(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 845 940 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.03.2015 Bulletin 2015/11

(51) Int Cl.:
D06B 1/02 *(2006.01)* ***D06B 5/08*** *(2006.01)*

(21) Application number: **14184062.9**

(22) Date of filing: **09.09.2014**

(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
Designated Extension States:
BA ME

(30) Priority: **10.09.2013 IT MI20131492**

(71) Applicant: **Biella Shrunk Process S.A.S. di Pietro Alberto & C.**
13854 Quaregna (IT)

(72) Inventor: **Alberto, Michele**
13854 Quaregna BI (IT)

(74) Representative: **Spina, Alessandro et al**
Società Italiana Brevetti S.p.A.
Via Carducci, 8
20123 Milano (IT)

(54) Apparatus and method for the washing of fabrics

(57) The invention relates to an apparatus (100) for the washing of fabrics in a continuous and open mode, said apparatus (100) comprising at least one processing unit (10) that extends in a longitudinal direction (L) of the apparatus (100), said processing unit (10) comprising a plurality of cylinders that define a washing path extending from an inlet (11) to an outlet (12) thereof. Said at least one processing unit (10) further comprises a first and a second perforated moving surfaces (20, 21) configured to receive a fabric (F) to be treated between them, said moving surfaces (20, 21) being supported by sets of cylinders comprising both cylinders (40; 50, 60) of said washing path and further cylinders (41; 61), each moving surface forming a closed loop path with said cylinders and at least one of said cylinders (40, 41, 60, 61) being a driven cylinders, wherein said closed loop paths share the same cylinders (40; 50, 60) which define said washing path. The processing unit (10) further comprises a plurality of first and second nozzles (30, 31) arranged along the entire washing path and facing the perforated moving surfaces (20, 21), said nozzles (30, 31) being connected to sources of washing fluids and being configured for dispensing said fluids at pressures comprised between 5 and 50 bar, preferably between 8 and 15 bar, and at flow rates comprised between 10.000 and 50.000, preferably between 20.000 and 40.000, liters/hour per linear meter of fabric in the direction of its width. The invention also relates to a washing method carried out by said washing apparatus.

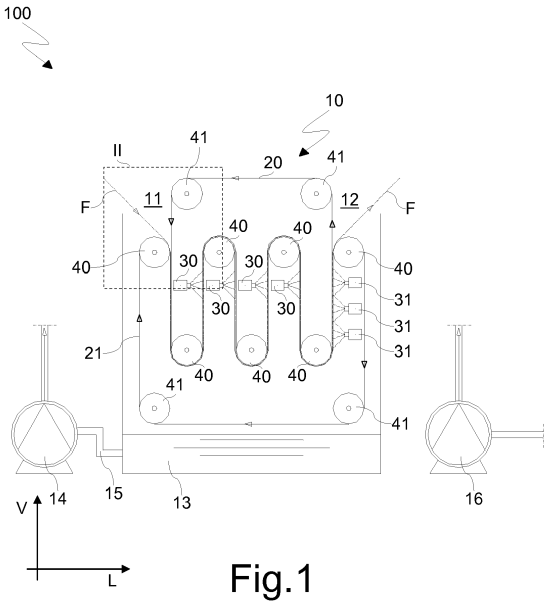

Fig.1

EP 2 845 940 A1

Description

[0001] The present invention relates to industrial washing of fabrics subsequently to their weaving processes and more particularly to an apparatus and a method for the washing of fabrics in the so called "continuous and open mode", which indicates that fabrics pass through a washing apparatus from an inlet to an outlet and are kept fully extended in the direction of their width.

[0002] Washing of fabrics manufactured through industrial weaving processes is necessary to eliminate impurities therefrom such as, for example, residues of spinning or weaving, as well as chemicals such as caustic soda and bleaching agents.

[0003] Known washing systems for fabrics comprise one or more processing units consisting of tanks containing a plurality of cylinders that define a washing path. Washing is carried out by way of washing fluids such as water or mixtures of water and detergents at temperatures comprised between 20°C and 99°C. A fabric is mainly washed by immersion in the washing fluids, typically first in tanks containing mixtures of water and detergents and then in tanks containing water only, wherein rinsing operations are carried out. It is also known to carry out washing by spraying water at pressures comprised between 2 and 4 bar directly on a fabric. Water is sprayed from perforated or slotted conduits arranged along the washing paths in the different tanks.

[0004] In washing apparatuses comprising small diameter cylinders or rollers, each processing unit includes a tank and a plurality of rollers having a diameter generally equal to or lower than 20 cm. The rollers are arranged along a longitudinal direction between an inlet and an outlet of the processing unit and grouped in parallel rows that are spaced apart vertically. The parallel rows formed by the groups of rollers define a zig-zag washing path for the fabrics to be treated. This configuration allows to achieve long washing paths within the processing units. However, the washing paths are rather tortuous and require to tension a fabric longitudinally, which results in the risk of undesirable elongations and formation of folds.

