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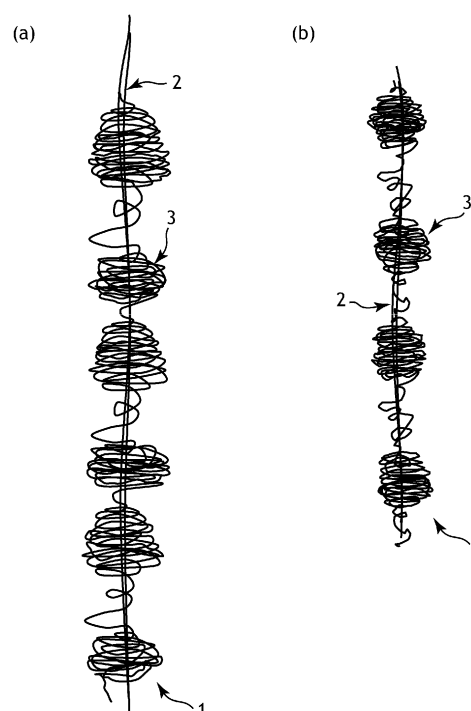
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(54) **DOWN-LIKE FIBERFILL MATERIAL AND MANUFACTURING METHOD THEREFOR**

(57) The present invention provides a novel down-like cotton material which is bulky, light-weight, excellent in washing resistance, heat-retaining property and heat insulation property and provides volume feeling, without odor from animals.

The down-like cotton material 1 of the present invention is formed as a cotton-like long fiber, in which filaments of an axial fiber and a float each composed of a polyester raw yarn are united by air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass in an aligned form, and the diameter of the down ball-like mass is 1.0 to 3.5cm and down ball-like masses are continually aligned at an interval of up to about 10cm or less in a length direction of the axial fiber.

Fig. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a down-like cotton material artificially produced in the conventionally unknown and novel natural down-like form which is bulky, light-weight, excellent in washing resistance, heat-retaining property and heat insulation property and provides volume feeling, without later-described problems with a conventionally used natural down with which quilt is packed or odor from animals, and a method for producing the same.

BACKGROUND

[0002] Conventionally, bedding quilts packed with natural down have been mainly used.

However, in a conventional type of natural down quilt, each down easily moves in a gusset seam of the quilt, and it is not advantageously fixed. Unless the quilt is fully packed with down, resulting nonuniformity fails to provide a proper heat-retaining property. In addition, a conventional type of natural down quilt cannot be washed due to balloon phenomenon and other factors. Duck and goose down used in a down quilt, which are collected from animals, are prone to odor from animals as well as an unstable amount of each material provided for climatic and environmental reasons.

[0003] Patent Document 1 discloses an entangled yarn for stuffing composed of long fibers, including a core yarn and a filament which is longer than the core yarn, wherein the core yarn and the filament are mixed by entangling so that the filament is wound in the core yarn.

[0004] In addition, Patent Document 1 discloses a method for producing an entangled yarn for stuffing, wherein a long-fiber core yarn and a long-fiber filament are fed into a known simplified air entangling apparatus at a different speed by using two supply rollers, entangled with each other and integrated, and the core yarn and the filament are mixed so that the filament is wound in the core yarn.

[0005] However, the entangled yarn for stuffing disclosed in Patent Document 1 unfortunately fails to be bulky, excellent in washing resistance, heat-retaining property and heat insulation property and provide volume feeling. This is because the entangled yarn for stuffing is characterized by no specific improvement in technical factors of a known simplified air entangling apparatus in particular for air entangling of a long-fiber core yarn and a long-fiber filament, so that the core yarn and the filament are mixed and the filament is wound in the core yarn to obtain a simplified long-fiber entangled yarn formed into a significantly irregular pattern.

PRIOR ART DOCUMENTS

Patent Documents

5 **[0006]** Patent Document 1: JP-A-2012-067430

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

10 **[0007]** The present invention was made in view of the above situation, and has an object to provide a down-like cotton material artificially produced in the conventionally unknown and novel natural down-like form which is bulky, excellent in washing resistance, heat-retaining property and heat insulation property and provides volume feeling, without the above-described problems with a conventionally used natural down with which quilt is packed or odor from animals, and a conventionally unknown method for producing the same.

15 **[0008]** The entangled yarn for stuffing disclosed in the Patent Document 1 obviously fails to provide a conventionally unknown and specific down ball-like mass having various types of useful effects as shown in the present application, because a core yarn and a filament are mixed in a significantly irregular form and the filament is simply wound in the core yarn.

