

(19)



(11)

**EP 2 550 388 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:

**13.06.2018 Bulletin 2018/24**

(51) Int Cl.:

**D06B 3/28 (2006.01)**

**D06B 23/00 (2006.01)**

(86) International application number:

**PCT/IB2011/050745**

(21) Application number: **11709494.6**

(22) Date of filing: **23.02.2011**

(87) International publication number:

**WO 2011/117763 (29.09.2011 Gazette 2011/39)**

(54) **MACHINE FOR THE DISCONTINUOUS TREATMENT OF FABRIC ROPES**

MASCHINE ZUR UNTERBROCHENEN BEHANDLUNG VON TEXTILSEILEN

MACHINE POUR LE TRAITEMENT DISCONTINU DE BOYAUX DE TISSU

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
PL PT RO RS SE SI SK SM TR**

(30) Priority: **22.03.2010 IT MI20100457**

(43) Date of publication of application:

**30.01.2013 Bulletin 2013/05**

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## Description

**[0001]** This invention relates to a machine for the discontinuous treatment of fabric ropes, of the type comprising the features described in the preamble to claim 1.

**[0002]** More particularly, the machine according to this invention is used during industrial processes relating to the production of fabrics and carries out various processing operations, such as dyeing, bleaching or washing.

**[0003]** For that purpose, the fabric is twisted over itself in such a way that it takes on the shape of a rope and is immersed in a treatment bath.

**[0004]** Prior art machines for this type of operation comprise a tank containing the treatment liquid bath and a plurality of motor-driven reels, each able to rotate about its own axis of rotation, on each of which a respective fabric rope to be treated rests, the fabric rope being closed in a loop and descending from the reel until it is in the bath and then rising from the bath on the opposite side of the reel. Each reel is contained in a respective box-shaped body positioned above the tank and is connected to the tank and supported by an away pipe for the fabric rope from the reel to the tank and a return pipe for the fabric from the tank to the reel. The fabric rope is circulated both by the rotation of the reel and because the fabric is struck by a jet of treatment liquid sprayed by suitable nozzles. Each of the nozzles is positioned in the away pipe and is connected to the tank. The treatment liquid to be sprayed is drawn from the bath and fed to the nozzles through a single recirculation duct which, at an upper portion of the tank, is divided into as many branches as there are ropes to be treated. In particular, the single duct of prior art machines enters a horizontal pipe extending along the tank alongside containers housing the reels. Extending from each opposite end of the horizontal pipe there is a duct with a smaller cross-section which leads to a respective nozzle located in a respective end container. Extending from separate points of an intermediate portion of the horizontal pipe there are as many ducts with a smaller cross-section, each connected to a respective nozzle located on the intermediate containers. In the lower part of the tank, partly or completely immersed in the bath, there is a perforated basket able to move relative to the tank in a direction which is transversal to the direction of feed of the fabric. The movement of the end of the fabric conveyor duct, in combination with fabric feed, allows the fabric to be zigzagged on the bottom of the basket in a regular fashion. The fabric rope which is closed in a loop is made to rotate inside the machine for the time necessary for treatment optimisation.

**[0005]** Such a machine is illustrated, for example, in public document EP 1 884 583 B1.

**[0006]** The quantity of treatment liquid used must be such that it fills, to the correct level, the tank and the machine circuits (including the above-mentioned recirculation duct). The moving liquid contained in the circuits is in fact not useful for the purposes of the process and

represents between approximately 25% and approximately 40% of the total quantity.

**[0007]** Moreover, the structure of the horizontal pipe which acts as a manifold for the ducts which lead to the nozzles is such that it generates unevenness in the flow rate and pressure of the liquid sprayed on the various fabrics.

**[0008]** Document GB1168355 discloses that an endless textile material in rope form which is supported and moved by a winch within an autoclave passes through an annular device from which a converging jet of liquid is ejected which strikes the material and exerts a drag thereon. The winch can therefore become a speed regulating device rather than a driving member proper. The device consists of two concentric tubes, the annular space therebetween being fed by a pump, a pipe and a duct with liquid withdrawn from the autoclave through a grid, a filter and a heat exchanger. A valve in the duct controls the rate of flow of liquid through the device, the liquid being ejected as it passes between the flared upper edge of the inner tube and the overturned upper edge of the outer tube. A removable and interchangeable tubular nozzle with a flared upper section may rest on the flared part of the tube to enable the ink jet size to be adjusted. Fresh treatment liquid is introduced under pressure from a tank into the circulating liquid.

