vat (2); making a vacuum inside said vat (2) prior to said dyeing step, which vacuum enables the air contained in the vat itself to be substantially drawn out,

characterized in that it consists in admitting inert or antioxidant gases into said vat.

2. A process as claimed in claim 1, characterized in that it consists in creating a further vacuum inside said vat (2) subsequently to the discharging of at least one washing cycle, said further vacuum being of amount at least corresponding to the boiling temperature of the washing bath still present in the fabric, said boiling temperature being the same as the bath temperature, and in carrying out drawing out of the steam formed by said further vacuum from said vat (2).

3. A process as claimed in claim 2, characterized in that said steam drawn out of the vat (2) is submitted to condensing.

4. A process as claimed in claim 2, characterized in that said treatment bath is preferably discharged at a temperature at least as high as 54°C and said vacuum corresponds to a pressure valve not higher than 150 mbar absolute.

5. A machine for treating rope fabrics comprising:

at least one treatment vat (2) substantially in the form of a ring;  
means (5) for dragging the rope fabric along within said treatment vat (2);  
means (7) for charging and discharging a treatment bath into and from said vat;  
means (8) for circulating said treatment bath within said vat;  
means for vacuum creation (18) adapted to create a vacuum of a controlled amount in said vat,

characterized in that it comprises inert or antioxidant gas inlet means.

6. A machine as claimed in claim 5, characterized in that said vacuum-creating means (18) comprises a vacuum pump (19) and in that a heat exchanger (12) is interposed between said treatment vat and vacuum pump, which heat exchanger is adapted to operate at least as one condenser for steam drawn out of said vat.

7. A machine as claimed in claim 6, characterized in that said circulation means 8 of the treatment bath

is defined by a hydraulic circuit external to said vat (2) comprising at least one circulation pump (11) and said heat exchanger (12), which heat exchanger is adapted to selectively operate as a heater for the treatment bath.

8. A machine as claimed in claim 6, characterized in that downstream of said vacuum pump (19) it comprises a device (24) for separation of the gaseous step from the liquid step.

## Patentansprüche

1. Verfahren zur Behandlung von Seilgeflechten nach der Art bestehend mindestens in:

- Einbringen eines im Seil aufgewickelter Geflecht (4) in ein im wesentlichen ringförmig ausgebildetes Becken (2); Ergreifen der Enden des Seilgeflechtes (4), derart, dass dasselbe eine Abwicklung im geschlossenen Ring aufweist, die mindestens einen Teil des Beckens (2) belegt;
- Umwälzen des Seilgeflechtes (4) innerhalb des Beckens (2) und Unterwerfung des Seilgeflechtes (4) mindestens einem Färbeschritt und einem nachfolgenden Waschschrift, wobei jeder Schritt mindestens einen Arbeitsgang umfasst, der durch die Füllung und Entleerung eines Behandlungsbades ins und vom Becken (2) gebildet wird;
- Erzeugung, vor dem Färbeschritt, eines Unterdrucks innerhalb des Beckens (2), um im wesentlichen den Entzug der im Becken selbst enthaltenen Luft zu erlauben,

dadurch gekennzeichnet, dass es in der Einbringung von Schutzgasen oder Antioxydationsmitteln in das Becken besteht.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass es in der Erzeugung eines weiteren Unterdrucks innerhalb des Beckens (2) nach dem Auslauf mindestens des Waschvorganges, wobei der weitere Unterdruck mindestens einen Betrag besitzt, welcher der Siedetemperatur des noch im Seilgeflecht vorhandenen Waschbades entspricht, wobei die Siedetemperatur der Temperatur des Bades selbst entspricht, und in der Ausführung des Entzugs aus dem Becken (2) des mit dem weiteren Unterdruck gebildeten Dampfes besteht.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, dass der aus dem Becken (2) entzogene Dampf einer Kondensation ausgesetzt wird.

4. Verfahren nach Anspruch 2, dadurch gekennzeichnet,

net, dass das Behandlungsbad bevorzugter Weise bei einer Temperatur mindestens gleich 54° C entleert wird und der Unterdruck einem Druckwert nicht oberhalb von 150 mbar absolut entspricht.

5. Maschine zur Behandlung von Seilgeflechten, umfassend:

- mindestens ein im wesentlichen ringförmig ausgebildetes Behandlungsbecken (2);
- Mitnahmemittel (5) des Seilgeflechtes innerhalb des Behandlungsbeckens (2);
- Mittel (7) zum Füllen und Entleeren eines Behandlungsbades ins und vom Becken;
- Umwälzmittel (8) des Behandlungsbades innerhalb des Beckens;
- Mittel zur Erzeugung von Vakuum (18), um einen Unterdruck kontrollierten Betrages im Becken zu erzeugen,

dadurch gekennzeichnet, dass sie Mittel zur Einbringung von Schutzgasen oder Antioxydationsmitteln umfasst.

