Abstract: Laminated product treating apparatus improved to prevent falling off core material from the laminated product in the course of treating the laminated product containing the core material with steam. First and second mesh belts 60, 70 respectively have a plurality of first and second openings 63, 73 and first and second closed regions 64, 74 each defined between each pair of the adjacent openings 63, 73. In the course of being fed and transported, the first mesh belt 60 and the second mesh belt 70 are relatively positioned so that the first openings 63 are more or less out of alignment with the second openings 73, i.e., the second closed region 74 overlap the first openings 63 and thereby the second closed region 74 partially closes the first openings 63.
Published:

— with international search report (Art. 21(3))
Description

Title of Invention: LAMINATED PRODUCT TREATING APPARATUS

Technical Field

[0001] The present disclosure relates to apparatus for producing of laminated products and more particularly to apparatus for treating laminated products, containing liquid-absorbent core material, with jets of steam.

RELATED ART

[0002] Apparatus using nozzles to inject jets of steam at elevated temperature and pressure to treat an object is well known. For example, JP 2004-238785 A discloses apparatus having a lower perforated endless belt and an upper endless belt sandwiching a fibrous web as an object to be treated therebetween to convey the fibrous web, and pressurized steam injection nozzles adapted to inject pressurized steam above the upper endless belt to the fibrous web. According to the disclosure of JP 2004-238785 A, such pressurized steam injection causes component fibers in the fibrous web to be interlaced together.

Citation List

Patent Literature

[0003] [PATENT DOCUMENT 1] JP 2004-238785 A

Summary of Invention

PROBLEM TO BE SOLVED BY THE INVENTION

[0004] In such apparatus, jets of steam pass through the perforations of the upper endless belt, then through the fibrous web and then most part of jets of steam pass through the perforations of the lower endless belt. Particularly when the jets of steam are sucked by a suction box provided beneath the lower endless belt, a velocity at which the jets of steam pass through the lower endless belt is accelerated. In such apparatus, if the laminate product comprises upper and lower fibrous sheets and a liquid-absorbent core material sandwiched between these two sheets, the core material having a relatively small particle size can fall off through the lower sheet under the effect of jets of steam passing through the perforations of the lower endless conveyor.

MEASURE TO SOLVE THE PROBLEM

[0005] At least a first aspect of the present invention is characterized in features as will be described below: a product treating apparatus having a machine direction, a cross direction being orthogonal to the machine direction, comprising first and second mesh belts sandwiching a product containing liquid-absorbent material, and the first mesh belt is provided with injection means on a side opposite to a side facing the product to
inject steam toward the product.

[0006] The improvement according to the present invention is characterized in that the first mesh belt has a plurality of first openings and a first closed region defined between each pair of the adjacent first openings and the second mesh belt has a plurality of second openings and a second closed region defined between each pair of the adjacent second openings wherein the first openings at least partially overlap the second closed region in a region underlying the injection means.

**Brief Description of Drawings**

[0007] [fig.1]Fig. 1 is a partially cutaway plan view of a laminated product.
[fig.2]Fig. 2 is a sectional view of the laminated product taken along the line II-II in Fig. 1.
[fig.3]Fig. 3 is a diagram illustrating the laminated product treating apparatus according to a first embodiment.
[fig.4]Fig. 4 is a diagram illustrating first and second mesh belts.
[fig.5]Fig. 5 is a partially enlarged diagram illustrating the first and second mesh belts.
[fig.6]Fig. 6 is a sectional view taken along the line VI-VI in Fig. 5.
[fig.7]Fig. 7 is a partially enlarged diagram illustrating first and second mesh belts according to another embodiment.
[fig.8]Fig. 8 is a sectional view of the first and second mesh belts taken along the line VIII-VIII in Fig. 7.
[fig.9]Fig. 9 is a diagram illustrating the laminated product treating apparatus according to a second embodiment.
[fig.10]Fig. 10 is a diagram illustrating the laminated product treating apparatus according to a third embodiment.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0008] Referring to Fig. 1, a laminated product 10 comprises a first sheet 11, a second sheet 12 and a liquid-absorbent core 13 sandwiched between these sheets 11, 12. As the first and second sheets 11, 12, for example, breathable and liquid-pervious fibrous nonwoven fabrics may be used. Such fibrous nonwoven fabrics may have a basis mass of about 10g/m². It is also possible to use, for example, plastic films as one of the first and second sheets 11, 12. If plastic films are used as one of the sheets 11, 12, breathable perforated plastic films are preferable. The core 13 may be formed of liquid-absorbent core materials made of hydrophilic materials such as a mixture of fluff pulp fibers and super-absorbent polymer particles. The hydrophilic fibers, in addition or as an alternative to the fluff pulp fibers, may comprise, for example, cotton fibers, rayon fibers or acetate fibers.