MEANS FOR SOLVING THE PROBLEM

20 **[0009]** To solve the problems as mentioned above, the present invention provides a down-like cotton material in a conventionally unknown and novel form, wherein filaments of an axial fiber and a float each composed of a polyester raw yarn are united by a special air entangling technique in air flow to be entangled, connected and integrated to have a down ball-like mass in an aligned form, and the down ball-like mass is in a massive form having a predetermined diameter, and the down ball-like mass is formed as a continually aligned cotton-like long fiber at a predetermined interval in a length direction of the axial fiber.

EFFECT OF THE INVENTION

25 **[0010]** According to the invention described in claims 1 to 4, filaments of an axial fiber and a float each composed of a polyester raw yarn are united by a special air entangling technique in air flow to be entangled, connected and integrated to have a down ball-like mass in an aligned form, and the down ball-like mass is in a massive form having a predetermined diameter, and the down ball-like mass is formed as a continually aligned cotton-like long fiber at a predetermined interval in a length direction of the axial fiber. For example, if the diameter ϕ of the down ball-like mass is 1.0 to 3.5cm and the interval is set at up to about 10cm or less, the invention can accomplish and provide a down-like cotton material arti-

cially produced in the conventionally unknown and novel natural down-like form which is bulky, excellent in washing resistance, heat-retaining property and heat insulation property and provides volume feeling, without the above-described problems with a conventionally used natural down with which quilt is packed or odor from animals.

[0011] According to the invention described in claims 5 to 11, the down-like cotton material according to the invention described in the claims 1 to 4 can readily be produced by a step of feeding an axial fiber and a float, a step of entangling by air in air flow and a step of reeling. Also, a down-like cotton material whose shape is stabilized by fixating a silicone resin can readily be produced. Production factors include the ratio of feeding a float to an axial fiber, the air volume for air entangling, the air pressure, whether an interval adjustment ring is disposed between a nozzle portion and a venturi or not, and adjustment of the interval between a tip nozzle portion and a mortar-like wall surface portion of the venturi by changing the thickness. By combining these, the size of the down ball-like mass, the interval between down ball-like masses and the float density are changed in various ways and the invention can accomplish and provide a method for producing a down-like cotton material having a down ball-like mass in a desired form.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 (a) is an enlarged schematic diagram showing a down-like cotton material completed in the form of a cotton-like long fiber by relatively enlarging a down ball-like mass artificially produced in the down-like form according to the Example of the present invention. Fig. 1 (b) is an enlarged schematic diagram showing a down-like cotton material completed in the form of a cotton-like long fiber by dwarfing a down ball-like mass artificially produced in the down-like form according to the Example of the present invention compared to Fig. 1 (a);

Fig. 2 is an enlarged view showing one example of each shape of a float used in production of a down-like cotton material according to this Example;

Fig. 3 is a flow chart showing a process of producing a down-like cotton material according to this Example;

Fig. 4 is a schematic view showing a step of feeding an axial fiber and a float, a step of entangling by air and a step of reeling after the step of entangling by air in a process of producing a down-like cotton material according to this Example;

Fig. 5 is an enlarged schematic view showing a Z-twisted and S-twisted float on an axial fiber in a step of entangling by air in a process of producing a down-like cotton material according to this Example. In detail, Fig. 5 is a schematic view showing, as shown in

Fig. 1, a down-like cotton material in the form of a down ball-like mass is formed with an axial fiber as a core in a unit for air entangling while a float is Z-twisted as shown in Fig. 16 (b), or twisted by air entangling in a Z-character direction, and Fig. 5 is a schematic view showing, as shown in Fig. 1, a down-like cotton material in the form of a down ball-like mass is formed with an axial fiber as a core at an interval from the above Z-twisted float in a unit for air entangling while a float is S-twisted as shown in Fig. 16 (b), or twisted by air entangling in an S-character direction;

Fig. 6 is a schematic assembly drawing showing a perspective view of a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 7 is a schematic elevational view showing a perspective view of disassembly of a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 8 is a schematic partial cross-sectional view showing a venturi of a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 9 is a schematic cross-sectional view showing a tip nozzle portion of a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 10 is a plan view showing a retaining ring in a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 11 is a partial cross-sectional view showing a retaining ring comprising a unit inner cylindrical body, a unit outer cylindrical body and a positioning and securing mechanism of a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 12 is a schematic elevational view showing a positioning and securing mechanism provided on a yarn and air supplier of a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 13 is an explanatory drawing showing a yarn and air supplier is not secured to a unit outer cylindrical body and the yarn and air supplier is secured to the unit outer cylindrical body in a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 14 is a schematic view showing a tip nozzle portion of a yarn and air supplier, a sample size of each portion of a venturi and a sample angle of a mortar-like wall surface portion of the venturi in a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 15 is a schematic view showing a sample size from an end surface of a tip nozzle portion of a yarn and air supplier to an outlet of the venturi in a unit