6. Maschine nach Anspruch 5, dadurch gekennzeichnet, dass die Mittel zur Erzeugung des Vakuums (18) eine Vakuumpumpe (19) umfassen, und dadurch, dass zwischen dem Behandlungsbecken und der Vakuumpumpe ein Wärmetauscher (12) zwischengeschaltet ist, der mindestens als Kondensator des dem Becken entzogenen Dampfes wirkt.

7. Maschine nach Anspruch 6, dadurch gekennzeichnet, dass die Umwälzmittel (8) des Behandlungsbades durch einen hydraulischen Kreislauf außerhalb des Beckens (2) festgelegt sind, der mindestens eine Umwälzpumpe (11) und einen Wärmetauscher (12) umfasst, wobei der Wärmetauscher wahlweise als Erhitzer des Behandlungsbades wirkt.

8. Maschine nach Anspruch 6, dadurch gekennzeichnet, dass sie nach der Vakuumpumpe (19) eine Einrichtung (24) zur Abtrennung der Gasphase von der Flüssigkeitsphase umfasst.

## Revendications

1. Procédé pour le traitement de tissus sous forme de boyau, du type consistant au moins à:

- charger dans une cuve (2) de conformation sensiblement annulaire un tissu (4) enroulé en boyau;
- engager les extrémités dudit tissu en boyau (4) de sorte que le tissu prenne une extension sans

fin (en anneau fermé) occupant au moins une portion de ladite cuve (2);

- faire circuler ledit tissu (4) à l'intérieur de ladite cuve (2) et soumettre ledit tissu en boyau (4) au moins à une étape de teinture et à une étape suivante de lavage, chaque étape comprenant au moins un cycle comportant le chargement et le déchargement d'un bain de traitement dans et de ladite cuve (2);
- créer le vide à l'intérieur de ladite cuve (2) avant ladite étape de teinture, ce vide permettant à l'air contenu dans la cuve elle-même d'être essentiellement enlevé,

caractérisé en ce qu'il comporte l'admission de gaz inertes ou antioxydants dans ladite cuve.

2. Procédé selon la revendication 1, caractérisé en ce qu'il consiste à créer un vide supplémentaire à l'intérieur de ladite cuve (2) après le déchargement d'au moins un cycle de lavage, ledit vide supplémentaire étant d'une valeur au moins correspondant à la température d'ébullition du bain de lavage encore présent dans le tissu, ladite température d'ébullition étant la même que la température du bain, et à effectuer l'extraction de ladite cuve (2) de la vapeur formée par ledit vide supplémentaire.

3. Procédé selon la revendication 2, caractérisé en ce que ladite vapeur extraite de la cuve (2) est soumise à condensation.

4. Procédé selon la revendication 2, caractérisé en ce que ledit bain de traitement est de préférence déchargé à une température au moins égale à 54°C et ledit vide correspond à une valeur de pression absolue non supérieure à 150 mbar.

5. Machine pour le traitement de tissus sous forme de boyau comportant.

- au moins une cuve de traitement (2) essentiellement en forme d'anneau;
- des moyens (5) d'entraînement du tissu en boyau à l'intérieur de ladite cuve de traitement (2),
- des moyens (7) de chargement et déchargement d'un bain de traitement dans et de ladite cuve;
- des moyens (8) destinés à causer la circulation dudit bain de traitement à l'intérieur de ladite cuve;
- des moyens (18) de création du vide, destinés à créer un vide d'une valeur contrôlée dans ladite cuve,

caractérisée en ce qu'elle comporte des moyens d'entrée d'un gaz inerte ou antioxydant.

6. Machine selon la revendication 5, caractérisée en ce que lesdits moyens de création du vide (18) comportent une pompe à vide (19) et en ce qu'un échangeur de chaleur (12) est interposé entre ladite cuve de traitement et la pompe à vide, cet échangeur de chaleur étant destiné à opérer au moins en qualité de condenseur pour la vapeur extraite de ladite cuve. 5
7. Machine selon la revendication 6, caractérisée en ce que lesdits moyens de circulation (8) du bain de traitement sont définis par un circuit hydraulique extérieur à ladite cuve (2) comprenant au moins une pompe de circulation (11) et ledit échangeur de chaleur (12), cet échangeur de chaleur étant destiné à opérer sélectivement en qualité d'appareil de chauffage pour le bain de traitement. 10 15
8. Machine selon la revendication 6, caractérisée en ce qu'elle comporte, en aval de ladite pompe à vide (19), un dispositif (24) destiné à séparer la phase gazeuse de la phase liquide. 20

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