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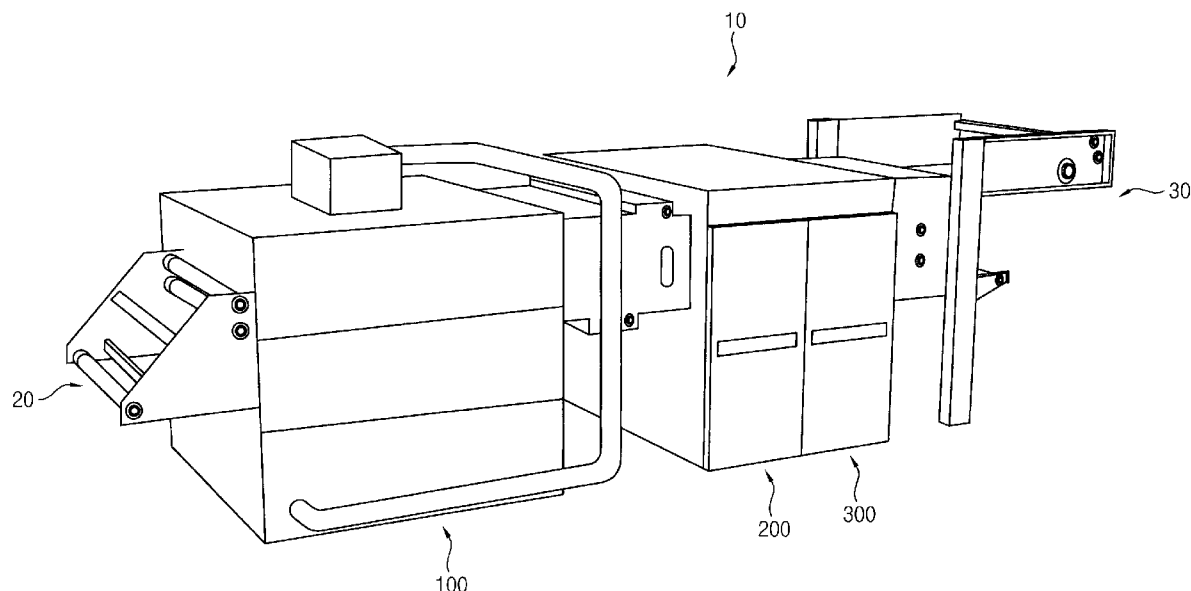
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(54) Title: SHEET TYPE MATERIALS DRYING APPARATUS AND A METHOD FOR CONTROLLING THE SAME



(57) Abstract: In a material drying apparatus and a method for controlling the material drying apparatus, the material drying apparatus includes a first drying unit, a steam unit and an additional unit. The first drying unit moves a textile material and dries the textile material using a heating wind. The steam unit moves the textile material dried by the first drying unit, and provides a steam to both sides of the textile material. The additional unit moves the textile material steamed by the steam unit, and provides the heating wind on both sides of the textile material.



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Description

Title of Invention: SHEET TYPE MATERIALS DRYING APPARATUS AND A METHOD FOR CONTROLLING THE SAME

Technical Field

- [1] The present disclosure of invention relates to a material drying apparatus and a method for controlling the material drying apparatus, and more specifically the present disclosure of invention relates to a material drying apparatus in which a sheet type textile is provided as a drying material so as to increase the drying efficiency of the drying material and a quality of the drying, and a method for controlling the material drying apparatus.

Background Art

- [2] A textile material manufactured to be clothes or textile products is treated with a plurality of processes after the production. In a textile drying process of the processes, a moisture absorbed by a drying material is dried until moisture content is to be about 8~10 %wt, and then processes for increasing drying quality regarding a reduction ratio are performed.
- [3] As a technique for the textile drying process, in a conventional tumbler type drying machine, a drum is rotated so that the textile material is rotated and dropped inside of the drum and the textile material is dried by a heating wind provided to the drum, and then a steam is provided from a rear end of the drum to decrease the reduction ratio of the textile material.
- [4] However, the conventional drying is merely a disposing type drying and a size of the drum is limited, so that a quantity of the textile material is limited, the drying is not uniformly performed due to the irregular rotation and drop of the textile material, and the reduction ratio also is not uniform. Thus, the drying quality of the textile material is decreased.
- [5] To solve the above-mentioned conventional drying problem, a drying apparatus in which the textile material is provided in parallel via a conveyer belt and the heating wind and the steam are directly provided on the conveyer belt, is developed.
- [6] However, in the above-mentioned conveyer type drying apparatus, a relatively wider space for drying the textile material is necessary, and thus a manufacturing equipment is more necessary to increase the cost price and a drying efficiency is relatively low.
- [7] Regarded prior arts on the technologies mentioned above are Korean patent publication No. 10-1362385 and Korean utility model publication No. 20-0439629.

Disclosure of Invention

Technical Problem

- [8] The present invention is developed to solve the above-mentioned problems of the related arts. The present invention provides a material drying apparatus capable of increasing drying efficiency and drying quality due to a relatively low reduction ratio, minimizing a space for a manufacturing equipment, and decreasing cost prices for manufacturing equipment.
- [9] The present invention also provides a method for controlling the material drying apparatus.
- [10] The present invention also provides a method for controlling the material drying apparatus.

Solution to Problem

- [11] According to an example embodiment, the material drying apparatus includes a first drying unit, a steam unit and an additional unit. The first drying unit moves a textile material and dries the textile material using a heating wind. The steam unit moves the textile material dried by the first drying unit, and provides a steam to both sides of the textile material. The additional unit moves the textile material steamed by the steam unit, and provides the heating wind on both sides of the textile material.
- [12] In an example embodiment, the first drying unit may include a drying cylinder having a plurality of cylinders moving the textile material on a surface of the cylinders, and a plurality of moving rollers guiding the textile material.
- [13] In an example embodiment, a tension sensor sensing a moving tension of the textile material may be disposed between the cylinders adjacent to each other.
- [14] In an example embodiment, rotational velocities of the cylinders of the first drying unit after the tension sensor, cylinders of the steam unit and cylinders of the additional drying unit may be controlled based on tensions sensed by the tension sensor.
- [15] In an example embodiment, the first drying unit may include a frame forming an outer form of the first drying unit, and dividing a space into an upper space in which some of the cylinders are disposed and a central space in which others of the cylinders are disposed, and a heating wind provider providing the heating wind into the frame.
- [16] In an example embodiment, the steam unit may include one of a steam cylinder on which the textile material moves and a steam conveyer moving the textile material, and the additional drying unit may include one of a drying cylinder on which the textile material moves and a drying conveyer moving the textile material.
- [17] In an example embodiment, each of the steam cylinder and the drying cylinder may have a cylindrical shape having an opening inside thereof.
- [18] In an example embodiment, in each of the steam cylinder and the drying cylinder, outer surface thereof may have a porous structure through which the steam and the

heating wind pass, and the steam and the heating wind may be provided to the textile material from outside thereof and inside thereof.

- [19] In an example embodiment, each of the steam cylinder and the drying cylinder may include a holder having a plurality of pins which extends from the surface of each of the steam cylinder and the drying cylinder to fix the textile material.
- [20] In an example embodiment, the holder may move along the surface of each of the steam cylinder and the drying cylinder to fit a width of the textile material.
- [21] In an example embodiment, each of the steam cylinder and the drying cylinder may vibrate with respect to a central axis thereof.
- [22] In an example embodiment, the steam conveyer and the drying conveyer may form a closed roof and continuously move, when the steam unit includes the steam conveyer and the additional drying unit includes the drying conveyer.
- [23] In an example embodiment, the steam unit may include a steam block facing the steam conveyer and providing the steam on a surface of the textile material, and the additional drying unit may include a drying block facing the drying conveyer and providing the heating wind on a surface of the textile material.
- [24] In an example embodiment, the steam may pass through the steam conveyer and may be provided to an opposite surface of the textile material, and the heating wind may pass through the drying conveyer and may be provided to an opposite surface of the textile material.
- [25] In an example embodiment, a plurality of pins may be formed along an outer side of each of the steam conveyer and the drying conveyer, and may extend with a radial shape to fix the textile material.
- [26] According to another example embodiment, a method for controlling a material drying apparatus in a drying process for a textile material is performed by a first drying unit, a steam unit and an additional drying unit. In the method, drying conditions are determined in the first drying unit, the steam unit and the additional drying unit, based on the textile material. A moving tension of the textile material passing through the first drying unit and a number of revolution of cylinders of the first drying unit are measured. A moving velocity of the textile material in the steam unit and the additional drying unit is measured. The moving velocity of the textile material in the cylinders of the first drying unit after a tension sensor, the steam unit and the additional drying unit is controlled.
- [27] In an example embodiment, in the method, temperature and humidity of exhaust moist air from the first drying unit, the steam unit and the additional drying unit, and initial and final moisture contents of the textile material, after determining the drying conditions are measured.
- [28] In an example embodiment, the measured information may be provided to a mobile

terminal, and the control may be performed using the mobile terminal.