**[0009]** Document US5894747 discloses a low liquid gentle jet dyeing machine which has a pressure vessel with one or more inner chambers located interior to and spaced from the interior edges of the pressure vessel. An endless rope of fabric is contained within each inner chamber. The fabric is plaited to form a plug in the inner chamber. A rotatable perforated barrel reel lifts the fabric from this plug through the outlet of the inner chamber. The fabric then enters a jet dyeing chamber which contains a parallel flow non-clog venturi disposed so as to gently impregnate the fabric with dye liquid. The fabric exits the jet dyeing chamber through a cloth discharge tube which is disposed to convey the fabric to the entrance of the inner chamber in such a way that the angular change of direction of the fabric is minimized. The side walls and floor of the inner chamber are perforated, with the number of side wall perforations being greater toward the chamber entrance and lesser toward the chamber outlet. As the fabric leaves the cloth discharge tube and contacts the inner chamber, the dye liquid leaves the fabric through the perforations of the inner chamber.

**[0010]** A plastic liner is placed along the floor of the inner chamber in order to assist the movement of the plug of fabric from the entrance to the outlet of the inner chamber. The inner chamber has a cross section which increases in depth from the entrance to the outlet to allow the fabric plug to progress from the entrance to the outlet with less and less binding. Beneath the vessel is a pump suction header which maximizes the net positive suction pressure for the pump which recirculates the dye from the pressure vessel to the non-clog jet venturi.

**[0011]** Document US6427495 discloses a machine for

the treatment of cord fabrics, in particular for dyeing, is made up of a container of any shape, in one top part of which is set at least one motor-driven reel for moving the cord fabric, a device for jet-dyeing by the spraying of dye on the fabric set on at least one side of the at least one reel, and a device for overflow-dyeing of the fabric, which is set on the other side of the at least one reel, there being set underneath said at least one reel and underneath said devices a reservoir, which is designed to contain the fabric and the treatment liquid bath and which can move basically crosswise with respect to the direction of displacement of the cord fabric in order to fold the cord fabric in the reservoir itself. The displacement of the reservoir inside the container is simply crosswise in a rectilinear or oscillating fashion, or else is a motion made up of both types of motion, and the speed of the reservoir is fixed, or else variable in time.

**[0012]** The Applicant saw the need to contain the quantity of treatment liquid used in each cycle, consequently reducing the treatment costs and having less environmental impact, whilst maintaining and/or increasing the effectiveness of the treatment on the fabrics.

**[0013]** In this context, the technical purpose which forms the basis of this invention is to propose a machine for the discontinuous treatment of fabric ropes which allows a reduction in the quantity of treatment liquid moving in the circuits.

**[0014]** This invention also has for an aim to propose a machine for the discontinuous treatment of fabric ropes which allows the properties of the jets of treatment liquid emitted by the nozzles to be made more uniform.

**[0015]** The technical purpose specified and the aims indicated are substantially achieved by a machine for the discontinuous treatment of fabric ropes in which the branch ducts leading to the nozzles located close to the various reels extend in radial directions from a shared manifold.

**[0016]** More specifically, this invention relates to a machine for the discontinuous treatment of fabric ropes, comprising the features according to claim 1. That solution allows a reduction in the quantity of bath circulating in the machine ducts, that is to say, it allows a reduction in the quantity of bath which is not useful for the purposes of the process. The new system achieves a reduction in the quantity of bath circulating, compared with prior art machines, equal to approximately 10% of the free bath (that not retained in the fabric) and a percentage equal to approximately 20 - 30% of the quantity of bath circulating in the machine pipes. In a machine containing approximately 2700 litres of free bath and a total of approximately 5800 litres of treatment liquid, the reduction is no less than 270 litres for each treatment cycle.

**[0017]** Moreover, this solution allows an improvement in the system for distribution of the treatment liquid to the nozzles designed to move the fabric. Compared with prior art manifolds, this solution guarantees greater uniformity of flow rates and feed pressures between the various branch tubes.

**[0018]** The branch tubes which feed the nozzles are connected to the manifold in a region of the manifold in which the pressure is constant.

