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(71) Applicant: **L.A.I.P. S.r.l.**
59100 Prato (IT)

(72) Inventor: **Becheri, Marco Nicola**
59100 Prato (IT)

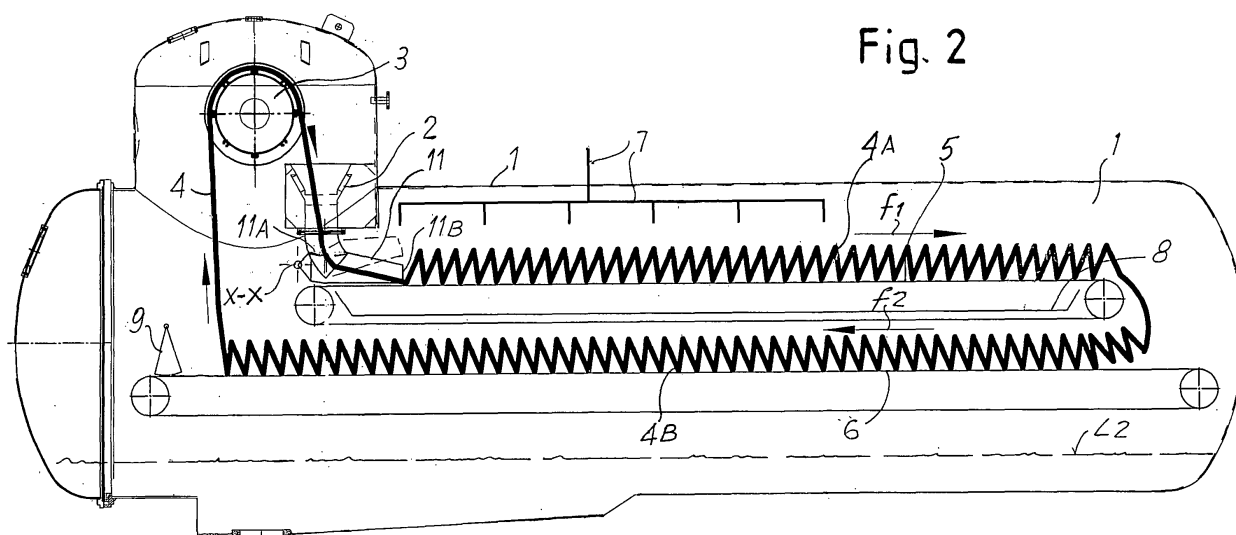
(74) Representative: **Mannucci, Michele et al**
Ufficio Tecnico Ing.A. Mannucci S.R.L.
Via della Scala 4
50123 Firenze (IT)

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(54) **Machine and method for treating fabric**

(57) In the process the fabric (4) is conveyed in a path formed principally of two horizontal, parallel and superposed rectilinear branches (4A, 4B), in which the fabric moves in opposite directions not being immersed in

a treatment bath. The machine that performs the process comprises a pressure vessel (1), inside which circulation mechanical means (3, 5, 6) for circulation of the fabric in rope form (4A, 4B) in a gathered arrangement are suitable to make the fabric circulate according to the process.



Description

[0001] The present invention relates to a method and to a machine for treating fabrics, preferably in rope form, in particular for washing and dyeing, of the type in which a piece of fabric is closed in a loop by stitching the initial and final ends together and is made to circulate repeatedly and continuously in a pressure vessel in a relaxed state without tension while a treatment fluid is fed.