[0009] The laminated product 10 as has been described above may be used in disposable
wearing articles such as diapers. Specifically, the laminated product 10 may be provided on the inner side of a diaper to absorb and then to contain bodily fluids such as urine excreted by the wearer so that such bodily fluid such as urine may be prevented from leaking out the diaper.

[0010] First Embodiment

Referring to Fig. 3, a first continuous sheet 21 is fed by a plurality of feed rolls 30 in a machine direction MD. The first continuous sheet 21 will be cut later at predetermined positions into an individual first sheet 11 constituting the laminated product 10. The first continuous sheet 21 is put on a peripheral surface of a suction drum 40 adapted to rotate in a counter-clockwise direction and is thereby moved to a core material feeder 50. The suction drum 40 is formed on the peripheral surface thereof with depressions 41, each having a planar shape (See Fig. 1) substantially the same as the core 13 in the laminated product 10, at a desired pitch in a circumferential direction.

[0011] The core material feeder 50 is provided with a hood 51 shaped to cover the suction drum 40 and includes a pulp feed section 52 serving to feed fluff pulp fibers 13a as a part of hydrophilic materials and a polymer particle feed section 53 serving to feed super-absorbent polymer particles 13b as a part of the hydrophilic materials. From the pulp feed section 52 and the polymer particle feed section 53, the respective core materials are deposited into the depressions 41 of the suction drum 40.

[0012] The depressions 41 of the suction drum 40 are under a suction effect by vacuum pressure and thereby the first continuous sheet 21 put on the peripheral surface of the suction drum 40 is deformed along the respective depressions 41. The core material is deposited into portions of the first continuous sheet 21 deformed in this manner and the cores 13 are formed in accordance with the shapes of the respective depressions 41.

[0013] The first continuous sheet 21 formed with the cores 13 leaves the peripheral surface of the suction drum 40 and runs toward the feed rolls 30 on the downstream in the machine direction MD. On the first continuous sheet 21, the cores 13 are intermittently arranged in the machine direction MD. Now a second continuous sheet 22 is continuously fed onto the first continuous sheet 21 to sandwich the cores 13 therebetween. The cores 13 are sandwiched between the first continuous sheet 21 and the second continuous sheet 22 in this manner to form a continuous laminated product 20.

[0014] The continuous laminated product 20 is transported in the machine direction MD by the feed rolls 30 and sandwiched between first and second mesh belts 60, 70 both being air-permeable. The first mesh belt 60 lies above the continuous laminated product 20 as viewed in a vertical direction TD in Fig. 3, i.e., on the side of injection means 80. The second mesh belt 70 lies below the continuous laminated product 20 as viewed in the vertical direction TD in Fig. 3, i.e., on the side of suction means 90.
first and second mesh belts 60, 70 are the endless belts driven by first and second belt
driving means 61, 71, respectively. The first belt driving means 61 comprises first and
second rolls 61a, 61b arranged on an imaginary line extending in parallel to the
machine direction MD and third and fourth rolls 61c, 61d arranged above the first and
second rolls 61a, 61b as viewed in the vertical direction TD so that the first mesh belt
60 may circulate in the clockwise direction in contact with these rolls from the outside.
The second belt driving means 71 comprises fifth and sixth rolls 71a, 71b arranged on
an imaginary line extending in parallel to the machine direction MD and seventh and
eighth rolls 71c, 71d arranged above the first and second rolls 71a, 71b as viewed in
the vertical direction TD so that the second mesh belt 70 may circulate in the counter-
clockwise direction in contact with these rolls from the outside.