**[0019]** In other words, all of the branch tubes are fed with the treatment liquid at the same pressure.

**[0020]** The manifold has the shape of a cylinder and the branch tubes come out of a lateral wall of the cylindrical manifold.

**[0021]** The main axis of the cylindrical manifold is preferably vertical.

**[0022]** The branch tubes are preferably positioned in a horizontal plane.

**[0023]** Each of the branch tubes preferably has a cross-section area which is constant from the manifold to the at least one respective nozzle.

**[0024]** The branch tubes preferably have identical cross-section areas.

**[0025]** Each of the preferred features listed above helps to improve the uniformity of the flow rates and feed pressures between the various branch tubes.

**[0026]** In a preferred embodiment, the machine also comprises a heat exchanger inserted in a cylindrical body positioned along the recirculation duct and the manifold is positioned above and supported by the cylindrical body and preferably integrated in the cylindrical body.

**[0027]** That preferred embodiment allows a component which is already present (the heat exchanger) to be used to support the manifold, without having to provide additional supporting frames which would increase machine dimensions and cost.

**[0028]** Further features and advantages of this invention are more apparent in the detailed description below, with reference to a preferred, non-limiting, embodiment of a machine for the discontinuous treatment of fabric ropes, illustrated in the accompanying drawings, in which:

- Figure 1 is a schematic side view, partly in cross-section, of a machine for the discontinuous treatment of fabric ropes in accordance with this invention;
- Figure 2 is a top view of the machine of Figure 1.

In the accompanying drawings, the numeral 1 denotes in its entirety a machine for the discontinuous treatment of fabric ropes in accordance with this invention.

**[0029]** The machine 1 comprises a main tank 2 designed to receive, in its internally delimited volume, a treatment liquid, which may for example, be a dye for dyeing the fabric rope "T", or a detergent for subjecting the fabric "T" to a washing cycle. The tank 2 illustrated is a cylinder with a horizontal main axis "Y - Y". The liquid forms a bath 3 which occupies the lower part of the main tank 2 (visible in Figure 1).

**[0030]** In the upper part of the machine 1, above the tank 2, there is a plurality of reels 4 (six are shown in the example illustrated), each being motor-driven and able to rotate about its own horizontal axis of rotation. Each

reel 4 supports and guides a respective rope formed by a fabric "T" along a closed treatment path in the main tank 2 (Figure 1). Each reel 4 is positioned inside a box-shaped container 5 mounted above the tank 2 by means of a first tubular body 6 and a second tubular body 7. The box-shaped containers 5 are aligned with each other and positioned along an axis parallel with the main axis "Y - Y" of the main body 2 (Figure 2). The tubular bodies 6, 7, as well as supporting the box-shaped container 5, put the reel 4 in communication with the inside of the main tank 2. The fabric rope "T" descends from the reel 4 into the tank 2 through the first tubular body 6 and ascends again from the tank 2 to the reel 4 through the second tubular body 7 (Figure 1).

**[0031]** Inserted in the first tubular body 6 there is at least one movement nozzle (not illustrated) angled at an acute angle to the direction of feed of the rope "T", for dispensing against the fabric rope "T" a pressurised jet of the treatment liquid drawn from the bottom of the main tank 2 through a recirculation duct 8 equipped with a pump "P" (Figure 1). Said nozzle performs the dual function of wetting the fabric "T", before immersion, and providing the thrust to make it advance towards the bath 3.

**[0032]** The recirculation duct 8 has a first end 9 connected to the bottom of the tank 2 and a second end 10 connected to the bottom of a cylindrical body 11 with a vertical axis which, in the known way, contains a heat exchanger. The pump "P" is positioned on the duct 8 between the tank 2 and the cylindrical body 11 (Figure 1).

**[0033]** At an upper end of the cylindrical body 11 there is a manifold 12 integrated in the cylindrical body 11 and therefore comprising a cylindrical lateral wall 13 shared with the cylindrical body 11 and an upper wall 14 which closes the top of the cylindrical body 11. The manifold 12 internally delimits a cylindrical volume separated from the heat exchanger by a partition 15 comprising at least one passage for the treatment liquid.

**[0034]** The manifold 12 has a main axis "X - X".

**[0035]** In particular, as shown in Figure 1, the main axis "X - X" is vertical and the manifold 12 is positioned substantially at the same height as the first tubular bodies 6.