[0002] In the most widely used systems, the pressure vessel has an elongated horizontal development (see figure 1) and, in proximity to one end of the pressure vessel, a motorized reel 101 feeds the fabric 102 in rope form into the central part of an annular nozzle 103 to which the treatment liquid is fed. In this way, the fabric is propelled inside a tube 104 (also called "jet tube") in which the flow of treatment liquid continues to convey the fabric through the entire length of the machine. At the exit of the jet tube 104, the fabric in rope form then drops into the body of the pressure vessel 105, a considerable part of which is filled with the treatment liquid, and travels along the return branch floating, guided by a perforated container 106 called "basket". This method requires a relatively high level L1 of bath, otherwise the fabric tends to accumulate and block the cycle. A similar process is described in the European patent EP 0723045 by the applicant Zonco Federico & Figlio Spa. This process, which has the same disadvantages described above, comprises a jet tube which co-acts with a belt conveyor in an upper branch of the path of a fabric in rope form. At the exit of the conveyor, the fabric drops to the bottom of the pressure vessel and performs the return path floating in the treatment bath, drawn by said conveyor belt.

[0003] In some cases, at the exit of the jet tube, the fabric in rope form drops onto a conveyor belt on which it travels the return path. This method requires the presence of a lesser quantity of liquid in the pressure vessel, as floating is not necessary along the return path, but the flow rate of liquid in the nozzle remains high to provide high propulsion on the fabric to convey it from one end of the machine to the other. A method of this type is described, for example, in the European patent EP 126062 to Flainox.

[0004] US patent n°4,644,765 to Kiyoharu Kito provides for a similar arrangement, in which however the fabric remains in contact with the conveyor belt also in the return branch thereof which is above the fabric, this branch being completely immersed in the treatment bath in proximity to the bottom of the pressure vessel.

[0005] The system according to the invention proposes carrying out the treatment, in particular dyeing, of fabrics in rope form with relatively low and constant ratios (quantities of bath used)/(weight of fabric treated). In the method according to the invention, the path of the fabric in rope form comprises at least two mainly horizontal, parallel and superposed branches, in which the fabric is resting on respective belt conveyors moved in opposite directions, said path branches being above the level of

the treatment liquid present in the pressure vessel. The fabric is fed by a reel to an initial end of the upper conveyor in cooperation with a ring nozzle (known by itself) through which the fabric is made to pass and to which a fluid is fed to propel the fabric itself, as will be described in greater detail hereunder. In this way, the fabric is conveyed along the length of the pressure vessel and made to drop, with overturning of the fabric, onto the initial end of the lower conveyor below. In turn, the lower conveyor carries the fabric back towards the motorized reel, which lifts it from the lower conveyor and deposits it once again at the initial end of the upper conveyor. In this way it is possible to make the fabric in rope form circulate in a relaxed state inside the pressure vessel irrespective of the quantity and of the type of treatment fluids injected along the path thereof, and it is also possible to obtain circulation of the fabric in the total absence of treatment liquids, for example to dry the fabric.

[0006] Preferably, the relaxed fabric in rope form is distributed in a zigzag fashion on the first conveyor through a distribution means, so as to use the width of the conveyor by distributing the fabric thereon in an orderly zigzag fashion. The configuration of the conveyors according to the invention maintains this arrangement of the fabric even when it drops onto the lower conveyor and is conveyed thereby.

[0007] In substance, the use of the two superposed conveyor belts allows the bath to be reduced to the quantity necessary for dyeing, therefore much lower than the quantities required in prior art machines, in which a considerable part of the fabric is immersed and suspended in the bath which also acts as conveying means. This results in a saving of water, auxiliary products, energy and waste products, which must be purified.

[0008] In a preferred embodiment of the invention, along one or more of said branches of the horizontal path inside the pressure vessel, the treatment liquid that drops from the fabric is evacuated before it drops onto the fabric resting on the lower belt conveyor contaminating it, or before the liquid drops inside the pressure vessel with the impurities extracted from the fabric itself. The evacuated liquid can thus be returned to the machine feed or discharged to the drain. In this way the quality of treatment on the fabric is increased and the quantity of treatment bath used can be decreased, reducing both the consumption of substances and the environmental impact.

[0009] The invention also relates to a machine for treatment of fabrics in rope form suitable to carry out the method described above. In particular, in a pressure vessel with treatment fluid feeding means, the machine comprises circulation means for circulation of the fabric in rope form in a gathered arrangement and suitable to make the fabric circulate even without being immersed in the treatment fluids.