Advantageous Effects of Invention

- [29] According to the present example embodiments, the first drying unit dries the textile material, the steam unit steams the textile material, and then the additional drying unit removes the moisture generated by the steaming. Further, the steam and the heating wind are provided to both sides of the textile material in moving the textile material, and thus the drying efficiency and drying quality may be enhanced.
- [30] In addition, in the first drying unit, the moving velocity of the textile material in following cylinders of the first drying unit, the steam unit or the additional drying unit is controlled based on the measured moving tension of the textile material or additional measured results, and thus the moving tension of the textile material may be maintained uniformly and a reduction ratio of the textile material may be effectively maintained within a predetermined range.
- [31] In addition, a plurality of cylinders is disposed separately in an upper space or in a lower space of the first drying unit, and thus the space may be efficiently used and the drying may be efficiently enhanced.
- [32] In addition, the steam unit and the additional drying unit may include the cylinder or the conveyer selectively, and thus optimized manufacturing equipment may be selected via a various kinds of combinations, based on the steam and the heating wind providing situations.
- [33] In addition, when the steam cylinder and the drying cylinder are used, the porous structure is applied so that the steam and the heating wind may be provided from outside or inside of the cylinder. Thus, the textile material may be uniformly and effectively dried and steamed.
- [34] In addition, the holder and the pins may fit the width of the textile material, and thus any size of the textile material may be effectively dried and the textile material may be prevented from being wrinkled during the drying.
- [35] In addition, the steam cylinder vibrates with respect to the central axis thereof, and thus a residual stress of the textile material may be effectively removed. Thus, the reduction ratio may be maintained within a predetermined range and the material drying apparatus may be functioned as a tenting apparatus.
- [36] Alternatively, when the steam conveyer and the drying conveyer are used, the conveyers form the closed roof and continuously move, and thus the moving velocity of the textile material may be efficiently controlled and the space for the steam unit and the additional drying unit may be efficiently used.
- [37] In addition, a mixing ratio of the exhaust moist air and the steam in the steam unit is controlled such that the material drying apparatus may have more enhanced energy ef-

iciency.

- [38] In addition, the steam conveyer and the drying conveyer include the pins fixing the textile material, and thus the drying efficiency and the drying quality may be more enhanced.

Brief Description of Drawings

- [39] FIG. 1 is a perspective view illustrating a material drying apparatus according to an example embodiment of the present invention;
- [40] FIG. 2 is an inner structural view illustrating a first drying unit of FIG. 1;
- [41] FIG. 3 is a schematic view illustrating a steam unit and an additional drying unit of FIG. 1;
- [42] FIG. 4 is a perspective view illustrating a steam cylinder and a drying cylinder of FIG. 3;
- [43] FIG. 5 is a schematic view illustrating a steam unit and an additional drying unit of a material drying apparatus according to another example embodiment of the present invention; and
- [44] FIG. 6 is a flow chart illustrating a method for controlling the material drying apparatus of FIGS. 1 and 4.

Best Mode for Carrying out the Invention

- [45] The invention is described more fully hereinafter with Reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity. It will be understood that, although the terms first, second, third etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.
- [46] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.
- [47] It will be further understood that the terms "comprises" and/or "comprising," when

used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

- [48] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.
- [49] Hereinafter, exemplary embodiment of the invention will be explained in detail with reference to the accompanying drawings.
- [50] FIG. 1 is a perspective view illustrating a material drying apparatus according to an example embodiment of the present invention. FIG. 2 is an inner structural view illustrating a first drying unit of FIG. 1. FIG. 3 is a schematic view illustrating a steam unit and an additional drying unit of FIG. 1. FIG. 4 is a perspective view illustrating a steam cylinder and a drying cylinder of FIG. 3.
- [51] Referring to FIGS. 1 to 4, the material drying apparatus according to the present example embodiment includes an inlet 20 through which a textile material 50 is provided, and an outlet 30 through which the textile material 50 is discharged after the drying, and further includes a first drying unit 100, a steam unit 200 and an additional drying unit 300.
- [52] The textile material 50 is firstly dried in the first drying unit 100. Then, the textile material 50 contracted in the drying is recovered by a steam shower in the steam unit 200 and a residual stress of the textile material 50 is removed to maintain a reduction ratio of the textile material 50 within a predetermined range.
- [53] Then, the moisture remaining in the textile material 50 due to the steam unit 200 is removed via the additional drying unit 300.
- [54] Here, the steam from the steam unit 200 may be provided by an additional steam generator (not shown), or an exhaust moist air which is a recycled air of the heating wind used in the first drying unit 100 or the additional drying unit 300 may be used as the steam.
- [55] More specifically, the first drying unit 100 includes a frame 110, a driving cylinder 120, a driving gear (not shown), a heating wind provider 140, a moving roller 150 and a tension sensor 160.
- [56] The frame 110 forms an outer frame of the first drying unit 100, and may have a hexahedron shape.

- [57] An inside of the frame 110 is divided into an upper frame 111, a central frame 112 and a lower frame. As mentioned below, some of the cylinders may be disposed in the upper frame 111, and others of the cylinders may be disposed in the central frame 112. A heating wind generator may be disposed in the lower frame 113.
- [58] The driving cylinder 120 includes a plurality of cylinders 121, 122, 123 and 124, and moves the textile material 50 inside of the first drying unit 100.
- [59] Here, the number of cylinders may be 4 as illustrated in FIG. 2, and first and fourth cylinders 121 and 124 may be disposed in the upper frame 111 and second and third cylinders 122 and 123 may be disposed in the central frame 112.
- [60] Each of the cylinders has a cylindrical shape and the textile material 50 moves on a surface of the cylinder, and as illustrated in FIG. 2, the textile material 50 may move in a series of first to fourth cylinders 121, 122, 123 and 124.
- [61] Further, each of the cylinders may have a shape as illustrated in FIG. 4, and further explanation may be followed below.
- [62] The drying gear provides a power to the first to fourth cylinders 121, 122, 123 and 124 using a gear, a pulley and so on. Here, the power provided to each of the first to fourth cylinders 121, 122, 123 and 124 may be controlled differently.
- [63] The heating wind provider 140 receives the heating wind generated in the heating wind generator disposed in the lower frame 113 via a heating wind providing line 141, and provides the heating wind to the textile material 50 moving on the first to fourth cylinders 121, 122, 123 and 124 inside of the frame 110.
- [64] For example, as illustrated in FIG. 2, the heating wind provider 140 provides the heating wind from an upper side of the upper frame 111 to the upper and central frames 111 and 112.
- [65] Accordingly, as the heating wind is provided by the heating wind provider 140, the textile material 50 is dried inside of the first drying unit 100.
- [66] The moving roller 150 is a plural, and is disposed between the inlet 20 and the first to fourth cylinders 121, 122, 123 and 124, to guide the inlet and the moving of the textile material 50. Here, the number and the disposition of the moving roller 150 may be variously changed based on the moving condition of the textile material 50.
- [67] The tension sensor 160 is disposed between at least one of the first to fourth cylinders 121, 122, 123 and 124 and the moving roller 150 adjacent the at least one of the first to fourth cylinders 121, 122, 123 and 124, to sense the moving tension of the textile material 50.
- [68] After the moving tension of the textile material 50 is sensed, whether the moving tension thereof is proper to the moving condition of the textile material 50 is decided, and then the rotating velocity of each of the first to fourth cylinders 121, 122, 123 and 124 or the moving velocity of the textile material 50 in the steam unit 200 and the ad-

ditional drying unit 300 are controlled.

[69] Here, the rotating velocity of the cylinders controlled may be the following of the measured cylinder.

[70] For example, when the tension sensor 160 measures the tension of the textile material 50 passing through the first cylinder 121 between the first cylinder 121 and the moving roller adjacent to the first cylinder 121, the rotating velocity of the second to fourth cylinders 122, 123 and 124 following the first cylinder 121 may be decreased or increased, if the measured tension is larger or smaller than the predetermined or ideal tension of the first cylinder 121. In addition, the moving velocity of the textile material 50 in the steam unit 200 and the additional drying unit 300 following the first cylinder 121 may be increased or decreased.

[71] In addition to the control of the tension measured by the tension sensor 160, the rotating velocity of the first to fourth cylinders 121, 122, 123 and 124 or the moving velocity of the textile material 50 in the following steam unit 200 and additional drying unit 300 may be controlled based on additional control elements.

[72] The steam unit 200 is connected to the first drying unit 100, and steams the dried textile material 50. Thus, the textile material 50 contracted by the drying in the first drying unit 100 is recovered and residual stress of the textile material 50 is removed, and thus the reduction ratio may be maintained within a predetermined range.

[73] More specifically, the steam unit 200 includes a steam cylinder 210, a holder 220 and a moving roller 230.