[0005] Washing apparatuses comprising large diameter cylinders or drums are also known. In these apparatuses each processing unit comprises at least one drum having a diameter e.g. in the order of 1 m on which a fabric to be washed is wound. The drum is partially immersed in a tank, thus allowing to soak the fabric to be cleaned in the washing fluids. Similarly to washing apparatuses comprising rollers, those comprising drums may additionally employ washing fluids sprayed from perforated or slotted conduits arranged above and/or around the drums. The processing units also comprise cylinders or rollers having a diameter that is smaller than the diameter of the respective drums and serve to guide a fabric to and from the drums.

[0006] An example of a similar washing apparatus is disclosed in the European patent application EP 280068 A1.

[0007] The drums may have wavy shaped mantles or mantles made up of a plurality of slats, which allow washing water to cross the fabric wrapped around the drum, thus washing it simultaneously on the two opposite faces.

[0008] Compared to apparatuses comprising groups of rollers, washing apparatuses comprising large drums have shorter and less tortuous washing paths, whereby the elongation problems of the treated fabrics and the risks of formation of folds are reduced. The shorter washing paths notwithstanding, tensioning of the fabrics is still necessary due to their remarkable weight when wet. Moreover, in order to achieve an adequate washing action, it is necessary to provide a washing apparatus with a number of processing units, whereby the overall size of a washing apparatus comprising large drums is generally larger than the overall size of an apparatus provided with groups of rollers, particularly in the longitudinal direction.

[0009] Also known are combined washing apparatuses comprising processing units with groups of rollers, as well as processing units provided with drums of a larger diameter.

[0010] Further washing apparatuses for fabrics comprise a washing path defined by a plurality of cylinders or rolls and comprising a bath designed to hold a fabric-processing liquor inside which suction and jet units are arranged. The suction and jet units receive a fabric between them and the bath liquor is caused to flow therethrough from one face to the opposite one. An example of such an apparatus is disclosed in the international publication WO 96/05350 A1.

[0011] Still further washing apparatuses for fabrics include a washing path defined by a conveyor belt above which hollow or slotted conduits configured to dispense washing fluids are arranged. A fabric to be washed is arranged folded on the conveyor belt and moved along the washing path. The fabric can be made to pass several times through the washing path by way of cylinders and rollers.

[0012] Despite the availability of washing apparatuses of different types and sizes, there is still the need to improve apparatuses and methods for the washing of fabrics, which is an object of the present invention.

[0013] Said object is achieved with a washing apparatus and a washing method, whose main features are specified in the independent claims 1 and 9, respectively, while other features are specified in the remaining claims.

[0014] An idea of solution underlying the present invention is to convey a fabric along a washing path not directly in contact with the cylinders as in known washing systems, either small diameter rollers or drums, but sandwiched between two perforated moving surfaces that convey it from an inlet to an outlet of a processing unit. The use of perforated moving surfaces to convey a fabric along the washing path allows to carry out washing of the fabric while minimizing its elongation problems. In fact, the tensile stresses generated by the drawing cylinders arranged along the washing path only indirectly

stress the fabric, because they are mainly absorbed by the moving surfaces conveying it.

[0015] Furthermore, the perforated moving surfaces allow to ensure maintenance of an open configuration of the fabric along the whole washing path, thus avoiding the risk of formation of folds independently of the conformation of the latter.

[0016] It is also an idea of solution underlying the invention to perform washing of a fabric with washing fluids that are exclusively fed at high pressures and high flow rates by nozzles arranged along the washing path. Differently from prior art apparatuses as those disclosed by EP 280068 A1 and WO 96/05350 A1, in the apparatus of the invention a fabric is not partly or fully immersed in tanks containing washing fluids. The washing apparatus and method of the invention instead exploit the dynamic action of washing fluids sprayed at high pressures and flow rates, which generate on the fabrics high impact forces that allow them to completely cross the latter, thus removing impurities therefrom much more effectively than it happens in known washing apparatuses.

[0017] Consequently, it is possible to reduce the length of the washing paths, for example by using a smaller number of tanks, and the overall size of a washing apparatus, as well as its manufacturing costs. Compared to washing apparatuses known in the field, processing times and operation costs are also remarkably reduced.

[0018] The perforated moving surfaces used to convey a fabric along the washing path comprise a plurality of apertures configured to facilitate passage of the washing fluids from one face of the fabric to the opposite one, while at the same time spreading the pressures exerted by the washing fluids over the entire surface of the fabric so as to prevent them from being damaged, such as scratched, worn and torn.

[0019] The perforated moving surfaces may for example be in the form of meshes made of metal or synthetic materials.

[0020] According to an embodiment of the invention, the washing apparatus comprises at least one processing unit, wherein the perforated surfaces sandwiching a fabric to be cleaned are conveyors belts respectively moved by sets of rollers, and wherein some of the rollers are arranged along the washing path. The nozzles that spray jets of water and mixtures of water and detergents toward the fabric are arranged in the portions of the washing path between subsequent rollers.