Referring to Figs. 3 and 4, the first and second mesh belts 60, 70 respectively have
segments 62, 72 running in parallel to each other and these segments are defined
between the first and second rolls 61a, 61b and between the fifth and sixth rolls 71a,
71b, respectively. Along these segments 62, 72, the continuous laminated product 20 is
compressed in a thickness direction as they are transported in the machine direction
MD. It should be appreciated here that the present invention is not limited to the case
in which the continuous laminated product is compressed between the first and second
mesh belts 60, 70 and includes also the case in which the continuous laminated product
is sandwiched between the first and second mesh belts 60, 70 and transported in the
machine direction MD without being compressed.

Above the segment 62 of the first mesh belt 60 as viewed in the vertical direction TD
and moving in parallel to the machine direction MD, the apparatus is provided with the
injection means 80 serving to inject steam. The injection means 80 is supplied with
steam from a boiler 81 adapted to generate steam by heating water at a temperature
higher than its boiling point via a pressure controller 82 serving to compress steam to a
predetermined high pressure. The injection means 80 comprises a plurality of nozzles
80a (not shown) arranged in a cross direction CD intersecting with the machine
direction MD. The nozzles 80a each having a diameter, for example, in a range of 0.1
to 2.0mm are arranged in the cross direction CD at a pitch in a range of 0.5 to 10.0mm,
preferably in a range of 0.5 to 5.0mm, more preferably in a range of 0.5 to 3.0mm.

Below the segment 72 of the second mesh belt 70 as viewed in the vertical direction
TD and moving in parallel to the machine direction MD, the apparatus is provided with
the suction means 90 in the form of a suction box or the like adapted to suck steam
injected from the nozzles 80a. With this arrangement, steam injected from the re-
spective nozzles 80a is sucked by the suction means 90 through the first mesh belt 60,
the continuous laminated product 20 and the second mesh belt 70. An injection
quantity of steam from the nozzles 80a may be appropriately adjusted depending on a
traveling speed of the first and second mesh belts 60, 70 and, if the first and second mesh belts travel at a rate of about 5 to 500m/min, the injection quantity per unit surface area of the continuous laminated product 20 is preferably in a range of about 0.03kg/m² to 1.23kg/m².

As the first and second mesh belts 60, 70, mesh belts formed, for example, of a metallic wire product made of stainless alloy or bronze, mesh belts formed, for example, of plastic fibers such as polyester fibers or aramid, or metallic belts formed of a perforated metallic plate may be used. Referring to Figs. 5 and 6, the first and second mesh belts 60, 70 respectively have a plurality of first and second openings 63, 73 and first and second closed regions 64, 74 defined between each pair of the adjacent openings 63, 73, respectively. In the first and second mesh belts 60, 70, mesh density is in a range of about 2 to 600 per inch, wire diameter is in a range of about 0.03 to 5.0mm and open area ratio is in a range of about 10 to 85%. Each of the first and second openings 63, 73 has a generally rectangular shape.

The first and second mesh belts 60, 70 are relatively position-adjusted so that the first openings 63 may be out of alignment with the second openings 73 along the respective segments 62, 72 traveling in parallel to the machine direction MD, at least along portions thereof directly injected with steam from the nozzles 80a. In other words, the first and second mesh belts 60, 70 are relatively position-adjusted so that the second closed region 74 may overlap the first openings 63 and the first openings 63 may be partially closed by the second closed region 74. In this way, injected steam passes the first openings 63 of the first mesh belt 60, compresses the continuous laminated product 20 in the thickness direction and moves to the second mesh belt 70. The first openings 63 overlap the second closed region 74 and, as a result, speed of steam passing through the second mesh belt 70 is reduced in comparison with the case in which the first openings 63 match the second openings 73. In this way, it is possible to prevent the core material contained in the continuous laminated product 20 from falling off through the second continuous sheet 22 as steam passes through the second mesh belt 70.

Of the core material, particularly the super-absorbent polymer particles have small particle diameter but it is possible to prevent core materials from falling off by reducing a flow rate of steam on the side of the second continuous sheet 22. The fluff pulp fibers 13a has an average fiber length in a range of about 0.5 to 20.0mm and the super-absorbent polymer particles have an average particle diameter in a range of several micro meters to about 3mm. As such core material, the material commonly used in the related technical field may be used. By dimensioning the mesh size of the second mesh belt to be smaller than the average particle diameter of the super-absorbent polymer particles, it is possible to prevent the super-absorbent polymer
particles from falling off through the second mesh belt 70. Even if the super-absorbent polymer particles are present between the second continuous sheet 22 and the second mesh belt 70, it is possible to prevent such polymer particles from falling on the suction means 90 through the second mesh belt 70.