[74] The steam cylinder 210 has a cylindrical shape, and an outer surface is porous so that the steam may easily pass through the steam cylinder 210. The steam cylinder 210 has a vacant shape inside thereof except for a central axis 211 of the steam cylinder 210.

[75] In addition, the moving roller 230 is disposed at both sides of the steam cylinder 210, and guides the textile material 50 moving on the surface of the steam cylinder 210.

[76] The steam passes through the steam cylinder 210 and is provided to the inside of the steam cylinder 210, and thus a side of the textile material 50 is steamed.

[77] In addition, since the inside of the steam cylinder 210 is vacant, the steam, as illustrated in FIG. 3, passes through the steam cylinder 210 and is provided from the inside to outside of the steam cylinder 210. Thus, the opposite side of the textile material 50 is also steamed.

[78] Thus, both sides of the textile material 50 are steamed and thus the textile material 50 is uniformly steamed.

[79] The holder 220 is disposed at an outer surface of both sides of the steam cylinder 210 having the cylindrical shape. The holder 220 may move along a longitudinal direction of the steam cylinder 210 and may be fixed at an arbitrary position, as illustrated in FIG. 4.

- [80] In addition, a plurality of first pins 221 extending with a radial shape, may be formed at the holder 220, and the first pins 221 may extend outside of the steam cylinder 210.
- [81] Thus, the first pins 221 fixes both ends of the textile material 50 when the textile material 50 moves along the outer surface of the steam cylinder 210, and thus the textile material 50 may uniformly move with widely extended.
- [82] Since the holder 220 changes the distance with each other and is fixed as illustrated in FIG. 4, the position of the holder 220 may be changed to fit to the width of the textile material 50 and the textile material 50 may be effectively fixed by the first pins 221, even though the textile material 50 may have variously kinds of widths.
- [83] In addition, the steam cylinder 210 may vibrate with respect to the central axis 211 thereof. Here, the direction of the vibration of the steam cylinder 210, as illustrated in FIG. 3, may be a direction of right and left, a direction of up and down, or various kinds of directions.
- [84] Accordingly, the steam cylinder 210 may vibrate with respect to the central axis 211 thereof, and thus the drying quality of the textile material 50 and the tissue quality of the textile material 50 may be increased. In addition, the textile material 50 is fixed by the first pins 221 and is vibrated, and thus the drying and tissue quality of the textile material 50 may be more enhanced.
- [85] Further, as illustrated in FIG. 3, one steam cylinder 210 is disposed, but at least two steam cylinders may be continuously disposed with a direction of right and left or a direction of up and down, and thus the textile material 50 may move along at least two consecutive steam cylinders.
- [86] As explained above, each of the first to fourth cylinders 121, 122, 123 and 124 of the first drying unit 100 may have same shape, structure and movement as the steam cylinder 210.
- [87] For example, each of the first to fourth cylinders 121, 122, 123 and 124 includes the holder 220, has a porous structure and has a vacant inside thereof.
- [88] Thus, the first drying unit 100 may dry and steam the textile material 50 at the same time, and thus may function as the tentering apparatus.
- [89] The additional drying unit 300 is connected to the steam unit 200, and dries the moisture or the humidity remaining in the steamed textile material 50. Thus, the textile material 50 from which the moisture or the humidity is removed is discharged through the outlet 30.
- [90] More specifically, the additional drying unit 300 includes a drying cylinder 310, a holder 320 and a moving roller 330.
- [91] Here, the additional drying unit 300 is substantially same as the steam cylinder 210 except that the heating wind is provided from inside of the drying cylinder 310 to outside of the drying cylinder 310, or from outside thereof to inside thereof, and thus

both sides of the textile material 50 are dried.

[92] For example, a shape, a structure, a movement and so on of the drying cylinder 310 may be substantially same as those of the steam cylinder 210, and a shape, a structure, a movement and so on of the holder 320 and the moving roller 330 may be substantially same as those of the holder 220 and the moving roller 230.

[93] However, the vibration of the drying cylinder 310 may less increase the drying efficiency, and thus the drying cylinder 310 may not vibrate with respect to the central axis thereof.

[94] Thus, any repetitive explanation of the additional drying unit 300 will be omitted.

[95] FIG. 5 is a schematic view illustrating a steam unit and an additional drying unit of a material drying apparatus according to another example embodiment of the present invention.

[96] The first drying unit of the material drying apparatus 11 according to the present example embodiment is substantially same as the first drying unit 100 in FIGS. 1 and 2, and thus any repetitive explanation concerning the first drying unit will be omitted.

[97] Referring to FIG. 5, the material drying apparatus 11 according to the present example embodiment includes a steam unit 201 and an additional drying unit 301.

[98] Here, the steam unit 201 includes a moving roller 231, a driving roller 232, a steam conveyer 250 and a steam block 260.

[99] The moving roller 231 guides the movement of the textile material 50, and may be variously arranged to control the moving direction of the textile material 50.

[100] The driving roller 232 moves the steam conveyer 250, and may control the moving velocity of the steam conveyer 250.

[101] The steam conveyer 250 is driven by the driving roller 232, and moves the textile material 50.

[102] In the present example embodiment, the steam conveyer 250 is continuously connected to the steam conveyer 250, and totally forms a closed roof. Alternatively, the steam conveyer 250 may independently form the closed roof.

[103] A plurality of pins 255 extends with a radial shape at both ends of the steam conveyer 250 along a width direction, and thus the textile material 50 moves with widely extended.

[104] In the present example embodiment, the steam conveyer 250 moves the textile material 50 along a horizontal direction, and then a central portion of the steam conveyer 250 is concaved toward a lower direction to form a concave portion 251. Here, the steam block 260 is disposed to face the steam conveyer 250, at the concave portion 251.

[105] The steam block 260 receives the steam from the upper side 261, and the steam is provided to a side of the textile material 50 from the steam block 260. Thus, the side of

the textile material 50 is steamed.

[106] Here, an outer surface of the steam block 260 has a porous structure so that the steam may easily pass through the steam block 260.

[107] An outer surface of the steam conveyer 250 has a porous structure so that the steam may easily pass through the steam conveyer 250, and as illustrated in FIG. 5, the steam is provided to the steam block 260 from the inside of the steam conveyer 250. Thus, the opposite side of the textile material 50 is steamed.

[108] Thus, both sides of the textile material 50 may be uniformly steamed.

[109] In the connection with the steam conveyer 250, the position or the number of the concave portion 251 may be variously changed, and the steam block 260 is disposed at the concave portion 251, to face the steam conveyer 250 for steaming.

[110] Likewise, the additional drying unit 301 includes a moving roller 331, a driving roller 332, a drying conveyer 350 and a drying block 360.

[111] Here, a shape, a structure and a movement of the moving roller 331 are substantially same as those of the moving roller 231 of the steam unit 201, and a shape, a structure and a movement of the driving roller 332 are substantially same as those of the driving roller 232, and thus any repetitive explanation will be omitted.

[112] A shape, a structure and a movement of the drying conveyer 350 are substantially same as those of the steam conveyer 250, but the drying conveyer 350 is connected to a rear end of the steam conveyer 250 and the heating wind not the steam is provided to the textile material 50 via the drying conveyer 350.

[113] In addition, as illustrated in FIG. 5, the drying conveyer 350 is continuously connected to the steam conveyer 250, and totally forms the closed roof. Although not shown in the figure, the drying conveyer 350 may form the closed roof independently.

[114] Further, a shape, a structure and a movement of the drying block 360 are substantially same as those of the steam block 260, but the heating wind is only provided via the drying block 360 to dry the textile material 50.

[115] Accordingly, the closed roof type steam conveyer and drying conveyer steam and dry the textile material 50.

[116] In FIG. 3, the steam unit 200 includes the steam cylinder 210, and the additional drying unit 300 includes the drying cylinder 310. In FIG. 5, the steam unit 201 includes the steam conveyer 250, and the additional drying unit 301 includes the drying conveyer 350.

[117] Alternatively, although not shown in the figure, the steam unit may include the steam cylinder and the additional drying unit may include the drying conveyer moving with the closed roof. Likewise, the steam unit may include the steam conveyer moving with the closed roof, and the additional drying unit may include the drying cylinder.

[118] FIG. 6 is a flow chart illustrating a method for controlling the material drying

apparatus of FIGS. 1 and 4.