[0010] These circulation means in particular comprise two superposed belt conveyors moved in opposite directions, and a motorized reel to transfer the fabric from the

lower conveyor to the upper conveyor. The upper conveyor receives the fabric from the reel at an initial end thereof and unloads the fabric through gravity, overturning it, onto an initial end of the lower conveyor. The motorized reel then picks up the fabric from the final end of the lower conveyor, to lift it and deposit it on the initial end of the upper conveyor. The machine also comprises adjusting means for adjusting the feeding speed of said belt conveyors and the rotation speed of said transfer reel, said regulating means being suitable to guarantee feed of the fabric in a gathered arrangement and in adjustable conditions, without accumulations forming along the path.

[0011] The treatment fluid feeding means comprise said ring nozzle surrounding a section of passage of the fabric in rope form and suitable to feed a treatment fluid in the direction of feed thereof. There can also be provided one or more nozzles suitable to spray said fluids onto the fabric transverse to the path thereof, in particular along at least one of said belt conveyors.

[0012] In a preferred embodiment of the invention, the machine comprises a tray for collection of the liquid sprayed onto the fabric and which drips from the fabric when it is resting on one or more of said belt conveyors, there being provided evacuation means of the liquid thus collected - for example a pump and a relative exit duct from the pressure vessel - to prevent the liquid, which is charged with fibers and/or other substances extracted from the fabric, from dropping onto the fabric of a branch of path below or onto the bottom of the pressure vessel, contaminating them.

[0013] Therefore, the conveyor system according to the present invention does not require the presence of liquid inside the machine. This characteristic is also useful during the wash step. In fact, in a conventional machine it is not possible to discharge the bath completely without stopping the pump and, consequently, circulation of the piece. Conversely, in the machine in question, the entire bath can be discharged and the piece can be maintained in movement by feeding the nozzle directly from the water supply system. In this way, the water strikes and washes the fabric, while the waste water is collected in the trays under the conveyor belts and discharged directly, without contaminating the washed fabric. This results in very efficient washing, reducing both times and water consumption.

[0014] The invention will be better understood by following the description and accompanying drawing, which shows a non-limiting example of the invention. In the drawing:

figure 1 shows a longitudinal schematic cross-sectional view of a dyeing and washing machine according to a prior art technique, already described above; figure 2 shows a similar view to that of figure 1, but of a dyeing and washing machine according to the invention.

[0015] With reference to figure 2, the process takes place inside a pressure vessel 1 equipped with the normal dyeing equipment (pump for circulation of the bath and relative pipes, heat exchanger, receptacle for feeding dyes, etc.) which are not represented.

[0016] The fabric 4 is gathered roughly in the direction of width to form the so-called rope, with the ends stitched together to produce a continuous loop. The motorized reel 3 draws the fabric in rope form through friction and feeds it to the dyeing nozzle 2.

[0017] Through a suitable circuit provided with valves, the dyeing nozzle 2 can be fed in different ways:

- from a main pump which draws the liquid present on the bottom of the pressure vessel to make it recirculate;
- from a receptacle containing the dye bath, by means of a respective feed pump;
- directly from the water supply system.

[0018] The fabric is deposited by the nozzle 2 on an upper belt conveyor 5 and drops therefrom onto a lower belt conveyor 6, which returns it towards the reel 3 that picks it up from the lower conveyor 6 and, lifting it, returns it to the nozzle 2. The two superposed belt conveyors 5 and 6 move with continuous motion in opposite directions, as indicated by the respective arrows f1, f2, at a lower speed than the peripheral speed of the reel, so that the fabric is deposited on the conveyors in a gathered arrangement, but folded in a zigzag fashion by means of a specific distributor 11. The distributor comprises a short tubular branch 11 inside which the fabric delivered from the nozzle 2 is made to pass, the fabric entering the distributor 11 from an upper entry opening 11A and exiting from an axial end opening 11 B. The tubular branch 11 is made to oscillate according to a horizontal axis (x-x), so that, at the exit from the branch 11, the fabric is distributed in a zigzag fashion on the conveyor 5 in a vertical plane.