[0021] By injecting steam to the continuous laminated product as has been described above, the core 13 is compressed in its thickness direction and the continuous laminated product 20 as a whole is thinned. Steam injected from the nozzles 80a may be dry steam containing no moisture, saturated steam or wet steam containing moisture. When steam is wet steam or saturated steam, hydrophilic fibers can be easily wetted and deformed. In the case of dry steam being used, dry steam vaporizes moisture contained in hydrophilic fibers and vaporized moisture facilitates hydrophilic fibers to be deformed. If the hydrophilic fibers are thermoplastic synthetic fibers, the heat of dry steam facilitates the thermoplastic synthetic fibers to be deformed. In the continuous laminated product compressed by steam at a high pressure, the hydrophilic fibers such as fluff pulp fibers are rapidly deformed at a heated and wetted condition or at a heated condition and repulsion forces against the compression force of the first and second mesh belts 60, 70 is reduced. Consequently, the compressed shape can be easily maintained.

[0022] In the continuous laminated product 20 as has been described above, if a plastic film is used for one of the first and second continuous sheets 21, 22, such plastic film preferably has a plurality of perforations through which at least steam can pass.

[0023] The continuous laminated product 20 having been compressed is transferred from the first and second mesh belts 60, 70 to the feed rolls 30 and cut by a cutter 31 along a cutting line extending in the cross direction CD. The cutting line is set between each pair of the adjacent cores 13. The continuous laminated product 20 may be cut in this manner to obtain the individual laminated product 10 exemplarily illustrated by Fig. 1.

[0024] As illustrated in Figs. 7 and 8, the first mesh belt 60 and the second mesh belt 70 respectively have open area ratios differing from each other. Specifically, the first openings 63 are smaller than the second openings 73. By differentiating the open area ratios of the first and second mesh belts 60, 70, any one or more of the first openings 63 reliably overlap the second closed region 74 and no strict adjustment of relative position of the first mesh belt 60 and the second mesh belt 70 will be necessary.

[0025] As the first mesh belt, the belt having a mesh density of 9, an open area ratio of about 56% and a wire diameter of about 0.85mm may be used. As the second mesh belt, the belt having a mesh density of 6, an open area ratio of about 65% and a wire diameter of about 0.85mm may be used.

[0026] By enlarging the second openings 73 of the second mesh belt 70 circulating around the suction means 90, unacceptable drop of suction force can be avoided because
thereby a desired suction area can be assured. While the first openings 63 and the second openings 73 have substantially the same rectangular shapes according to the present embodiment, these openings may evenly have the other shapes such as circular shape or may have different shapes. When the shape of the first and the shape of second openings 63, 73 are different, the first openings 63 more easily overlap the second openings 74.

[0027] <Second Embodiment>

Fig. 9 shows the laminated product treating apparatus according to a second embodiment of the present invention. According to this embodiment, the apparatus has a plurality of the injection means 80 and a plurality of the suction means 90. The other features similar to those of the first embodiment are designated by the reference numerals similar to those used in the first embodiment and detailed description thereof is eliminated.

[0028] Above the segment 62 of the first mesh belt 60 traveling in parallel to the machine direction MD, two injection means 80 are arranged to be spaced from each other in the machine direction MD. The first roll 61a and the second roll 61b between which the segment 62 is defined are outside these two injection means 80 as viewed in the machine direction MD and the first mesh belt 60 circulates to encircle these two injection means 80.

[0029] Below the first mesh belt 60 as viewed in the vertical direction TD, two suction means 90 associated with the respective injection means 80 are arranged to be spaced from each other in the machine direction MD. In association with these two suction means, two second mesh belts 70, 70 are provided and respective second belt driving means 71, 71 drive these two second mesh belts 70, 70 to circulate around the respective suction means 90, 90.

[0030] With the arrangement as has been described above, the continuous laminated product 20 is twice subjected to steam treatment and compressed by the injection means 80 at two positions in the machine direction MD. Compared to the case in which the continuous laminated product 20 is once compressed by the injection means at a single position, a steam injection pressure can be reduced and, in consequence, a relatively low cost-injection means 80 of small-sized low pressure type may be used. The injection pressure may be reduced to prevent the core material from falling off the continuous laminated product through the second continuous sheet 22.