- [119] Referring to FIG. 6, in the method for controlling the material drying apparatus, conditions for drying and steaming in the first drying unit 100, the steam unit 200 and the additional drying unit 300 are determined based on the kinds or the size of the textile material 50 (step S10).
- [120] For example, the conditions for every textile material 50 such as the drying velocity, the temperature or the velocity of the heating wind, a quantity or the temperature of the steam, the temperature or the velocity of the heating wind in the additional drying, and so on, may be determined.
- [121] Then, the first drying unit 100 measures the moving tension of the textile material 50 and the number of revolution of each of the cylinders 121, 122, 123 and 124 (step S20).
- [122] Here, the method for measuring the moving tension is mentioned above, and the number of revolution of each of the cylinders may be measured using addition measuring devices (not shown).
- [123] After determining the drying conditions for the textile material 50, the temperature and the humidity of exhaust moist air from the first drying unit 100, the steam unit 200 and the additional drying unit 300, and initial and final moisture contents of the textile material 50 are measured (step S30).
- [124] Here, the measuring step S30 may be performed at the same time with the measuring step S20, and the measured information in step S30 may be provided at the same time with the measured information in step S20. Alternatively, the step S30 may be performed and the information in the step S30 may be provided independently.
- [125] Here, the measured information mentioned above such as the drying velocity, the temperature or the velocity of the heating wind, a quantity or the temperature of the steam, the temperature or the velocity of the heating wind in the additional drying, the moving tension, the number of revolution and so on, may be provided to a mobile terminal. Thus, a user or an operator may obtain the measured information via the mobile terminal.
- [126] Then, the moving velocity of the textile material 50 is measured in the steam unit 200 and the additional drying unit 300 (step S40).
- [127] Here, when the steam cylinder 210 and the drying cylinder 310 are equipped, the rotating velocity of each of the steam cylinder 210 and the drying cylinder 310 is measured by additional measuring apparatuses (not shown) and then the moving velocity of the textile material 50 may be measured.
- [128] Alternatively, when the steam conveyer 250 and the drying conveyer 350 are equipped, the moving velocity of each of the steam conveyer 250 and the drying conveyer 350 is measured to measure the moving velocity of the textile material 50.

- [129] Accordingly, based on the tension applied to the textile material 50 and the moving velocity of the textile material 50 at each section, whether the textile material 50 moves with a proper tension and a proper moving velocity is determined.
- [130] Thus, when the tension and the moving velocity of the textile material 50 are different from those predetermined, the tension and the moving velocity of the textile material 50 should be controlled.
- [131] For example, the number of revolution of cylinders following the cylinder now moving the textile material 50 is controlled, and the moving velocity of the textile material 50 in the steam unit 200 and the additional drying unit 300 is controlled (step S50).
- [132] Here, when the steam cylinder 210 and the drying cylinder 310 are equipped, the rotating velocity of each of the steam cylinder 210 and the drying cylinder 310 is controlled. Alternatively, when the steam conveyer 250 and the drying conveyer 350 are equipped, the moving velocity of each of the steam conveyer 250 and the drying conveyer 350 may be controlled.
- [133] Thus, the material drying apparatus 10 and 11 may be controlled to dry the textile material 50 with the same conditions initially determined.
- [134] In addition to controlling the moving velocity of the textile material 50, the mixing ratio between the exhaust moist air and the steam is controlled in the steam unit 200 based on the measured information (step S60).
- [135] Accordingly, the mixing ratio between the exhaust moist air and the steam is controlled considering the drying condition and the moving condition based on the measured information, to control the steam condition for the textile material 50. Thus, the energy efficiency in the material drying apparatus may be maximized.
- [136] Here, the user or the operator may perform the above-mentioned control using the mobile terminal. Thus, the user or the operator may obtain the measured information using the mobile terminal and perform the necessary control using the mobile terminal, too.
- [137] According to the present example embodiments, the first drying unit dries the textile material, the steam unit steams the textile material, and then the additional drying unit removes the moisture generated by the steaming. Further, the steam and the heating wind are provided to both sides of the textile material in moving the textile material, and thus the drying efficiency and drying quality may be enhanced.
- [138] In addition, in the first drying unit, the moving velocity of the textile material in following cylinders of the first drying unit, the steam unit or the additional drying unit is controlled based on the measured moving tension of the textile material or additional measured results, and thus the moving tension of the textile material may be maintained uniformly and a reduction ratio of the textile material may be effectively

maintained within a predetermined range.

- [139] In addition, a plurality of cylinders is disposed separately in an upper space or in a lower space of the first drying unit, and thus the space may be efficiently used and the drying may be efficiently enhanced.
- [140] In addition, the steam unit and the additional drying unit may include the cylinder or the conveyer selectively, and thus optimized manufacturing equipment may be selected via a various kinds of combinations, based on the steam and the heating wind providing situations.
- [141] In addition, when the steam cylinder and the drying cylinder are used, the porous structure is applied so that the steam and the heating wind may be provided from outside or inside of the cylinder. Thus, the textile material may be uniformly and effectively dried and steamed.
- [142] In addition, the holder and the pins may fit the width of the textile material, and thus any size of the textile material may be effectively dried and the textile material may be prevented from being wrinkled during the drying.
- [143] In addition, the steam cylinder vibrates with respect to the central axis thereof, and thus a residual stress of the textile material may be effectively removed. Thus, the reduction ratio may be maintained within a predetermined range and the material drying apparatus may be functioned as a tentering apparatus.
- [144] Alternatively, when the steam conveyer and the drying conveyer are used, the conveyers form the closed roof and continuously move, and thus the moving velocity of the textile material may be efficiently controlled and the space for the steam unit and the additional drying unit may be efficiently used.
- [145] In addition, a mixing ratio of the exhaust moist air and the steam in the steam unit is controlled such that the material drying apparatus may have more enhanced energy efficiency.
- [146] In addition, the steam conveyer and the drying conveyer include the pins fixing the textile material, and thus the drying efficiency and the drying quality may be more enhanced.
- [147] Having described the example embodiments of the present invention and its advantage, it is noted that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by appended claims. 210, and guides the textile material 50 moving on the surface of the steam cylinder 210.
- [148] The steam passes through the steam cylinder 210 and is provided to the inside of the steam cylinder 210, and thus a side of the textile material 50 is steamed.
- [149] In addition, since the inside of the steam cylinder 210 is vacant, the steam, as illustrated in FIG. 3, passes through the steam cylinder 210 and is provided from the

inside to outside of the steam cylinder 210. Thus, the opposite side of the textile material 50 is also steamed.

[150] Thus, both sides of the textile material 50 are steamed and thus the textile material 50 is uniformly steamed.

[151] The holder 220 is disposed at an outer surface of both sides of the steam cylinder 210 having the cylindrical shape. The holder 220 may move along a longitudinal direction of the steam cylinder 210 and may be fixed at an arbitrary position, as illustrated in FIG. 4.

[152] In addition, a plurality of first pins 221 extending with a radial shape, may be formed at the holder 220, and the first pins 221 may extend outside of the steam cylinder 210.

[153] Thus, the first pins 221 fixes both ends of the textile material 50 when the textile material 50 moves along the outer surface of the steam cylinder 210, and thus the textile material 50 may uniformly move with widely extended.

[154] Since the holder 220 changes the distance with each other and is fixed as illustrated in FIG. 4, the position of the holder 220 may be changed to fit to the width of the textile material 50 and the textile material 50 may be effectively fixed by the first pins 221, even though the textile material 50 may have variously kinds of widths.

[155] In addition, the steam cylinder 210 may vibrate with respect to the central axis 211 thereof. Here, the direction of the vibration of the steam cylinder 210, as illustrated in FIG. 3, may be a direction of right and left, a direction of up and down, or various kinds of directions.

[156] Accordingly, the steam cylinder 210 may vibrate with respect to the central axis 211 thereof, and thus the drying quality of the textile material 50 and the tissue quality of the textile material 50 may be increased. In addition, the textile material 50 is fixed by the first pins 221 and is vibrated, and thus the drying and tissue quality of the textile material 50 may be more enhanced.

[157] Further, as illustrated in FIG. 3, one steam cylinder 210 is disposed, but at least two steam cylinders may be continuously disposed with a direction of right and left or a direction of up and down, and thus the textile material 50 may move along at least two consecutive steam cylinders.

[158] As explained above, each of the first to fourth cylinders 121, 122, 123 and 124 of the first drying unit 100 may have same shape, structure and movement as the steam cylinder 210.

[159] For example, each of the first to fourth cylinders 121, 122, 123 and 124 includes the holder 220, has a porous structure and has a vacant inside thereof.

[160] Thus, the first drying unit 100 may dry and steam the textile material 50 at the same time, and thus may function as the tentering apparatus.

[161] The additional drying unit 300 is connected to the steam unit 200, and dries the

moisture or the humidity remaining in the steamed textile material 50. Thus, the textile material 50 from which the moisture or the humidity is removed is discharged through the outlet 30.

[162] More specifically, the additional drying unit 300 includes a drying cylinder 310, a holder 320 and a moving roller 330.

[163] Here, the additional drying unit 300 is substantially same as the steam cylinder 210 except that the heating wind is provided from inside of the drying cylinder 310 to outside of the drying cylinder 310, or from outside thereof to inside thereof, and thus both sides of the textile material 50 are dried.