for air entangling used in a process of producing a down-like cotton material according to this Example; Fig. 16 (a) is a schematic view showing flow of an axial fiber and a float in a unit for air entangling used in a step of entangling by air, and a route from an end surface of a tip nozzle portion of an air supplier to an outlet of a venturi in a process of producing a down-like cotton material according to this Example, and Fig. 16 (b) is a schematic view showing disturbance of a float during air entangling in a unit for air entangling used in a step of entangling by air in a process of producing a down-like cotton material according to this Example;

Fig. 17 is a schematic view showing cases where an interval adjustment ring for adjusting the interval from an end surface of a tip nozzle portion of a yarn and air supplier to a mortar-like wall surface portion of a venturi is used or not in a unit for air entangling used in a process of producing a down-like cotton material according to this Example;

Fig. 18 is a schematic view showing a step for processing a silicone resin in a process of producing a down-like cotton material according to this Example;

Fig. 19 is an explanatory drawing showing thermal contraction of an axial fiber or a float according to this Example;

Fig. 20 is a diagram showing the conditions of a thermal shrinkage test after a second heating step in a process of producing a down-like cotton material according to this Example;

Fig. 21 is a diagram showing the results of a thermal shrinkage test after a second heating step in a process of producing a down-like cotton material according to this Example;

Fig. 22 is an explanatory drawing conceptually showing the size of a down ball-like mass integrated with an axial fiber according to this Example and the interval between down ball-like masses;

Fig. 23 is a diagram showing a qualitative relationship between the size of a shape of a down ball-like mass according to this Example and the air pressure in a step of entangling by air; and

Fig. 24 is a diagram showing a qualitative relationship between the density of a down ball-like mass according to this Example and the ratio of feeding a float to an axial fiber.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The objective of present invention is to accomplish and provide a down-like cotton material artificially produced in the conventionally unknown and novel natural down-like form which is bulky, excellent in washing resistance, heat-retaining property and heat insulation property and provides volume feeling, without the above-described problems with a conventionally used natural down with which quilt is packed or odor from animals. To

achieve this objective, filaments of an axial fiber and a float each composed of a polyester raw yarn are united by air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass in an aligned form, and the down ball-like mass is formed as a continually aligned cotton-like long fiber at a predetermined interval in a length direction of the axial fiber. The diameter ϕ of the down ball-like mass is 1.0 to 3.5cm and the interval is set at up to about 10cm or less.

Example

[0014] A down-like cotton material artificially produced in the conventionally unknown and novel natural down-like form according to the Example of the present invention and a method for producing the same will be described with reference to Figs. 1 to 24.

[0015] Fig. 1 (a) is an enlarged schematic diagram showing a down-like cotton material 1 completed in the form of a cotton-like long fiber by relatively enlarging a down ball-like mass artificially produced in the down-like form according to the Example of the present invention. Fig. 1 (b) is an enlarged schematic diagram showing a down-like cotton material 1 completed in the form of a cotton-like long fiber by dwarfing a down ball-like mass artificially produced in the down-like form according to the Example of the present invention compared to Fig. 1 (a).

[0016] The down-like cotton material 1 to this Example 1, as later shown in Figs. 5 and 16, is formed into the down ball-like mass shown in Fig. 1 after a float 3 is Z-twisted with an axial fiber 2 as a core in a unit for air entangling 21, or twisted by air entangling in a Z-character direction, and further formed into the down ball-like mass shown in Fig. 1 after the float 3 is S-twisted with the axial fiber 2 as a core at an interval from the down-like cotton material 1 in the form of the Z-twisted down ball-like mass, or twisted by air entangling in an S-character direction.

[0017] The Z-twisted down ball-like mass and an S-twisted down ball-like mass are continually formed at an interval to provide the down-like cotton material 1 according to this Example.

[0018] The down-like cotton material 1 according to this Example, as shown in Fig. 1, includes the axial fiber 2 and the float 3 which is longer than the axial fiber 2. The axial fiber 2 and the float 3 form a down-like cotton material by air entangling by the unit for air entangling 21 used in a step of entangling by air in a process of producing a down-like cotton material. Specifically, the float 3 is opened to form a cotton-like fiber, and the axial fiber 2 and the float 3 are entangled, connected and integrated. In other words, the Z-twisted down ball-like mass and the S-twisted down ball-like mass are continually formed at an interval to form a cotton-like long fiber artificially produced in the form of down overall.