[0021] According to an alternative embodiment of the invention, the washing apparatus comprises at least one processing unit wherein one of the perforated moving surfaces is wound on a drum of the processing unit and coats or directly forms its mantle, while the other perforated moving surface is a conveyor belt moved by a plurality of rollers of a smaller diameter than the diameter of the drum. In this case the nozzles that deliver the jets of water and mixtures of water and detergents toward the fabric are arranged circumferentially around the drum.

[0022] According to a further embodiment of the invention, the washing apparatus may include both processing units comprising pairs of conveyor belts and processing units comprising a single conveyor belt and a drum whose mantle is coated or formed by a perforated surface.

[0023] Further advantages and features of the washing apparatus and method according to the present invention will become clear to those skilled in the art from the following detailed and non-limiting description of embodiments thereof with reference to the attached drawings wherein:

- Figure 1 schematically shows a washing apparatus according to an embodiment of the present invention;
- Figure 2 shows a detail II of Figure 1;
- Figure 3 schematically shows a washing apparatus according to an alternative embodiment of the present invention;
- Figure 4 shows a detail IV of figure 3.

[0024] Referring to the drawings, a washing apparatus for fabrics according to the invention is generally indicated by reference numeral 100 and comprises at least one processing unit 10 that extends in a longitudinal direction L. The processing unit 10 comprises a plurality of cylinders defining a washing path that extends between an inlet 11 and an outlet 12 of the processing unit 10. The type and arrangement of the cylinders will be described below with reference to specific embodiments of the invention.

[0025] During operation of the washing apparatus 100 a fabric F is received in the processing unit 10 in the direction of its length and maintained flat in the direction of its width along the washing path, thus allowing to carry out washing in open and continuous mode.

[0026] To this aim, according to the invention the processing unit 10 comprises a first and a second perforated moving surfaces 20, 21 supported by sets of cylinders comprising both cylinders of the washing path and idler cylinders. Each perforated moving surface forms a closed ring path with the set of cylinders. Each closed ring path comprises at least one motorized cylinder that causes the perforated moving surfaces to circulate around the respective sets of cylinders.

[0027] The ring or closed loop paths formed by the perforated moving surfaces 20, 21 share the same cylinders defining the washing path. Hence, the perforated moving surfaces are completely overlapped along the washing path from the inlet 11 to the outlet 12 of the processing unit 10, whereas they respectively move close to each other at the inlet 11 and away from each other at the outlet 12 driven by their respective idler cylinders.

[0028] During operation, the moving surfaces 20, 21 driven by respective sets of cylinders receive the fabric F to be washed between them at the inlet 11, thus forming a sandwich structure therewith. The fabric so sandwiched between the moving surfaces proceeds along the wash-

ing path to the outlet 12. Therefore, during washing the fabric F proceeds along the washing path dragged by the perforated moving surfaces 20, 21.

[0029] The mixtures of water and detergents needed to wash the fabric F are dispensed by a plurality of first nozzles 30 arranged along the entire washing path and facing the perforated moving surfaces 20, 21. Hence, during operation the nozzles face the sandwich structure formed by the moving surfaces and the fabric F arranged therebetween. Fresh water for the rinsing of the fabric F is instead supplied by a plurality of second nozzles 31 e.g. arranged in the portion of the washing path located near the outlet 12 of the processing unit 10.

[0030] The nozzles 30, 31 are also arranged over the entire width of the washing path, thus allowing to wash of the fabric F not only along its length but also along its width, so as to process its whole surface.

[0031] It will be understood that the rinsing nozzles 31 might also be arranged among the washing nozzles 30 configured to deliver the mixtures of water and detergents, so as to carry out intermediate rinsing steps during a washing cycle.

[0032] The apertures formed in the surfaces of handling 20, 21 allow cleaning fluids sprayed at high pressures and flow rates to cross the fabric F from one face to the opposite and to exert thereon and among its meshes friction forces that allow to effectively remove the impurities.

[0033] According to the present invention, the washing fluids dispensed by the nozzles 30, 31 are fed at high pressures, in particular comprised between 5 and 50 bar, preferably between 8 and 15 bar. In addition to this, the nozzles 30, 31 are configured to feed the washing fluids at flow rates comprised between 10000 and 50000, preferably between 20000 and 40000, liters/hour per linear meter of fabric in the direction of the width. Nozzles outlets suitable to ensure such flow rates are for example larger than or equal to 0.8 mm^2.

[0034] The above pressures and flow rates allow to achieve a high penetration of the washing fluids into the treated fabric F, which results in a more rapid and effective cleaning action with respect to known washing apparatuses that employ hollow or slotted conduits operated at lower pressures, e.g. comprised between 2 and 4 bars, combined with tanks containing washing fluids wherein the fabric is made to pass. In other words, differently from known washing apparatuses, the washing apparatus of the invention exploits the dynamic action of the washing fluids on the fabrics.

[0035] Thanks to these features, the washing path of a washing apparatus according to the invention is generally shorter than the washing path of a known washing apparatus.