[164] For example, a shape, a structure, a movement and so on of the drying cylinder 310 may be substantially same as those of the steam cylinder 210, and a shape, a structure, a movement and so on of the holder 320 and the moving roller 330 may be substantially same as those of the holder 220 and the moving roller 230.

[165] However, the vibration of the drying cylinder 310 may less increase the drying efficiency, and thus the drying cylinder 310 may not vibrate with respect to the central axis thereof.

[166] Thus, any repetitive explanation of the additional drying unit 300 will be omitted.

[167] FIG. 5 is a schematic view illustrating a steam unit and an additional drying unit of a textile drying apparatus according to another example embodiment of the present invention.

[168] The first drying unit of the textile drying apparatus 11 according to the present example embodiment is substantially same as the first drying unit 100 in FIGS. 1 and 2, and thus any repetitive explanation concerning the first drying unit will be omitted.

[169] Referring to FIG. 5, the textile drying apparatus 11 according to the present example embodiment includes a steam unit 201 and an additional drying unit 301.

[170] Here, the steam unit 201 includes a moving roller 231, a driving roller 232, a steam conveyer 250 and a steam block 260.

[171] The moving roller 231 guides the movement of the textile material 50, and may be variously arranged to control the moving direction of the textile material 50.

[172] The driving roller 232 moves the steam conveyer 250, and may control the moving velocity of the steam conveyer 250.

[173] The steam conveyer 250 is driven by the driving roller 232, and moves the textile material 50.

[174] In the present example embodiment, the steam conveyer 250 is continuously connected to the steam conveyer 250, and totally forms a closed roof. Alternatively, the steam conveyer 250 may independently form the closed roof.

[175] A plurality of pins 255 extends with a radial shape at both ends of the steam conveyer 250 along a width direction, and thus the textile material 50 moves with

widely extended.

- [176] In the present example embodiment, the steam conveyer 250 moves the textile material 50 along a horizontal direction, and then a central portion of the steam conveyer 250 is concaved toward a lower direction to form a concave portion 251. Here, the steam block 260 is disposed to face the steam conveyer 250, at the concave portion 251.
- [177] The steam block 260 receives the steam from the upper side 261, and the steam is provided to a side of the textile material 50 from the steam block 260. Thus, the side of the textile material 50 is steamed.
- [178] Here, an outer surface of the steam block 260 has a porous structure so that the steam may easily pass through the steam block 260.
- [179] An outer surface of the steam conveyer 250 has a porous structure so that the steam may easily pass through the steam conveyer 250, and as illustrated in FIG. 5, the steam is provided to the steam block 260 from the inside of the steam conveyer 250. Thus, the opposite side of the textile material 50 is steamed.
- [180] Thus, both sides of the textile material 50 may be uniformly steamed.
- [181] In the connection with the steam conveyer 250, the position or the number of the concave portion 251 may be variously changed, and the steam block 260 is disposed at the concave portion 251, to face the steam conveyer 250 for steaming.
- [182] Likewise, the additional drying unit 301 includes a moving roller 331, a driving roller 332, a drying conveyer 350 and a drying block 360.
- [183] Here, a shape, a structure and a movement of the moving roller 331 are substantially same as those of the moving roller 231 of the steam unit 201, and a shape, a structure and a movement of the driving roller 332 are substantially same as those of the driving roller 232, and thus any repetitive explanation will be omitted.
- [184] A shape, a structure and a movement of the drying conveyer 350 are substantially same as those of the steam conveyer 250, but the drying conveyer 350 is connected to a rear end of the steam conveyer 250 and the heating wind not the steam is provided to the textile material 50 via the drying conveyer 350.
- [185] In addition, as illustrated in FIG. 5, the drying conveyer 350 is continuously connected to the steam conveyer 250, and totally forms the closed roof. Although not shown in the figure, the drying conveyer 350 may form the closed roof independently.
- [186] Further, a shape, a structure and a movement of the drying block 360 are substantially same as those of the steam block 260, but the heating wind is only provided via the drying block 360 to dry the textile material 50.
- [187] Accordingly, the closed roof type steam conveyer and drying conveyer steam and dry the textile material 50.
- [188] In FIG. 3, the steam unit 200 includes the steam cylinder 210, and the additional

drying unit 300 includes the drying cylinder 310. In FIG. 5, the steam unit 201 includes the steam conveyer 250, and the additional drying unit 301 includes the drying conveyer 350.

- [189] Alternatively, although not shown in the figure, the steam unit may include the steam cylinder and the additional drying unit may include the drying conveyer moving with the closed roof. Likewise, the steam unit may include the steam conveyer moving with the closed roof, and the additional drying unit may include the drying cylinder.
- [190] FIG. 6 is a flow chart illustrating a method for controlling the textile drying apparatus of FIGS. 1 and 4.
- [191] Referring to FIG. 6, in the method for controlling the textile drying apparatus, conditions for drying and steaming in the first drying unit 100, the steam unit 200 and the additional drying unit 300 are determined based on the kinds or the size of the textile material 50 (step S10).
- [192] For example, the conditions for every textile material 50 such as the drying velocity, the temperature or the velocity of the heating wind, a quantity or the temperature of the steam, the temperature or the velocity of the heating wind in the additional drying, and so on, may be determined.
- [193] Then, the first drying unit 100 measures the moving tension of the textile material 50 and the number of revolution of each of the cylinders 121, 122, 123 and 124 (step S20).
- [194] Here, the method for measuring the moving tension is mentioned above, and the number of revolution of each of the cylinders may be measured using addition measuring devices (not shown).
- [195] After determining the drying conditions for the textile material 50, the temperature and the humidity of exhaust moist air from the first drying unit 100, the steam unit 200 and the additional drying unit 300, and initial and final moisture contents of the textile material 50 are measured (step S30).
- [196] Here, the measuring step S30 may be performed at the same time with the measuring step S20, and the measured information in step S30 may be provided at the same time with the measured information in step S20. Alternatively, the step S30 may be performed and the information in the step S30 may be provided independently.
- [197] Here, the measured information mentioned above such as the drying velocity, the temperature or the velocity of the heating wind, a quantity or the temperature of the steam, the temperature or the velocity of the heating wind in the additional drying, the moving tension, the number of revolution and so on, may be provided to a mobile terminal. Thus, a user or an operator may obtain the measured information via the mobile terminal.
- [198] Then, the moving velocity of the textile material 50 is measured in the steam unit 200

and the additional drying unit 300 (step S40).

[199] Here, when the steam cylinder 210 and the drying cylinder 310 are equipped, the rotating velocity of each of the steam cylinder 210 and the drying cylinder 310 is measured by additional measuring apparatuses (not shown) and then the moving velocity of the textile material 50 may be measured.

[200] Alternatively, when the steam conveyer 250 and the drying conveyer 350 are equipped, the moving velocity of each of the steam conveyer 250 and the drying conveyer 350 is measured to measure the moving velocity of the textile material 50.

[201] Accordingly, based on the tension applied to the textile material 50 and the moving velocity of the textile material 50 at each section, whether the textile material 50 moves with a proper tension and a proper moving velocity is determined.

[202] Thus, when the tension and the moving velocity of the textile material 50 are different from those predetermined, the tension and the moving velocity of the textile material 50 should be controlled.

[203] For example, the number of revolution of cylinders following the cylinder now moving the textile material 50 is controlled, and the moving velocity of the textile material 50 in the steam unit 200 and the additional drying unit 300 is controlled (step S50).

[204] Here, when the steam cylinder 210 and the drying cylinder 310 are equipped, the rotating velocity of each of the steam cylinder 210 and the drying cylinder 310 is controlled. Alternatively, when the steam conveyer 250 and the drying conveyer 350 are equipped, the moving velocity of each of the steam conveyer 250 and the drying conveyer 350 may be controlled.

[205] Thus, the textile drying apparatus 10 and 11 may be controlled to dry the textile material 50 with the same conditions initially determined.

[206] In addition to controlling the moving velocity of the textile material 50, the mixing ratio between the exhaust moist air and the steam is controlled in the steam unit 200 based on the measured information (step S60).

[207] Accordingly, the mixing ratio between the exhaust moist air and the steam is controlled considering the drying condition and the moving condition based on the measured information, to control the steam condition for the textile material 50. Thus, the energy efficiency in the textile drying apparatus may be maximized.

[208] Here, the user or the operator may perform the above-mentioned control using the mobile terminal. Thus, the user or the operator may obtain the measured information using the mobile terminal and perform the necessary control using the mobile terminal, too.

[209] According to the present example embodiments, the first drying unit dries the textile material, the steam unit steams the textile material, and then the additional drying unit

removes the moisture generated by the steaming. Further, the steam and the heating wind are provided to both sides of the textile material in moving the textile material, and thus the drying efficiency and drying quality may be enhanced.