[0019] Both belt conveyors 5, 6 are made of steel mesh or perforated, so that the excess bath drips naturally from the fabric.

[0020] Along and above the path of the upper conveyor 5 there are positioned sprayers 7 suitable to spray the fabric. The sprayers can be fed from the bath contained in the bottom of the pressure vessel, from the receptacle in which the dye bath is prepared, or from the water supply system. A similar configuration of nozzles can also be provided along and above the lower conveyor 6.

[0021] The level L2 of the treatment liquid in the pressure vessel is kept below the return branch of the conveyor 6, to prevent the fabric from coming into contact with this liquid which can contain unwanted substances or fibers extracted from the fabric itself.

[0022] Under the operating branch of the upper belt conveyor 5 there is a collection tray 8 for collecting the bath that drops from the fabric and from the nozzles 7; after filtering, this bath can be returned into circulation or

discharged into the sewers, preventing it from dropping onto the lower conveyor 6, onto the fabric resting thereon and in general inside the pressure vessel. An analogous configuration with tray can also be provided under the lower conveyor 6. In this way evacuation of the liquid that drops from the fabric is facilitated, allowing impurities to be removed as soon as they are extracted from the fabric, thereby improving the quality of the treatment.

[0023] In prior art treatment machines in which there is only one belt conveyor, the loops of fabric deposited at the exit from the nozzle or from the jet tube tend to cover the loops deposited previously, preventing subsequent unwinding from taking place regularly. Instead, with the two belt conveyors of the configuration according to the present invention, when the fabric in rope form reaches the end of the upper conveyor 5, it passes onto the lower conveyor 6 overturning. In this way any loops of zigzag fabric that have been covered by subsequent loops on the upper belt 5 are subsequently freed downwards, preventing irregular accumulations from dropping onto the lower belt 6 and also allowing regular pick-up of the fabric by the reel at the end of the lower belt conveyor 6.

[0024] At the outlet end of the lower conveyor 6 there is disposed a table or gate 9 hinged at the top, suitable to oscillate freely around a horizontal axis. If the feed of fabric by the lower conveyor is in excess with respect to the pick-up speed of the reel 3, an accumulation of fabric forms and presses against the gate 9 making it oscillate and thus activating a position sensor of said gate (not shown in the drawing). The signal of said sensor is sent to a regulating unit for adjusting the speed of the reel 3 and of the conveyors 5, 6 to balance them and restore normal operation of the assembly.

[0025] With the configuration described, movement of the fabric in rope form inside the pressure vessel 1 can be guaranteed irrespective of the flow rate of fluid fed through the nozzles 2, 7, and even in the absence of liquid. Moreover, frequently two or more adjacent fabrics in rope form can be treated in parallel in the same pressure vessel. This increases productivity, but when it is necessary to treat a small batch, such as a single fabric in rope form, the configuration according to the invention allows a drastic decrease in the quantity of bath present in the pressure vessel to maintain the same bath/fabric ratio without requiring to vary the dyeing recipe; this is impossible to obtain in prior art machines in which, due to the transport function performed by the bath, the quantity thereof can only be decreased marginally when the quantity of fabrics treated in parallel decreases.

[0026] Moreover, it must be taken into account that a considerable part of the dyeing action takes place when the rope passes through the nozzle 2, where the mechanical action facilitates fiber/dye bond. In fact, it is more accurate to calculate the duration of the dyeing process through the number of passages through the nozzle than by the time the fabric remains in the bath. In the conventional process, the fabric in rope form is almost always

immersed in the bath. When it passes through the nozzle it is already soaked and exchange is to some extent obstructed. Instead, with belt conveying according to the present invention, the material reaches the nozzle after having dripped and therefore penetration of the dye bath is facilitated, allowing improved uniformity and a decrease in dyeing times to be obtained.