[0036] The processing unit 10 also comprises a tank 13 which collects by gravity the mixtures of water and detergents dispensed by the nozzles 30, 31 for washing the fabric F. Referring to a vertical direction V, perpendicular to the longitudinal direction L, the tank 13 is arranged below the cylinders defining the washing path.

[0037] The sole function of the tank is to collect washing fluids falling from the fabric. Differently from prior art washing apparatuses, the apparatus of the invention does not require any passage of the fabric into the tank, washing being carried out exclusively through the dynamic cleaning action of the washing fluid sprayed at high pressures and flow rates by the nozzles.

[0038] Preferably, the mixtures of water and detergents collected in the tank 13 of each processing unit 10 are recirculated after filtration during a whole washing cycle by way of a respective pump 14 connected to the tank 13 through a suitable conduit 15. A pump allowing to supply clean water to the second nozzles 31 is instead indicated in the figures by reference number 16.

[0039] Now referring to Figures 1 and 2, according to an embodiment of the invention both the first and the second perforated moving surfaces 20, 21 are conveyor belts provided with a plurality of through apertures, for example, meshes made of plastic or metal.

[0040] The perforated moving surfaces 20, 21 are respectively supported by a plurality of cylinders in the form of rollers 40 having a small diameter, for example equal to 20 cm, which define the washing path from the inlet 11 to the outlet 12 of the processing unit 10. The perforated moving surfaces 20, 21 are also supported by additional rollers 41, which do not belong to the washing path and e.g. have the same diameter of the rollers 40 of the washing path.

[0041] In the frame of the present invention it is completely irrelevant whether the perforated moving surfaces 20, 21 are driven by a roller 40 of the washing path or by any one of the additional rollers 41.

[0042] As shown in Figures 1 and 2, along the washing path the rollers 40 are aligned longitudinally and divided into two groups that are spaced apart vertically. Moreover, the rollers 40 of the two groups are offset from each other in the longitudinal direction L, so that the washing path they define has a zig-zag pattern, whose total length varies depending on the number of rollers 40 and their relative distances in the longitudinal and vertical directions L, V of the apparatus 100.

[0043] The movement direction of the perforated moving surfaces 20, 21 and the rotation direction of the rollers 40 are shown in Figures 1 and 2 by way of arrows.

[0044] The nozzles 30 which provide the mixtures of water and detergents can be advantageously arranged between subsequent rollers 40 of the washing path in the vertical direction V. All the nozzles may be oriented in the same direction, so that during operation they alternately face the inner and outer faces of the sandwich structure formed by the perforated moving surfaces 20, 21 and the fabric F.

[0045] In order to prevent deformations of the fabric F during its passage along the washing path, it is necessary to synchronize the velocities of the two perforated moving surfaces 20, 21. To this aim, the apparatus 100 may advantageously comprise a control system (not shown) op-

erated by an appropriate control program, for example, in closed loop mode, which receives as inputs values indicative of the movement velocity of the moving surfaces 20, 21 and provides as outputs values for controlling the rotation speed of the motorized rollers.

[0046] Now referring to Figures 3 and 4, according to an alternative embodiment of the invention, the processing unit 10 comprises a cylinder in the form of a drum 50 of large diameter, for example equal to 1 m, on whose mantle the first perforated moving surface 20 is applied or integrally formed.

[0047] Similarly to the embodiment described above, the second perforated moving surface 21 is a conveyor belt supported by a plurality of rollers 60 of a smaller diameter than the drum 50, for example equal to 20 cm. The drum 50 and the rollers 60 form the washing path of the processing unit 10.

[0048] The second perforated moving surface 21 is also supported by additional rollers 61 that do not belong to the washing path and form a closed ring or loop path that is superimposed to the mantle of the drum 50, i.e. to the first moving surface 20 substantially over its whole circumference.

[0049] The inlet and outlet 11, 12 for the fabric F are adjacent to one another and arranged proximate to the mantle of the drum 50, while the nozzles 30, 31 intended to carry out washing and rinsing of the fabric F are arranged along the circumference of the drum 50.

[0050] The operation of the washing apparatus 100 according to this embodiment is the same as that of the embodiment described above, the fabric F being fed into the processing unit 10 from the inlet 11 to the outlet 12 and proceeding along the washing path sandwiched between the perforated moving surfaces 20, 21.

[0051] Also in this case, in order to avoid deformations of the fabric F during its passage along the washing path it is necessary to synchronize the speeds of the two perforated moving surfaces 20, 21. To this aim, the apparatus 100 may advantageously comprise a control system (not shown), e.g. operated in a closed loop mode, managed by a suitable control program that receives as input values indicative of the movement velocity of the moving surfaces 20, 21 and provides output values for controlling the rotation speed of the motorized rollers.

[0052] In Figures 3 and 4 the movement direction of the perforated moving surfaces 20, 21 and the rotation direction of the drum 50 and the rollers 60 are shown by way of arrows.

[0053] The present invention has herein been disclosed with reference to preferred embodiments of the washing apparatus and method. It is to be understood that there may be other embodiments relating to the same inventive idea, as defined by the scope of protection of the claims set forth below.