- [210] In addition, in the first drying unit, the moving velocity of the textile material in following cylinders of the first drying unit, the steam unit or the additional drying unit is controlled based on the measured moving tension of the textile material or additional measured results, and thus the moving tension of the textile material may be maintained uniformly and a reduction ratio of the textile material may be effectively maintained within a predetermined range.
- [211] In addition, a plurality of cylinders is disposed separately in an upper space or in a lower space of the first drying unit, and thus the space may be efficiently used and the drying may be efficiently enhanced.
- [212] In addition, the steam unit and the additional drying unit may include the cylinder or the conveyer selectively, and thus optimized manufacturing equipment may be selected via a various kinds of combinations, based on the steam and the heating wind providing situations.
- [213] In addition, when the steam cylinder and the drying cylinder are used, the porous structure is applied so that the steam and the heating wind may be provided from outside or inside of the cylinder. Thus, the textile material may be uniformly and effectively dried and steamed.
- [214] In addition, the holder and the pins may fit the width of the textile material, and thus any size of the textile material may be effectively dried and the textile material may be prevented from being wrinkled during the drying.
- [215] In addition, the steam cylinder vibrates with respect to the central axis thereof, and thus a residual stress of the textile material may be effectively removed. Thus, the reduction ratio may be maintained within a predetermined range and the textile drying apparatus may be functioned as a tenting apparatus.
- [216] Alternatively, when the steam conveyer and the drying conveyer are used, the conveyers form the closed roof and continuously move, and thus the moving velocity of the textile material may be efficiently controlled and the space for the steam unit and the additional drying unit may be efficiently used.
- [217] In addition, a mixing ratio of the exhaust moist air and the steam in the steam unit is controlled such that the textile drying apparatus may have more enhanced energy efficiency.
- [218] In addition, the steam conveyer and the drying conveyer include the pins fixing the textile material, and thus the drying efficiency and the drying quality may be more enhanced.
- [219] Having described the example embodiments of the present invention and its

advantage, it is noted that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by appended claims.

Claims

- [Claim 1] A material drying apparatus comprising:
a first drying unit moving a textile material and drying the textile material using a heating wind;
a steam unit moving the textile material dried by the first drying unit, and providing a steam to both sides of the textile material; and
an additional unit moving the textile material steamed by the steam unit, and providing the heating wind on both sides of the textile material.
- [Claim 2] The material drying apparatus of claim 1, wherein the first drying unit comprises:
a drying cylinder having a plurality of cylinders moving the textile material on a surface of the cylinders; and
a plurality of moving rollers guiding the textile material.
- [Claim 3] The material drying apparatus of claim 2, wherein a tension sensor sensing a moving tension of the textile material is disposed between the cylinders adjacent to each other.
- [Claim 4] The material drying apparatus of claim 3, wherein rotational velocities of the cylinders of the first drying unit after the tension sensor, cylinders of the steam unit and cylinders of the additional drying unit are controlled based on tensions sensed by the tension sensor.
- [Claim 5] The material drying apparatus of claim 2, wherein the first drying unit comprises:
a frame forming an outer form of the first drying unit, and dividing a space into an upper space in which some of the cylinders are disposed and a central space in which others of the cylinders are disposed; and
a heating wind provider providing the heating wind into the frame.
- [Claim 6] The material drying apparatus of claim 1, wherein the steam unit comprises one of a steam cylinder on which the textile material moves and a steam conveyer moving the textile material,
wherein the additional drying unit comprises one of a drying cylinder on which the textile material moves and a drying conveyer moving the textile material.
- [Claim 7] The material drying apparatus of claim 6, wherein each of the steam cylinder and the drying cylinder has a cylindrical shape having an opening inside thereof.
- [Claim 8] The material drying apparatus of claim 6, wherein in each of the steam

cylinder and the drying cylinder, outer surface thereof has a porous structure through which the steam and the heating wind pass, and the steam and the heating wind are provided to the textile material from outside thereof and inside thereof.

- [Claim 9] The material drying apparatus of claim 6, wherein each of the steam cylinder and the drying cylinder comprises a holder having a plurality of pins which extends from the surface of each of the steam cylinder and the drying cylinder to fix the textile material.
- [Claim 10] The material drying apparatus of claim 9, wherein the holder moves along the surface of each of the steam cylinder and the drying cylinder to fit a width of the textile material.
- [Claim 11] The material drying apparatus of claim 6, wherein each of the steam cylinder and the drying cylinder vibrates with respect to a central axis thereof.
- [Claim 12] The material drying apparatus of claim 6, wherein the steam conveyer and the drying conveyer form a closed roof and continuously move, when the steam unit comprises the steam conveyer and the additional drying unit comprises the drying conveyer.
- [Claim 13] The material drying apparatus of claim 6, wherein the steam unit comprises a steam block facing the steam conveyer and providing the steam on a surface of the textile material, wherein the additional drying unit comprises a drying block facing the drying conveyer and providing the heating wind on a surface of the textile material.
- [Claim 14] The material drying apparatus of claim 6, wherein the steam passes through the steam conveyer and is provided to an opposite surface of the textile material, and the heating wind passes through the drying conveyer and is provided to an opposite surface of the textile material.
- [Claim 15] The material drying apparatus of claim 6, wherein a plurality of pins is formed along an outer side of each of the steam conveyer and the drying conveyer, and extends with a radial shape to fix the textile material.
- [Claim 16] A method for controlling a material drying apparatus in a drying process for a textile material performed by a first drying unit, a steam unit and an additional drying unit, the method comprising:
determining drying conditions in the first drying unit, the steam unit and the additional drying unit, based on the textile material;
measuring a moving tension of the textile material passing through the

first drying unit and a number of revolution of cylinders of the first drying unit;
measuring a moving velocity of the textile material in the steam unit and the additional drying unit; and
controlling the moving velocity of the textile material in the cylinders of the first drying unit after a tension sensor, the steam unit and the additional drying unit.

[Claim 17]

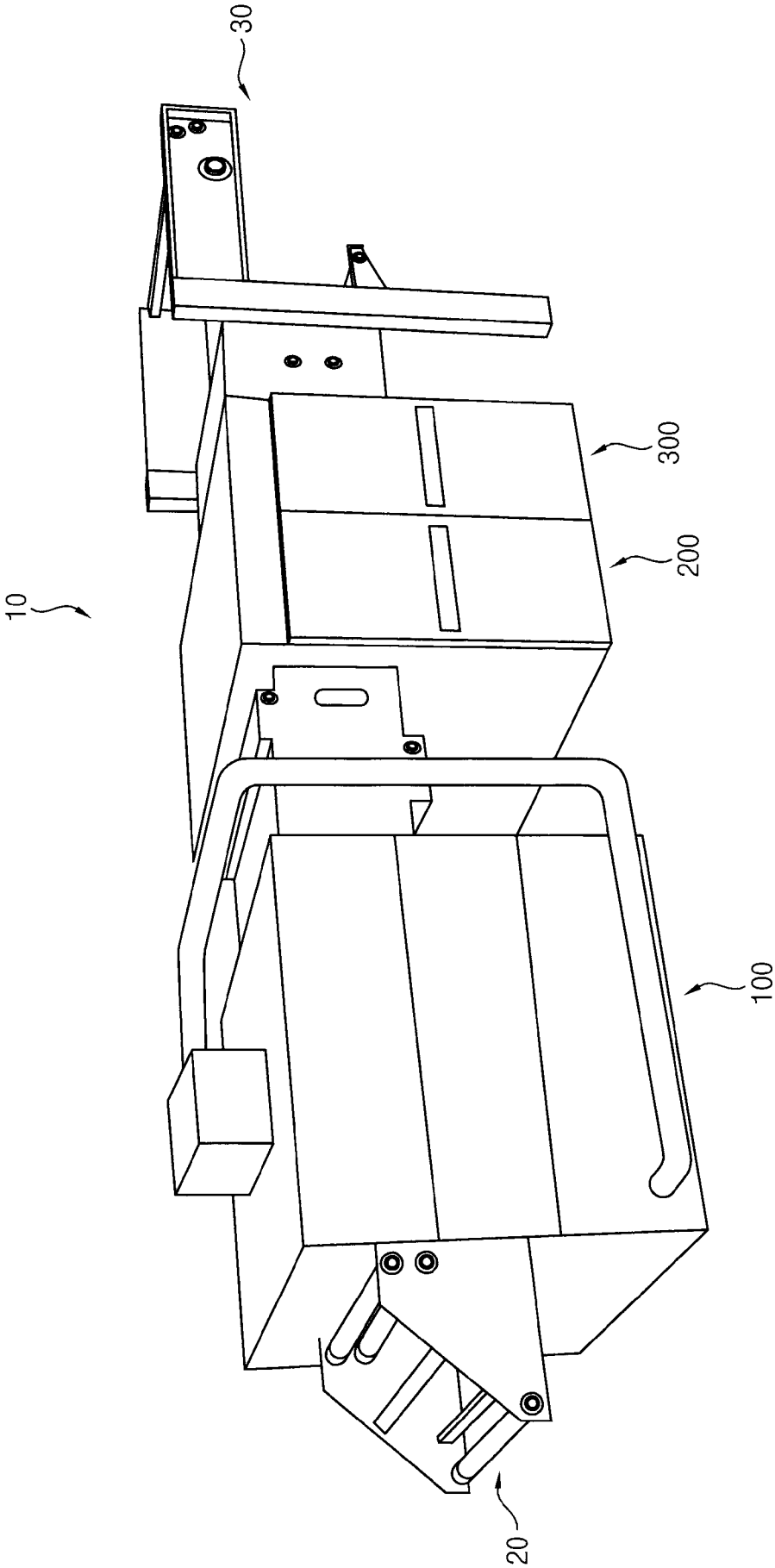
The method of claim 16, further comprising:

measuring temperature and humidity of exhaust moist air from the first drying unit, the steam unit and the additional drying unit, and initial and final moisture contents of the textile material, after determining the drying conditions.