[0031] The second mesh belt 70 implemented in the form of two endless circulating belts spaced from each other in the machine direction MD ensures that the positional relationships of the second openings 73 in these two mesh belts 80 scarcely match the positional relationship of the first openings 63 in the first mesh belt 60. In other words, the second openings 73 of two or more second mesh belts are difficult to match the
first openings 63 and, at least one of the second mesh belts 70, the second closed
region 74 may overlap the first openings 63. This means that no strict adjustment of the
position relationship between these first and second mesh belts 60, 70 is required.

[0032] In the continuous laminated product 20 sandwiched between the first and second
mesh belts 60, 70, in regions where the first closed region 64 and the second closed
region 74 overlap each other, the steam stream may be partially disturbed and a
pressure exerted on the continuous laminated product 20 may become uneven.
However, in the two second mesh belts 70 spaced from each other in the machine
direction MD, the positions of the second openings 73 and the second closed region 74
are difficult to match each other with respect to the continuous laminated product. In
consequence, even if a portion of the continuous laminated product 20 overlaps the
second closed region in the upstream side second mesh belt 70, such portion may
overlap the second openings 73 in the downstream side second mesh belt 70. By using
these two second mesh belts 70, the continuous laminated product 20 as a whole can be
uniformly treated with steam.

[0033] **Third Embodiment**

Fig. 10 shows the laminated product treating apparatus according to a third embodiment of the present invention. According to this embodiment, the apparatus has a plurality of the injection means 80 and a plurality of the suction means 90. The other features similar to those of the first embodiment are designated by the reference numerals similar to those used in the first embodiment and detailed description thereof is eliminated.

[0034] According to the present embodiment, the apparatus is provided with a pair of the injection means 80 spaced from each other in the machine direction MD. The first
mesh belt 60 also is paired in association with the respective injection means 80 so that
these first mesh belts 60 may be driven by the first belt driving means 61 to circulate around the associated injection means 80. These injection means 80 are arranged to face the respective segments 62, 72 of the belts 60, 70 adapted to travel in parallel to the machine direction MD.

[0035] The apparatus is provided with a pair of the suction means 90 to face the respective
injection means 80. The single second mesh belt 70 circulates around these paired
suction means 90. The second mesh belt 70 is driven by the second belt driving means
71 to circulate around the paired suction means 90 and includes the segment 72 facing the segments 62 of the first mesh belts 60 adapted to travel in parallel to the machine
direction MD.

[0036] Above the segments 62 of the respective first mesh belts 60 adapted to travel in
parallel to the machine direction MD, two injection means 80 spaced from each other
in the machine direction MD are provided in association with the respective segments
62. The first roll 61a and the second roll 61b defining each of the segments 62 are located outside the respective injection means 80, 80 as viewed in the machine direction MD and the first mesh belts 60, 60 circulate around these injection means 80, 80, respectively.

[0037] With the arrangement as has been described above, steam injection occurs at two positions spaced from each other in the machine direction MD and therefore the same effect as that obtained by the second embodiment (See paragraph [0029]). Specifically, the first mesh belt is implemented in the form of two endless circulating belts and therefore the positional relation with the second openings 73 can be easily adjusted and unevenness of steam can be prevented by the first closed region 64 (See paragraph [0030] and [0031]).

[0038] While the injection means 80 as well as the suction means 90 are paired according to the second and third embodiments, the apparatus may be provided with three or more of these means without departing from the scope of the present invention. Furthermore, not only it is possible to provide the apparatus with a plurality of the first mesh belts 60 or the second mesh belts 70 but also it is possible to provide the apparatus with a plurality of both the first mesh belts 60 and the second mesh belts 70 spaced one from another in the machine direction MD.

[0039] While the first and second mesh belts are in the form of circulating endless belts according to the first through third embodiment, the present invention is not limited to them and these mesh belts can be implemented in the form of linear belts extending in the machine direction MD. However, use of the endless circulating belts advantageously makes it possible to downside the apparatus as a whole. While the case in which the core 13 is sandwiched between the first continuous sheet 21 and the second continuous sheet 22 has been described above, the second continuous sheet 22 is not essential feature so far as the first continuous sheet 21 adapted to load the cores 13 thereon is prepared.