Claims

1. An apparatus (100) for the washing of fabrics in a continuous and open mode, said apparatus (100) comprising at least one processing unit (10) that extends in a longitudinal direction (L) of the apparatus (100), said processing unit (10) comprising a plurality of cylinders that define a washing path extending from an inlet (11) to an outlet (12) thereof, **characterized in that**
said at least one processing unit (10) further comprises a first and a second perforated moving surfaces (20, 21) configured to receive a fabric (F) to be treated between them, said moving surfaces (20, 21) being supported by sets of cylinders comprising both cylinders (40; 50, 60) of said washing path and further cylinders (41; 61), each moving surface forming a closed loop path with said cylinders and at least one of said cylinders (40, 41, 60, 61) being a driven cylinders, wherein said closed loop paths share the same cylinders (40; 50, 60) which define said washing path, and **in that**
said processing unit (10) further comprises a plurality of first and second nozzles (30, 31) arranged along the entire washing path and facing the perforated moving surfaces (20, 21), said nozzles (30, 31) being connected to sources of washing fluids and being configured for dispensing said fluids at pressures comprised between 5 and 50 bar, preferably between 8 and 15 bar, and at flow rates comprised between 10.000 and 50.000, preferably between 20.000 and 40.000, liters/hour per linear meter of fabric in the direction of its width.

2. A washing apparatus (100) according to claim 1, wherein said processing unit (10) further comprises a tank (13) suitable for collecting by gravity water and detergent mixtures dispensed by the first nozzles (30), said tank (13) being arranged below the cylinders (40; 50, 60) that define the washing path with respect to a vertical direction (V) of the apparatus (100), perpendicular to the longitudinal direction (L).

3. A washing apparatus (100) according to claim 2, wherein the processing unit (10) further comprises a pump (14) connected to the tank (13) through a duct (15), said pump (14) being configured to suck the mixtures of water and detergents collected in the tank (13) and to supply them to the first nozzles (30).

4. A washing apparatus (100) according to any one of claims 1 to 3, wherein both the first and the second perforated moving surfaces (20, 21) are conveyor belts comprising a plurality of apertures, said conveyor belts being supported by a plurality of cylinders (40) that define the washing path from the inlet (11) to the outlet (12) of the processing unit (10) and by

additional idler cylinders (41) external to the washing path.

5. A washing apparatus (100) according to claim 4, wherein the cylinders or rollers (40) of the washing path are longitudinally aligned and divided into two vertically spaced groups, the cylinders or rollers (40) of the two groups being mutually shifted in the longitudinal direction (L).

6. A washing apparatus (100) according to claim 5, wherein the nozzles (30, 31) of the processing unit (10) are arranged between consecutive cylinders (40) of the washing path in the vertical direction (V).

7. A washing apparatus (100) according to any one of claims 1 to 3, wherein the processing unit (10) comprises a drum (50) on whose mantle the first perforated moving surface (20) is applied or integrally formed, and wherein the second perforated moving surface (21) is a conveyor belt supported by a plurality of cylinders (60) forming a washing path with said drum (50) and by further cylinders (61) external to the washing path with which the conveyor belt forms a closed loop path which overlaps the mantle of the drum (50).

8. A washing apparatus (100) according to claim 7, wherein the nozzles (30, 31) for dispensing the washing fluids are arranged along the circumference of the drum (50).

9. A method for the washing of fabrics in a continuous and open mode, wherein a fabric (F) to be treated passes through a washing path comprising a plurality of cylinders of at least one processing unit (10) of a washing apparatus (100), said method comprising the steps of:

i) receiving said fabric (F) at an inlet (11) of said processing unit (10) between a first and a second perforated moving surfaces (20, 21) thus forming a sandwich structure, said first and a second perforated moving surfaces (20, 21) being supported by said cylinders of the washing path and by further idler cylinders with which they form respective closed loop paths;
ii) moving said sandwich structure along the washing path from said inlet (11) to an outlet (12) of the processing unit (10) by driving at least one of the cylinders of the respective closed loop paths;
iii) washing said fabric (F) exclusively by dispensing washing fluid jets towards said sandwich structure, said jets being supplied at pressures comprised between 5 and 50 bar, preferably between 8 and 15 bar, and at flow rates comprised between 10.000 and 50.000, and preferably between 20.000 and 40.000, liters/hour per linear meter of fabric in the direction of its width.

10. A washing method according to claim 9, further comprising a step of synchronizing the velocities of the perforated moving surfaces (20, 21) along the washing path.