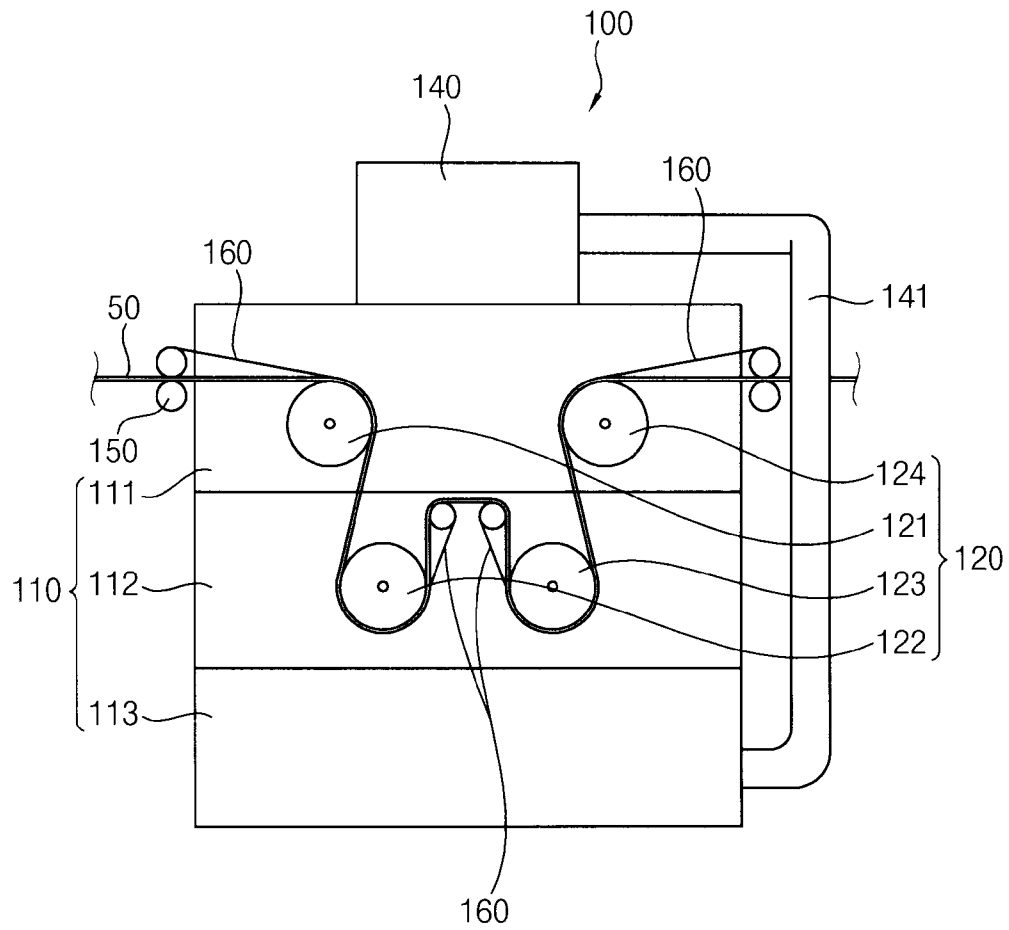
[Claim 18]

The method of claim 16, wherein the measured information is provided to a mobile terminal, and the control is performed using the mobile terminal.

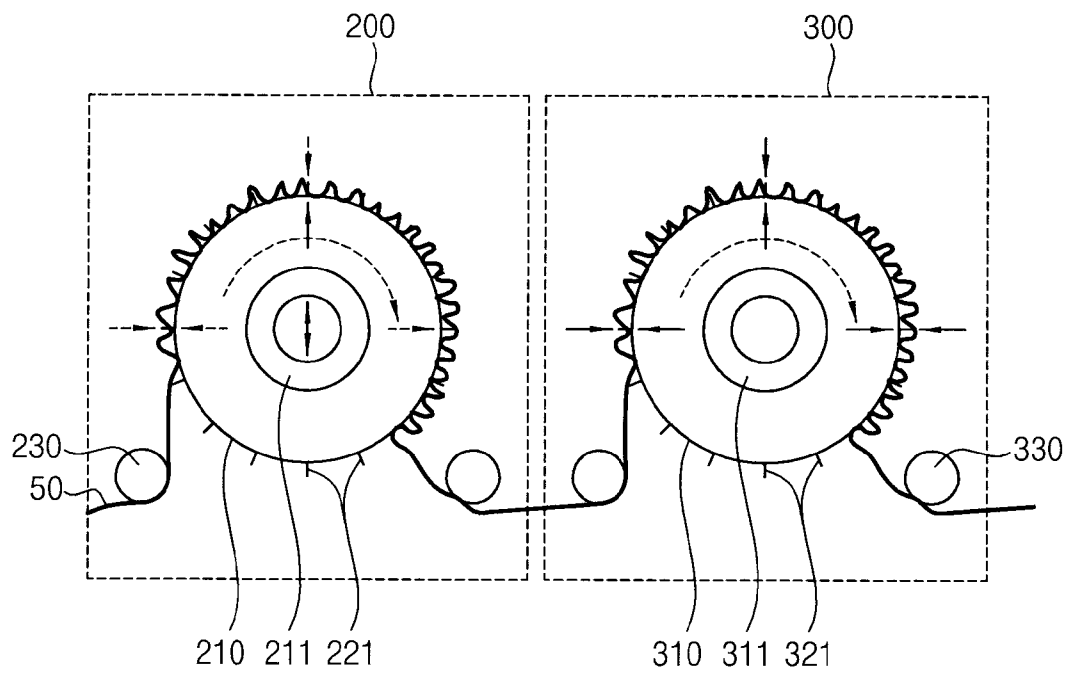
[Fig. 1]



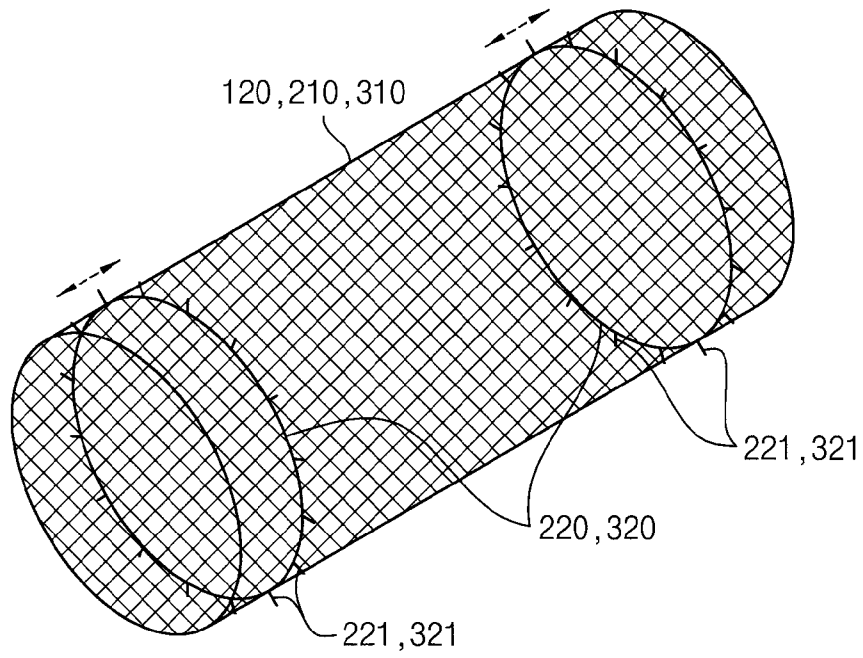
[Fig. 2]