**[0036]** Extending from the lateral wall 13 there are as many branch tubes 16 as there are reels 5. Each branch tube 16 connects the manifold 12 to the one or more movement nozzles located in a single first tubular body 6.

**[0037]** Each branch tube 16 comprises at least a first stretch 16a, close to the manifold 12, extending in a radial direction relative to the vertical main axis "X - X" of the manifold 12.

**[0038]** The branch tubes 16 extend from positions which are substantially located at the same height along the main axis "X - X" of the manifold 12.

**[0039]** In other words, the branch tubes 16 extend radially around the same annular portion of the manifold 12, in such a way that all of the tubes are fed with treatment liquid at the same pressure.

**[0040]** In particular, the branch tubes 16 extend in the same horizontal plane substantially as far as the first tu-

bular bodies 6. Figure 1 shows one of the branch tubes 16 which remains in the above-mentioned horizontal plane from the manifold 12 until it is close to the first tubular body 6, where there is a slight bend so as to make the branch tube 16 go into the first tubular body 6 in a direction perpendicular to the first tubular body 6.

**[0041]** Figure 2 shows how each of the branch tubes 16, which extend radially from the manifold 12, comprises a curve close to the respective first tubular body 6 in such a way that the tube is positioned perpendicular to the axis "Y - Y" of the tank 2.

**[0042]** The cross-section area of each branch tube 16 is constant along the longitudinal extension of the tube 16 (from the manifold 12 to the first tubular body 6). The branch tubes 16 also have identical cross-sections.

**[0043]** As shown in Figure 2, in the example embodiment illustrated, the manifold 12 and the branch tubes 16 are symmetrical relative to a plane of symmetry "S" of the tank 2. Said plane "S" cuts the tank 2 in half and is perpendicular to the main axis "Y - Y" of the tank 2.

## Claims

1. A machine for the discontinuous treatment of fabric in the form of ropes, comprising:

a main tank (2) delimiting an inner volume for the containment of a treatment liquid bath (3);  
a plurality of motor-driven reels (4) positioned at an upper portion of the tank (2) and each designed to support and guide a respective fabric rope (T) along a closed treatment path in the main tank (2);

at least one spraying nozzle located close to each of the motor-driven reels (4) and facing towards the respective fabric rope (T) for dispensing against the fabric rope (T) a pressurised jet of the treatment liquid;

a recirculation duct (8) whose first end (9) is connected to a lower portion of the tank (2) and whose second end (10) is in fluid communication with the nozzles;

a pump (P) operating on the recirculation duct (8);

a manifold (12) connected to the second end (10) of the recirculation duct (8) and extending along a main axis (X - X);

a plurality of branch tubes (16) extending from the manifold and connected to the nozzles;

**characterised in that** the branch tubes (16) come out of the manifold (12), according to directions substantially diverging from said manifold and converging toward a same central point of said manifold, said branch tubes (16) extending from positions which are located substantially at the same height along the main axis (X - X) of the manifold (12), wherein the manifold (12)

has the shape of a cylinder and the branch tubes (16) come out of a lateral wall (13) of the cylindrical manifold (12).

2. The machine according to claim 1, wherein the main axis (X - X) of the cylindrical manifold (12) is vertical. 5
3. The machine according to claim 1, wherein the branch tubes (16) are positioned in a horizontal plane. 10
4. The machine according to claim 1, wherein each of the branch tubes (16) has a constant cross-section area (A) from the manifold (12) to the at least one respective nozzle. 15
5. The machine according to claim 1, wherein the branch tubes (16) have identical cross-section areas (A). 20
6. The machine according to claim 1, also comprising a heat exchanger inserted in a cylindrical body (11) positioned along the recirculation duct (8), wherein the manifold (12) is positioned above and is supported by the cylindrical body (11) and is preferably integrated in the cylindrical body (11). 25