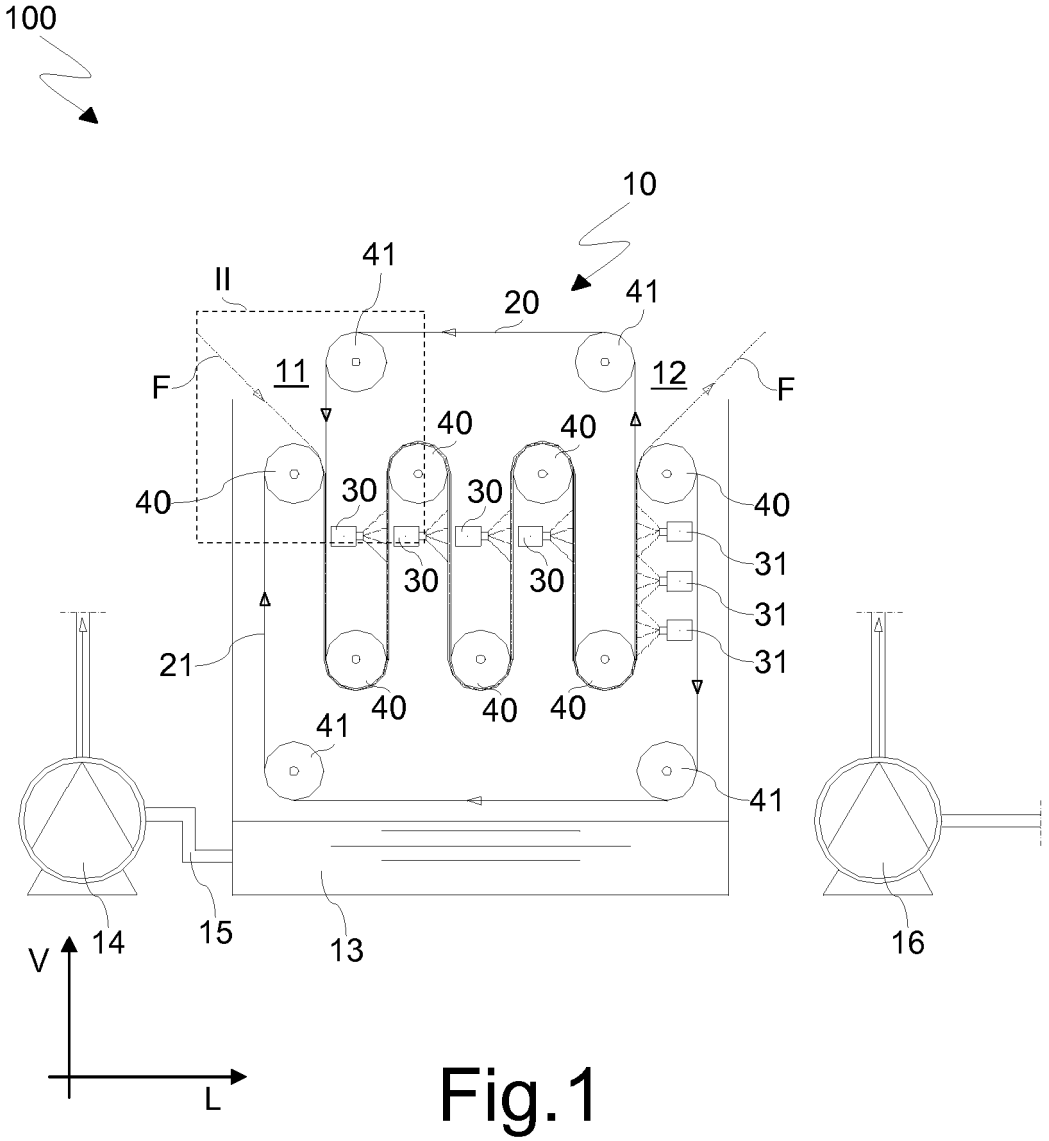
100
10
41
II
20
41
F
11
12
F
40
40
40
30
30
40
30
30
31
31
31
21
40
40
40
41
41
V
14
15
13
16
L