[0027] It is understood that the drawing only shows an example provided by way of a practical demonstration of the invention, which can vary in forms and arrangements without however departing from the scope of the concept underlying the invention. Any reference numbers in the appended claims are provided for the purpose of facilitating reading of the claims with reference to the description, and do not limit the scope of protection represented by the claims.

Claims

1. Method for treating fabrics, wherein the fabric (4) is made to circulate in a pressure vessel in a gathered arrangement and with feed of treatment fluids in vapor and/or liquid phase at least in a thrust nozzle (2) for propelling the fabric, **characterized in that** the fabric is conveyed in a path including two superposed branches (4A, 4B) in which the fabric is conveyed in opposite direction, said branches of path being above the level (L2) of the treatment liquid contained in the pressure vessel so that the fabric is never immersed therein.
2. Method according to claim 1, **characterized in that** the fabric is treated in rope form.
3. Method according to claim 1 or 2, **characterized in that** said branches are substantially rectilinear.
4. Method according to claim 1, 2 or 3, **characterized in that** said branches are substantially horizontal.
5. Method according to one or more of the preceding claims, **characterized in that** said branches are substantially parallel to one another.
6. Method according to one or more of the preceding claims, **characterized in that** along said branches the fabric is advanced by respective conveyors, said conveyors advancing the fabric in opposite directions.
7. Method according to one or more of the preceding claims, **characterized in that** the relaxed fabric in rope form is distributed in a zigzag fashion in said path branches (4A, 4B).
8. Method according to one or more of the preceding claims, **characterized in that** along one or more of

said path branches (4A, 4B) inside the pressure vessel, the treatment liquid that drops from the fabric is evacuated before coming into contact with the fabric in the branch of path below or dropping onto the bottom of the pressure vessel.

9. Machine for treating fabrics, comprising a pressure vessel (1) with treatment fluid feeding means (2, 7), **characterized in that** it comprises: at least two superposed mechanical conveyors (3, 5, 6) moved in opposite directions; and a transfer device (3) to transfer the fabric from the lower conveyor (6) to the upper conveyor (5). 5
10. Machine according to claim 9, **characterized in that** the upper conveyor (5) receives the fabric from said transfer device (3) and unloading the fabric, overturning it, onto the initial end of the lower conveyor (6), the transfer device (3) picking up the fabric from the final end of the lower conveyor (6) to lift it and deposit it on the initial end of the upper conveyor (6). 10
11. Machine according to claim 9 or 10, **characterized in that** it is arranged to treat said fabric in rope form. 15
12. Machine according to one or more of claims 9 to 11, **characterized in that** said conveyors are belt conveyors. 20
13. Machine according to one or more of claims 9 to 12, **characterized in that** said transfer device (3) is a motorized reel (3). 25
14. Machine according to one or more of claims 9 to 13, **characterized in that** it comprises a tray (8) suitable to collect the liquid sprayed onto the fabric resting on at least one of said conveyors (5, 6) and which drips from this fabric, there being provided means to remove the liquid thus collected from the pressure vessel to prevent it from dropping onto a branch of path of the fabric below or onto the bottom of the pressure vessel. 30
15. Machine according to one or more of claims 9 to 14, **characterized in that** it comprises regulating means for separately adjusting the feeding speed of said conveyors (5, 6) and of the rotation speed of said transfer device (3) to guarantee feed of the fabric in a gathered arrangement, and sensors for detecting any accumulations of fabric along the path thereof. 35
16. Machine according to one or more of claims 9 to 15, **characterized in that** it comprises movable gates (9) provided with respective position sensors and each disposed at the final end of a respective conveyor (5, 6), to indicate any accumulation of fabric in this position. 40

17. Machine according to one or more of claims 9 to 16, **characterized in that** it comprises a zigzag distribution means (11) of the fabric on the upper conveyor (5), said distribution means being interposed along the path of the fabric between the transfer device (3) and the initial part of the upper conveyor (5). 45