#### Patentansprüche

1. Maschine zur diskontinuierlichen Behandlung von Gewebe in Form von Seilen, umfassend:
  - einen Hauptbehälter (2), der ein Innenvolumen zur Aufnahme eines Behandlungsflüssigkeitsbades (3) begrenzt; 35
  - mehrere motorisch angetriebene Spulen (4), die an einem oberen Abschnitt des Tanks (2) angeordnet und jeweils dazu bestimmt sind, ein jeweiliges Gewebeseil (T) entlang einer geschlossenen Behandlungsbahn im Hauptbehälter (2) zu tragen und zu führen; 40
  - mindestens eine Sprühdüse, die in der Nähe jeder der motorisch angetriebenen Spulen (4) angeordnet und dem jeweiligen Gewebeseil (T) zugewandt ist, um gegen das Gewebeseil (T) einen Druckstrahl der Behandlungsflüssigkeit abzugeben; 45
  - einen Umwälzkanal (8), dessen erstes Ende (9) mit einem unteren Teil des Tanks (2) verbunden ist und dessen zweites Ende (10) mit den Düsen in Fluidverbindung steht; 50
  - eine Pumpe (P), die am Umwälzkanal (8) arbeitet; 55
  - einen Verteiler (12), der mit dem zweiten Ende (10) des Umwälzkanals (8) verbunden ist und sich entlang einer Hauptachse (X - X) erstreckt; mehrere Abzweigrohre (16), die sich von dem

Verteiler (12) erstrecken und mit den Düsen verbunden sind;

**dadurch gekennzeichnet, dass** die Abzweigrohre (16) aus dem Verteiler (12) entsprechend Richtungen, die im Wesentlichen vom Verteiler (12) divergieren und in einem zentralen Punkt des Verteilers konvergieren, herauskommen, wobei die Abzweigrohre (16) sich von Positionen erstrecken, die im Wesentlichen auf gleicher Höhe entlang der Hauptachse (X - X) von dem Verteiler (12) liegen, wobei der Verteiler (12) die Form eines Zylinders hat und die Abzweigrohre (16) aus einer Seitenwand (13) des zylindrischen Verteilers (12) herauskommen.

2. Maschine nach Anspruch 1, wobei die Hauptachse (X - X) des zylindrischen Verteilers (12) vertikal ist.
3. Maschine nach Anspruch 1, wobei die Abzweigrohre (16) in einer horizontalen Ebene angeordnet sind.
4. Maschine nach Anspruch 1, wobei jedes der Abzweigrohre (16) eine konstante Querschnittsfläche (A) vom Verteiler (12) zur mindestens einen Düse aufweist.
5. Maschine nach Anspruch 1, wobei die Abzweigrohre (15) gleiche Querschnittsflächen (A) aufweisen.
6. Maschine nach Anspruch 1, die außerdem einen Wärmetauscher umfasst, der in einem zylindrischen Körper (11) eingesetzt ist, der entlang des Umwälzkanals (8) angeordnet ist, wobei der Verteiler (12) über dem zylindrischen Körper (11) angeordnet und getragen ist und vorzugsweise in den zylindrischen Körper (11) integriert ist.