Fig.1

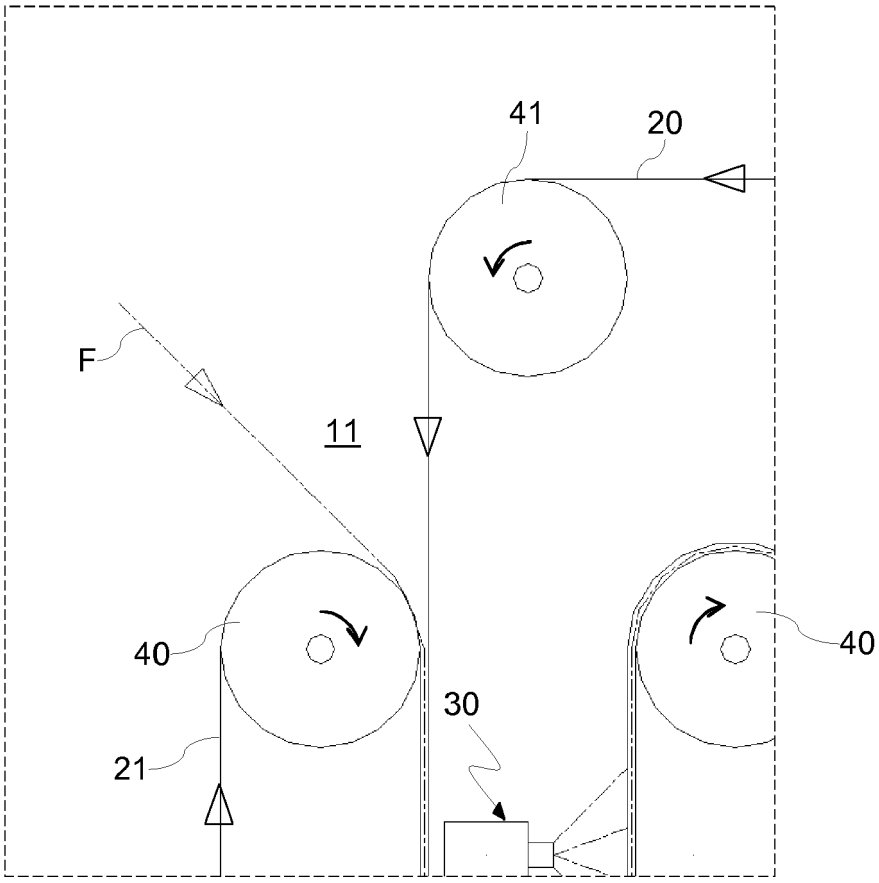

Fig.2

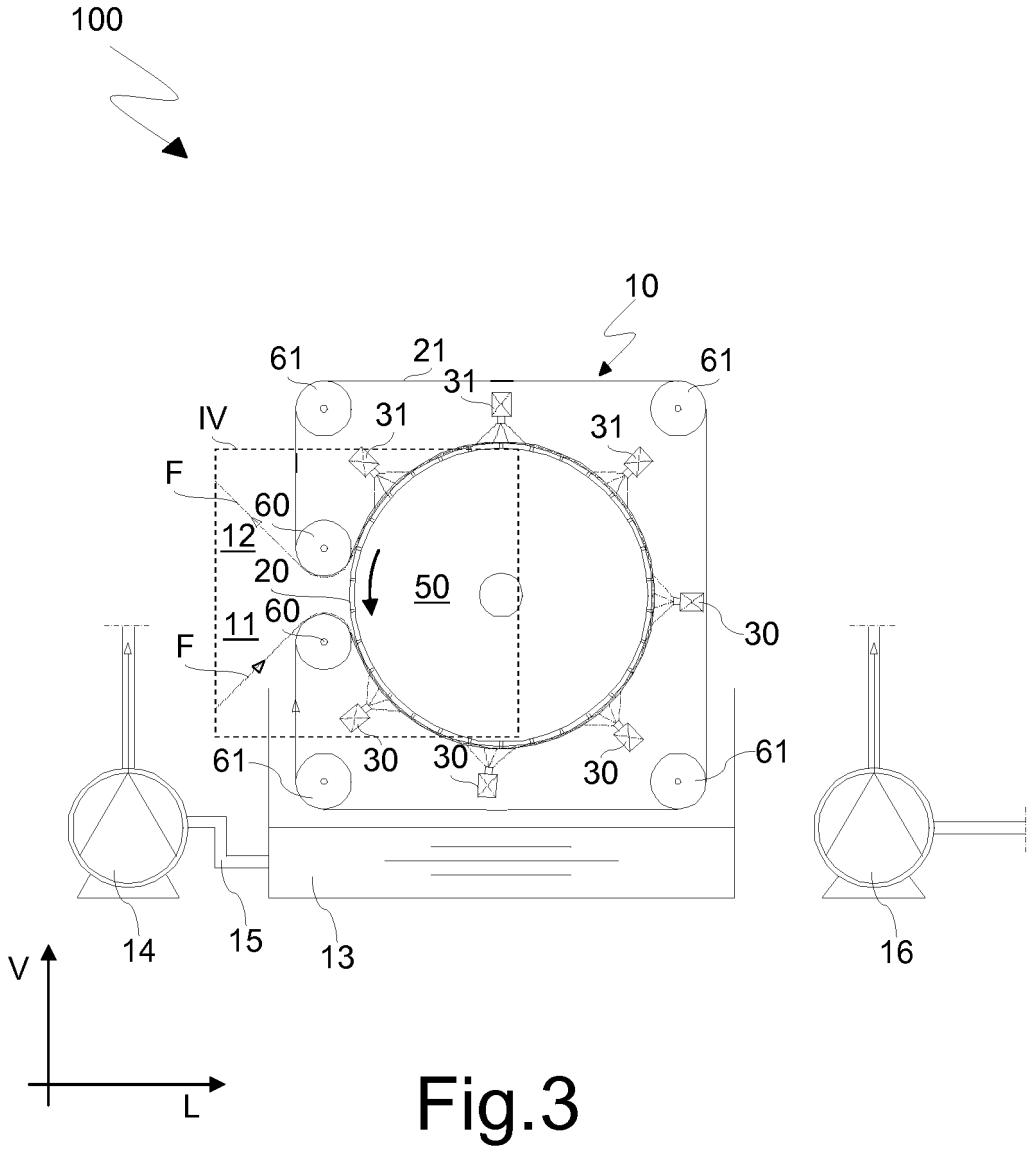
100
10
61
21
31
61
IV
31
31
F
60
12
20
50
11
60
F
30
61
30
30
30
61
14
15
13
16
V
L