18. Machine according to claim 17, **characterized in that** said distribution means comprises a short tubular branch (11) inside which the fabric is made to pass and presenting an upper opening (11A) for entry of the fabric and an opening (11 B) for exit of the fabric, the tubular branch (11) being made to oscillate according to a horizontal axis (x-x), transverse to the motion of the upper conveyor (5). 50

19. Machine according to one or more of claims 9 to 18, **characterized in that** along the path of at least one of the upper (5) and lower (6) conveyors there are positioned sprayers (7) suitable to spray the fabric, said sprayers being fed from one or more of the following sources: the bath contained in the bottom of the pressure vessel, the dye bath contained in the preparation receptacle thereof, the water supply system. 55

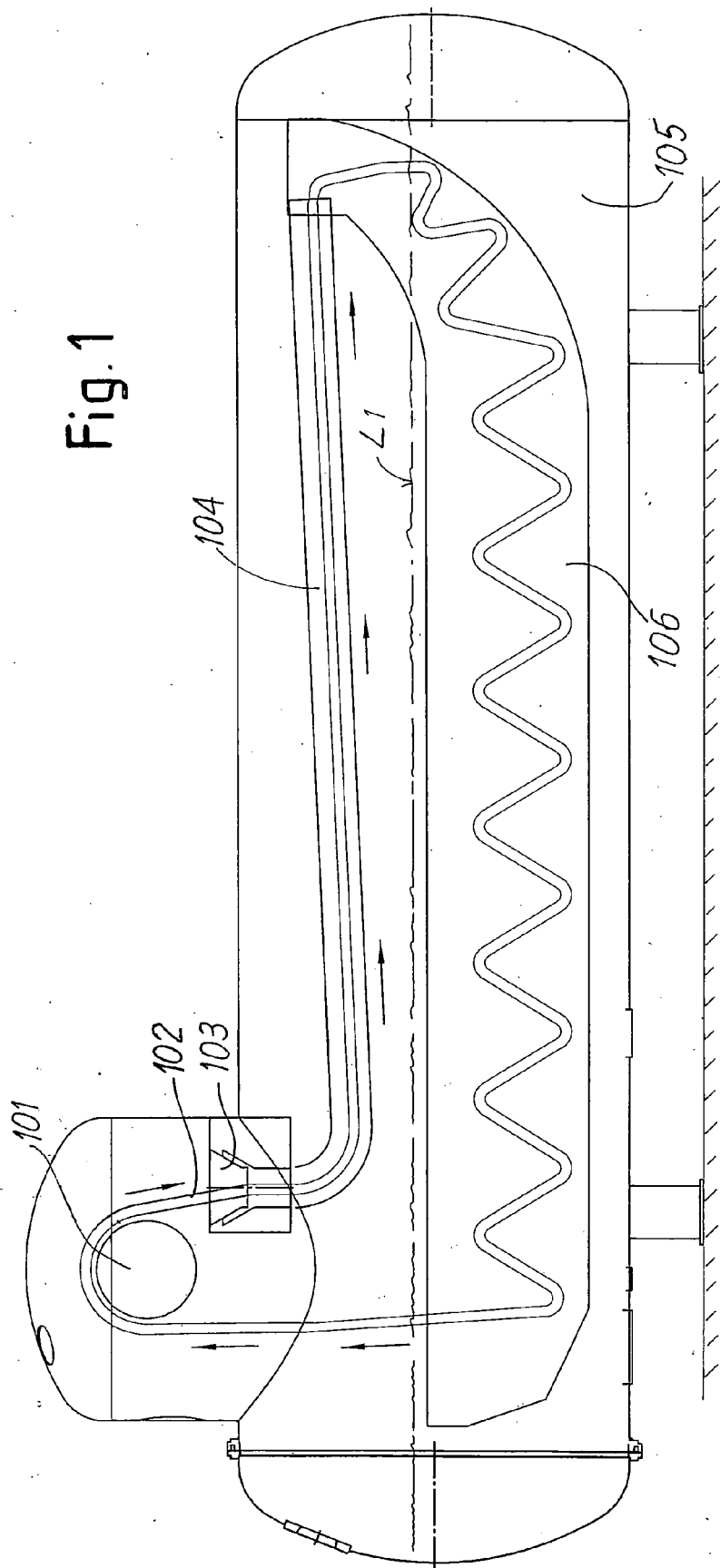
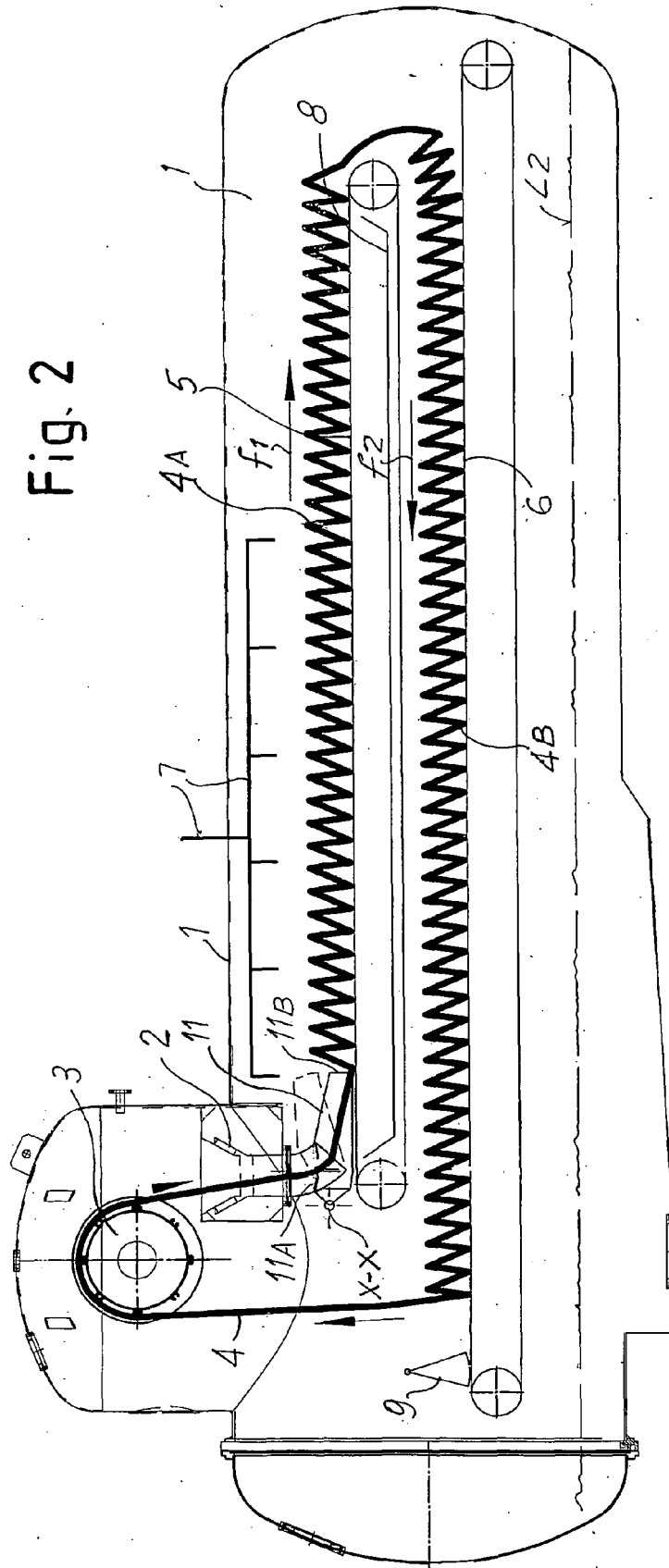


Fig. 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5342

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 September 2007	Examiner 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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 42 5342

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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