#### Revendications

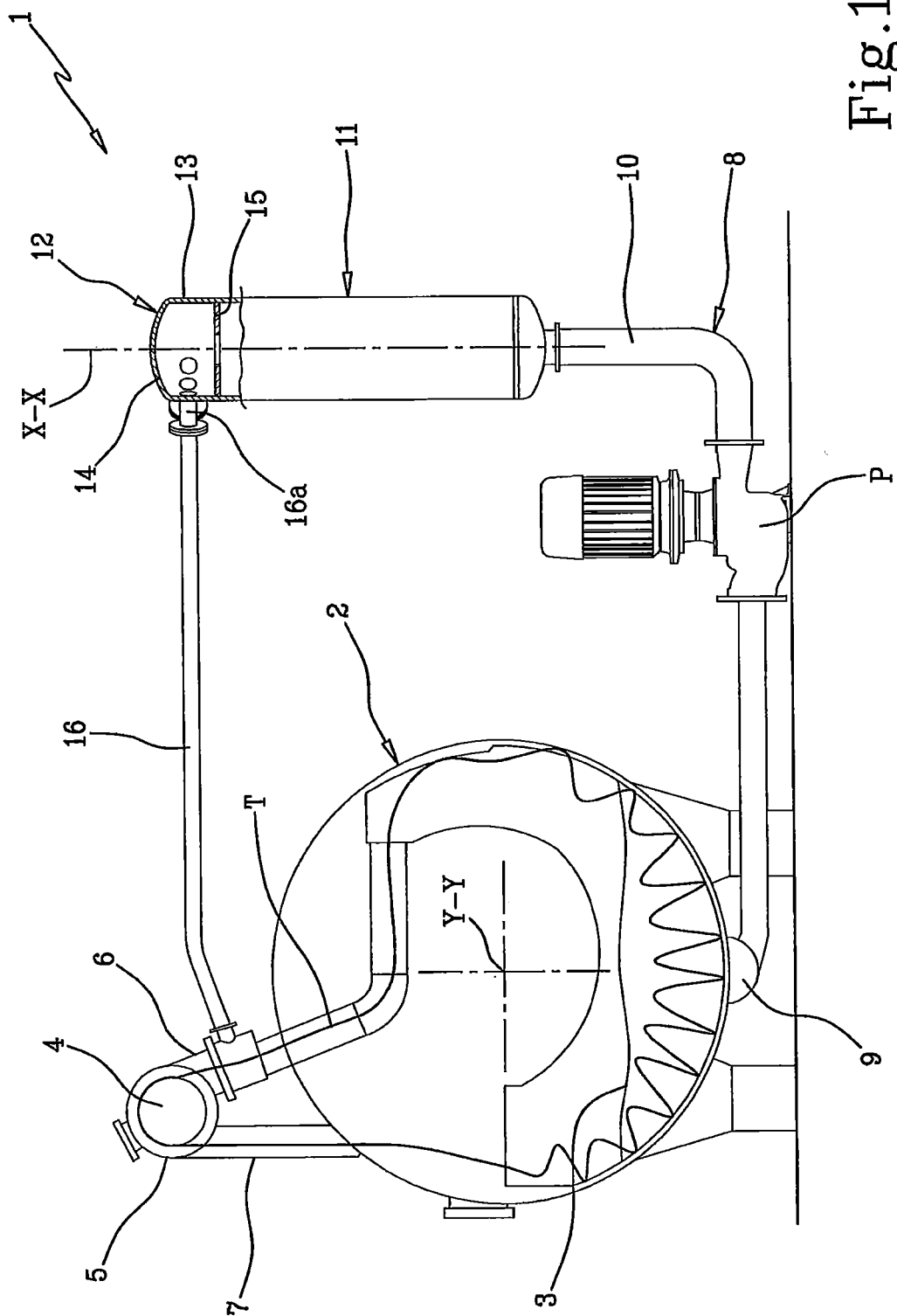
1. Machine pour le traitement discontinu de tissu sous forme de boyaux, comprenant :
  - un réservoir principal (2) délimitant un volume intérieur pour le confinement d'un bain de liquide de traitement (3) ;
  - une pluralité de rouleaux entraînés par moteur (4) positionnés au niveau d'une partie supérieure du réservoir (2) et conçus chacun pour supporter et guider un boyau de tissu respectif (T) le long d'un chemin de traitement fermé dans le réservoir principal (2) ;
  - au moins une buse de pulvérisation située près de chacun des rouleaux entraînés par moteur (4) et tournée vers le boyau de tissu respectif (T) pour distribuer un jet sous pression du liquide de traitement contre le boyau de tissu (T) ;
  - un conduit de recirculation (8) dont la première