Fig.3

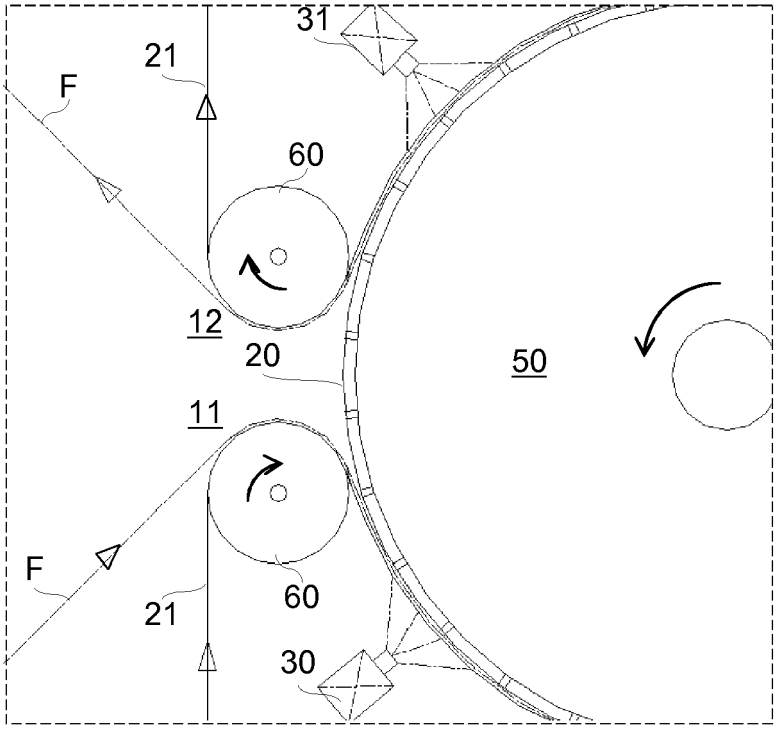

Fig.4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 18 4062

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 280 068 A1 (BABCOCK TEXTILMASCH [DE]) 31 August 1988 (1988-08-31)	1-3,7-10	INV. D06B1/02
A	* column 1, line 51 - column 2, line 5 * * column 3, lines 3-19 *	4-6	D06B5/08
X	WO 96/05350 A1 (KUESTERS EDUARD MASCHF [DE]; SCHUMACHER WALTER [DE]) 22 February 1996 (1996-02-22)	1,7-10	
A	* page 6, lines 9-24 *	2-6	
A	WO 2008/120073 A1 (CIMI S P A [IT]; PIZZATO VALTER [IT]) 9 October 2008 (2008-10-09) * page 13, line 4 - page 14, line 4 *	1-10	
A	US 3 763 672 A (BAHNSEN E) 9 October 1973 (1973-10-09) * column 3, line 46 - column 4, line 63 *	1-10	
A	US 5 233 717 A (WEBER HANS [CH] ET AL) 10 August 1993 (1993-08-10) * column 2, line 46 - column 3, line 7 * * column 6, lines 21-43 *	1-10	TECHNICAL FIELDS SEARCHED (IPC) D06B
A	WO 2010/065270 A2 (3M INNOVATIVE PROPERTIES CO [US]; SCHREIBER BRIAN E [US]; KOLB WILLIAM) 10 June 2010 (2010-06-10) * the whole document *	1-10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 October 2014	Bichi, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 18 4062

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-10-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0280068 A1	31-08-1988	DE 3703267 A1	18-08-1988
		EP 0280068 A1	31-08-1988
WO 9605350 A1	22-02-1996	DE 9413094 U1	14-12-1995
		WO 9605350 A1	22-02-1996
WO 2008120073 A1	09-10-2008	CN 101688345 A	31-03-2010
		EP 2145037 A1	20-01-2010
		WO 2008120073 A1	09-10-2008
US 3763672 A	09-10-1973	NONE	
US 5233717 A	10-08-1993	BR 9006914 A	28-01-1992
		DE 59010167 D1	04-04-1996
		EP 0445245 A1	11-09-1991
		ES 2083460 T3	16-04-1996
		JP H04501892 A	02-04-1992
		JP H07100909 B2	01-11-1995
		US 5233717 A	10-08-1993
		WO 9104367 A1	04-04-1991
WO 2010065270 A2	10-06-2010	CN 102224287 A	19-10-2011
		EP 2376694 A2	19-10-2011
		JP 5491518 B2	14-05-2014
		JP 2012510005 A	26-04-2012
		KR 20110099255 A	07-09-2011
		US 2011220147 A1	15-09-2011
		WO 2010065270 A2	10-06-2010

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 280068 A1 **[0006] [0016]**
- WO 9605350 A1 **[0010] [0016]**