[0040] Of the embodiments as have been described above, the feature and arrangement in one embodiment may be added to or combined with the other embodiment. Term "first, second,...eighth" is used merely to distinguish the elements, positions or the like having the same designations one from another.

[0041] The first aspect of the present invention described above may be arranged in at least the following items:

(i) A laminated product treating apparatus having a machine direction, a cross direction being orthogonal to the machine direction, comprising first and second mesh belts arranged to sandwich a laminated product to be treated, and the first mesh belt is provided with injection means on a side opposite to a side facing the laminated product to inject steam toward the laminated product wherein: the first mesh belt has a plurality
of first openings and a first closed region defined between each pair of the adjacent
first openings and the second mesh belt has a plurality of second openings and a
second closed region defined between each pair of the adjacent second openings
wherein the first openings at least partially overlap the second closed region in a region
underlying the injection means.
Preferably, the first openings only partially overlap the second closed regions. Ac-
cordingly, a passage of steam may be provided through the first and second openings
that partially overlap, wherein the passage of steam through the openings is partially
blocked by the portion of the second closed region that obstructs the first opening.
A further aspect of the present invention described above may be arranged in at least
the following items:
(xix) A method of manufacturing a laminated product containing a liquid absorbent
material using the apparatus as defined in (i) or any of (ii) to (xviii).

One or more aspects of the present invention described in the above items (i) and
(xix) may provide one or more of the following advantageous effects:
(a) At least over the segment directly injected with seam, the first openings of the
first mesh belt overlap the second closed region of the second mesh belt. With such ar-
rangement, passage velocity of steam through the second mesh belt can be appro-
priately reduced. It is possible thereby to prevent the core material contained in the
laminated product sandwiched between these mesh belts from falling off through the
sheet covering the core material.

Additionally, one or more of the following embodiments are provided in accordance
with further aspects:
(ii) The mesh belts may be formed from metallic wire, from plastic fibers or from
perforated metallic plates.
(iii) Preferably the mesh belts are spaced from one another such that the product is
compressed therebetween.
(iv) The nozzles may have a diameter of 0.1 to 2.0mm and may be arranged at a
pitch, in the cross direction, of 0.5 to 10.0mm. More preferably in a range of 0.5 to
5.0mm. Most preferably in a range of 0.5 to 3.0mm.
(v) The mesh belts may travel at a rate of 5 to 500m/min and the injection quantity of
steam per unit surface area may be 0.03kg/m² to 1.23kg/m².
(vi) The first mesh belt and the second mesh belt may have the same open area ratio.
(vii) The first and second mesh belts may be relatively positioned such that first and
second openings are out of alignment.
(viii) The open area ratio of the belts may be 10 to 85%. The mesh density of the
belts may be 2 to 600 per inch. The wire diameter may be 0.03 to 5.0mm.
(ix) The first mesh belt may have an open area ratio smaller than an open area ratio
of the second mesh belt.

(x) The first mesh belt may have an open area ratio of about 56% and the second mesh belt may have an open area ratio of about 65%. The first mesh belt may have a mesh density of 9. The first mesh belt may have a wire diameter of about 0.85mm. The second mesh belt may have a mesh density of 6. The second mesh belt may have a wire diameter of about 0.85mm.

(xi) The openings in the first mesh belt and the second mesh belt may be the same shape. Alternatively, the openings in the first mesh belt may be a different shape to the openings in the second mesh belt. The openings in the first mesh belt and/or the second mesh belt may be rectangular or circular.

(xii) A plurality of the injection means may be provided and arranged to be spaced one from another in the machine direction.

(xiii) One only of the first mesh belt and the second mesh belt may comprise a plurality of endless circulating belts in association with a plurality of the injection means spaced one from another in the machine direction.

(xiv) Both of said first mesh belt and said second mesh belts may comprise a plurality of endless circulating belts.

(xv) Preferably, the overlaps in the region(s) underlying the injection means differ between each of the plurality of endless circulating belts.

(xvi) Preferably, the plurality of endless circulating belts comprises two belts.

(xvii) The second mesh belt is provided with suction means adapted to suck the steam injected from the injection means on a side of opposite to a side facing the laminated product.

(xviii) Preferably the suction means is in alignment with the injection means in the machine direction.