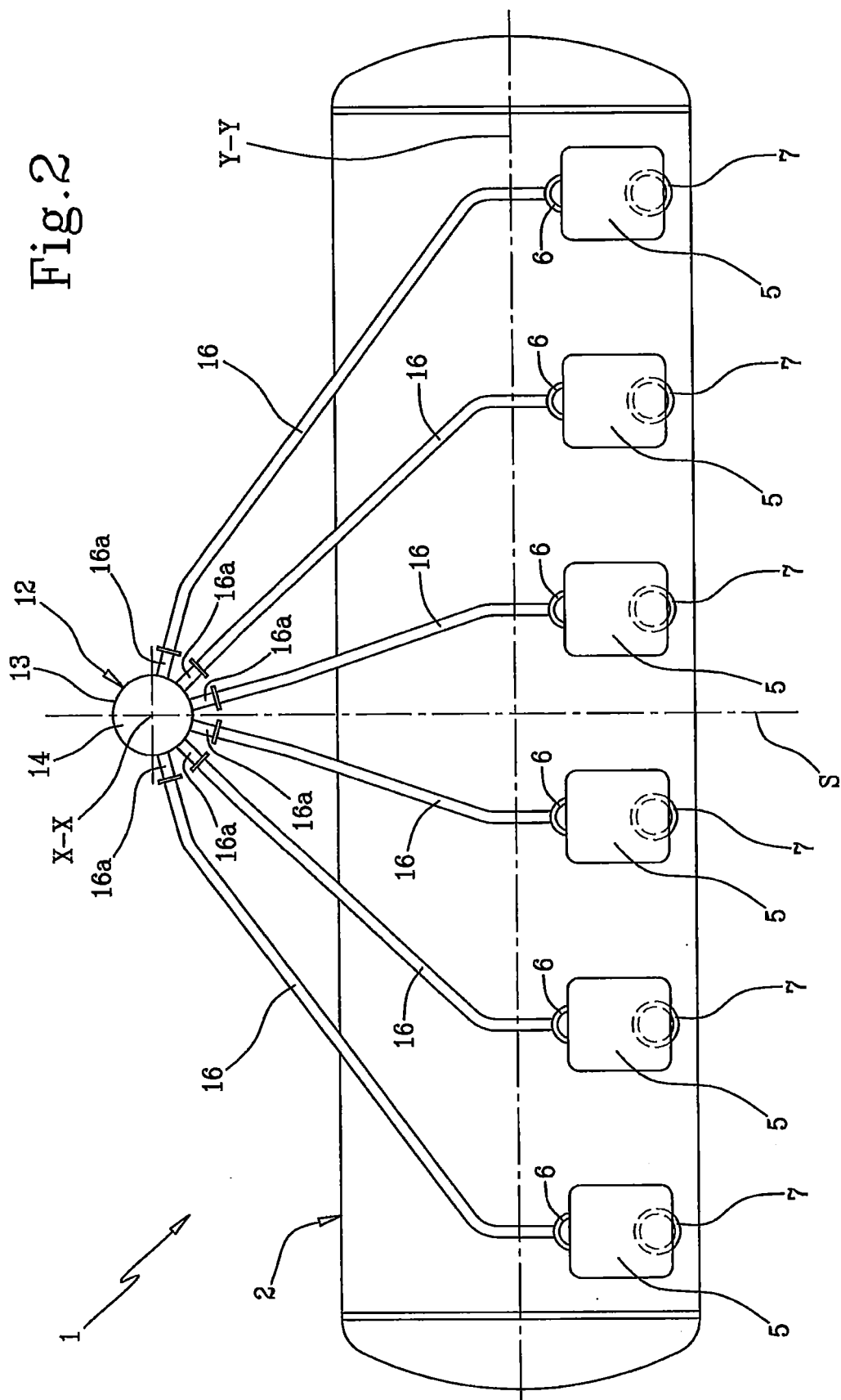
extrémité (9) est reliée à une partie inférieure du réservoir (2) et dont la seconde extrémité (10) est en communication fluïdique avec les buses ; une pompe (P) fonctionnant sur le conduit de recirculation (8) ;  
 un collecteur (12) relié à la seconde extrémité (10) du conduit de recirculation (8) et s'étendant le long d'un axe principal (X - X) ;  
 une pluralité de tubes de dérivation (16) s'étendant du collecteur et reliés aux buses ;  
**caractérisée en ce que** les tubes de dérivation (16) sortent du collecteur (12), selon des directions sensiblement divergeant dudit collecteur et convergeant vers un même point central dudit collecteur, lesdits tubes de dérivation (16) s'étendant de positions qui sont situées sensiblement à la même hauteur le long de l'axe principal (X - X) du collecteur (12), dans laquelle le collecteur (12) a la forme d'un cylindre et les tubes de dérivation (16) sortent d'une paroi latérale (13) du collecteur cylindrique (12).

2. Machine selon la revendication 1, dans laquelle l'axe principal (X - X) du collecteur cylindrique (12) est vertical.
3. Machine selon la revendication 1, dans laquelle les tubes de dérivation (16) sont positionnés dans un plan horizontal.
4. Machine selon la revendication 1, dans laquelle chacun des tubes de dérivation (16) a une section transversale constante (A) du collecteur (12) à l'au moins une buse respective.
5. Machine selon la revendication 1, dans laquelle les tubes de dérivation (16) ont des sections transversales (A) identiques.
6. Machine selon la revendication 1, comprenant également un échangeur de chaleur inséré dans un corps cylindrique (11) positionné le long du conduit de recirculation (8), dans laquelle le collecteur (12) est positionné au-dessus et est supporté par le corps cylindrique (11) et est intégré de préférence dans le

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**REFERENCES CITED IN THE DESCRIPTION**

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