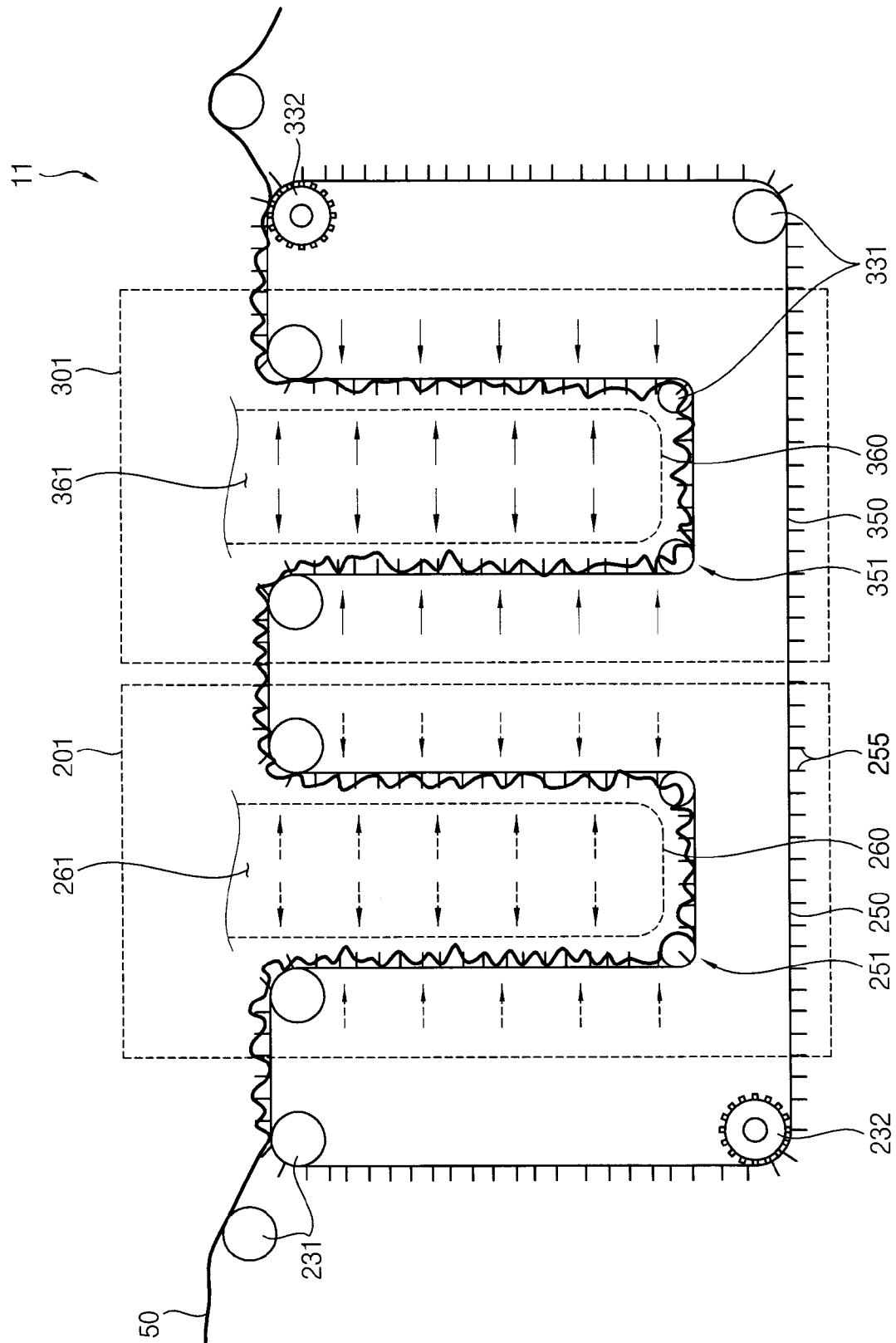
[Fig. 3]



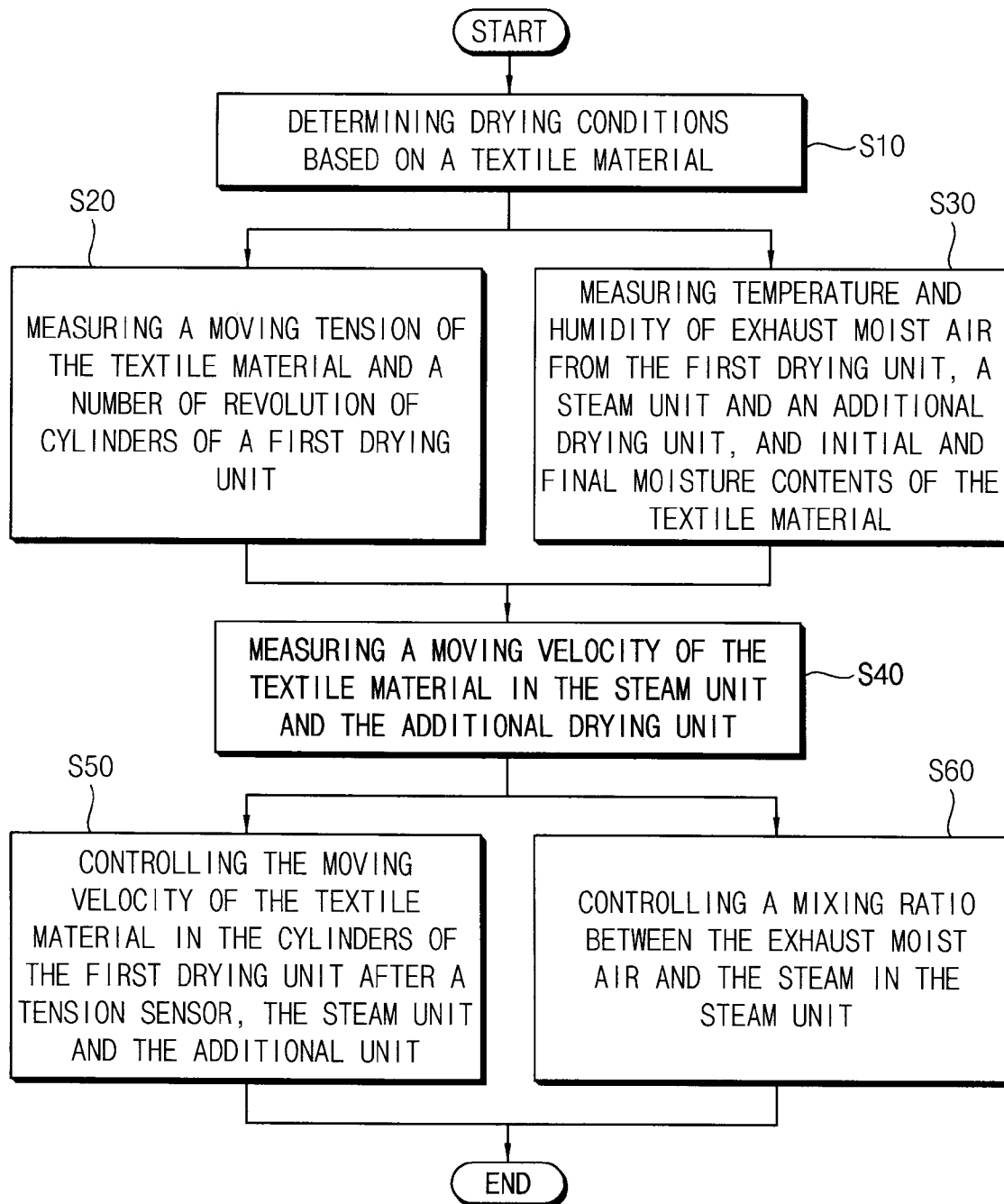
[Fig. 4]



[Fig. 5]



[Fig. 6]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2017/008581**A. CLASSIFICATION OF SUBJECT MATTER****F26B 15/14(2006.01)i, D06B 15/00(2006.01)i, F26B 21/00(2006.01)i, B65H 20/02(2006.01)i, B65H 23/26(2006.01)i, B65H 23/04(2006.01)i, B65H 20/06(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)

F26B 15/14; D06B 15/04; D06C 27/00; F26B 13/00; F26B 13/14; D06B 5/08; B05C 11/00; B05D 7/00; F26B 13/20; D06B 15/00; F26B 21/00; B65H 20/02; B65H 23/26; B65H 23/04; B65H 20/06

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords:

material drying apparatus, textile material, first drying unit, steam unit, additional unit, tension sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y		8, 12-15
Y	KR 10-0834006 B1 (LEE, CHANG JUN) 30 May 2008 See paragraphs [0028]-[0046]; and figures 2-3.	8
Y	JP 06-046288 U (KYOTO KIKAI K.K.) 24 June 1994 See paragraphs [0010]-[0018]; and figure 1.	12-15
A	KR 10-2008-0005154 A (JANG, SEONG UK) 10 January 2008 See paragraphs [0017]-[0058]; and figure 1.	1-18
A	US 2012-0328772 A1 (KIDA et al.) 27 December 2012 See paragraphs [0028]-[0046]; and figures 1-4.	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 November 2017 (20.11.2017)

Date of mailing of the international search report

22 November 2017 (22.11.2017)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2017/008581

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