(xx) Preferably, in the method of manufacturing, the liquid absorbent material comprises super-absorbent polymer particles and the mesh size of the second mesh belt is arranged to be smaller than the average particle diameter of the super-absorbent polymer particles.

According to the embodiments in the above (ii) to (xviii) and (xx), the features of which may be taken in isolation or in combination with one another, the advantageous effect(s) set forth at (a) is/are better ensured. Further advantageous effects of the respective embodiments may be obtained as discussed in the respective related descriptions.
Claims

[Claim 1] A laminated product treating apparatus having a machine direction, a cross direction being orthogonal to the machine direction, comprising first and second mesh belts arranged to sandwich a laminated product to be treated, and said first mesh belt is provided with injection means on a side opposite to a side facing said laminated product to inject steam toward said laminated product, wherein:
said first mesh belt has a plurality of first openings and a first closed region defined between each pair of the adjacent first openings and said second mesh belt has a plurality of second openings and a second closed region defined between each pair of the adjacent second openings wherein said first openings at least partially overlap said second closed region in a region underlying the injection means.

[Claim 2] The laminated product treating apparatus defined by Claim 1, wherein the nozzles have a diameter of 0.1 to 2.0mm and are arranged at a pitch, in the cross direction, of 0.5 to 10.0mm.

[Claim 3] The laminated product treating apparatus defined by Claim 1 or 2, wherein the mesh belts travel at a rate of 5 to 500m/min and the injection quantity of steam per unit surface area is 0.03kg/m² to 1.23kg/m².

[Claim 4] The laminated product treating apparatus defined by any one of Claims 1 through 3, wherein said first mesh belt and said second mesh belt have the same open area ratio.

[Claim 5] The laminated product treating apparatus defined by any one of Claims 1 through 4, wherein said open area ratio of the belts is 10 to 85%.

[Claim 6] The laminated product treating apparatus defined by any one of Claims 1 to 3, wherein said first mesh belt has an open area ratio smaller than an open area ratio of said second mesh belt.

[Claim 7] The laminated product treating apparatus defined by Claim 6, wherein the first mesh belt has an open area ratio of about 56% and the second mesh belt has an open area ratio of about 65%.

[Claim 8] The laminated product treating apparatus defined by any one of Claims 1 through 7, wherein the openings in the first mesh belt are a different shape to the openings in the second mesh belt.

[Claim 9] The laminated product treating apparatus defined by any one of Claims 1 through 8, wherein a plurality of said injection means are provided that are arranged to be spaced one from another in said machine
direction.

[Claim 10] The laminated product treating apparatus defined by any one of Claims 1 through 9, wherein one only of said first mesh belt and said second mesh belt comprises a plurality of endless circulating belts.

[Claim 11] The laminated product treating apparatus defined by any one of Claims 1 to 9, wherein both of said first mesh belt and said second mesh belt comprises a plurality of endless circulating belts.

[Claim 12] The laminated product treating apparatus defined by Claim 11, wherein the overlaps in the region(s) underlying the injection means differ between each of the plurality of endless circulating belts.

[Claim 13] The laminated product treating apparatus defined by any one of Claims 1 through 12, wherein said second mesh belt is provided with suction means adapted to suck said steam injected from said injection means on a side opposite to a side facing said laminated product.

[Claim 14] A method of manufacturing a laminated product containing a liquid absorbent material using the apparatus as defined in any one of Claims 1 through 13.

[Claim 15] The method of manufacturing a laminated product defined by Claim 14, wherein the liquid absorbent material comprises super-absorbent polymer particles and the mesh size of the second mesh belt is arranged to be smaller than the average particle diameter of the super-absorbent polymer particles.
INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2011/001423

A. CLASSIFICATION OF SUBJECT MATTER

IntCl. D04H/46(2006.01)i, D04H/40(2006.01)i, D06B/08(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IntCl. D04H 1/00-18/00, D06B 1/00-23/30, D06C 3/00-29/00, D06G 1/00-5/00, D06H 1/00-7/24, D06J 1/00-1/12

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

Published examined utility model applications of Japan 1992-1996
Published examined utility model applications of Japan 1971-2011
Published registered utility model specifications of Japan 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No.


Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search
02.05.2011

Date of mailing of the international search report
17.05.2011

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