[0019] Specifically, the down-like cotton material 1 is aligned at an interval between down ball-like masses lat-

er described in detail to form a cotton-like long fiber overall after the axial fiber 2 and the float 3 are entangled and connected.

[0020] The down ball-like mass in this Example, as shown in Fig. 1 and as later shown in Fig. 22, is defined as a mass portion obtained after filaments of the axial fiber 2 and the float 3 are united to be entangled, connected and integrated and mass portions are continually aligned at an interval of about 1cm to 10cm, or up to about 10cm or less, relative to the axial fiber 2 in the down-like cotton material 1 in an aligned form. The diameter ϕ of the float 3 is about 1.0 to 3.5cm.

[0021] Illustrative example of the shape of the float 3, as shown in Fig. 2, includes a hollow yarn, a type C cross-section yarn and a modified cross-section yarn with a hollow ratio of 30 to 40% to reduce weight.

[0022] The hollow yarn and type C cross-section yarn have a larger surface area than a yarn with a circular cross-section of the same weight, and the air receiving area becomes larger than the yarn of the circular cross-section. Accordingly, the air resistance during air entangling is higher and resulting air flow can cause dispersion and disturbance to promote air entangling. The weight can advantageously be reduced compared to a yarn of the same surface area.

[0023] Since a modified cross-section yarn (a non-circular cross-section in the shape of a star, rhombus, and irregular quadrangle) has a larger surface area than a yarn with a circular cross-section, the air receiving area becomes larger than the yarn of the circular cross-section due to an uneven surface thereof. Advantageously, the air resistance during air entangling is higher and resulting air flow can cause dispersion and disturbance to further promote air entangling.

[0024] Subsequently, a material and a characteristic thereof of the down-like cotton material 1 according to this Example will be described in detail. The axial fiber 2 and the float 3 in this Example are composed of a polyester raw yarn, a non-twisted yarn, a non-interlace processed yarn and other yarns. The total fineness of the axial fiber 2 and the float 3 is 30 to 200D (denier), and the total number of filaments of the axial fiber 2 and the float 3 is 12 to 96f.

[0025] The ratio of the axial fiber 2 to the float 3 in length amount (length amount to be fed into a unit for air entangling 21) is in the range of 1:10 to 1:40, and preferably 1:20 to 1:30. Specifically, the float 3 whose length amount is 10 to 40 times (preferably 20 to 30 times) relative to the axial fiber 2 is fed into the unit for air entangling 21. If the length amount is 1 to 9 times, the amount for the float 3 to be entangled in the axial fiber 2 is small, and if the length amount is over 40 times, the amount of the float 3 is too large, thereby failing to form a favorable down ball-like mass.

[0026] The relationship between the air pressure in the unit for air entangling 21 and the size of the down ball-like mass will be described later.

[0027] The weight of the down-like cotton material 1 in

unit length is preferably 0.01 to 3g/m, and particularly 0.02 to 1.5g/m. In terms of yarn number or denier, the weight is preferably 90 to 27000D (denier), and particularly 180 to 13500D.

[0028] The diameter ϕ of the down ball-like mass portion in the float 3 is about 1.0 to 8cm, and particularly preferably about 1.0 to 3.5cm or 1.5 to 4cm.

[0029] The fineness of the float 3 is, e.g. 0.1 to 300Dtex (Deci tex), preferably 1 to 50Dtex, and particularly 2 to 25Dtex.

[0030] The total fineness is 10 to 600Dtex, preferably 20 to 250Dtex, and particularly 30 to 100Dtex.

[0031] As for the weight of the axial fiber 2 and the float 3 in the down-like cotton material 1, the weight of the float 3 is 100:51 to 99wt%, 100:80 to 98wt%, and 100:85 to 97wt%, relative to the total weight (axial fiber 2 + float 3).

[0032] The axial fiber 2 and the float 3 comprise a fusion fiber and a non-fusion fiber. The fusion fiber is composed of 2 or more polymers having a different melting point (a high melting point polymer and a low melting point polymer).

[0033] In the 2 or more polymers, illustrative example of the high melting point polymer includes a polyester multi-filament and a polypropylene polymer, and illustrative example of the low melting point polymer includes a polyethylene polymer and a low melting point polypropylene polymer.

[0034] The fusion temperature is preferably 80 to 200°C, and the difference in melting point temperature is preferably 10 to 200°C.

[0035] In the axial fiber 2, in order to fuse a low melting point polymer, a core sheath structure, with a high melting point polymer as a core and a low melting point polymer as a sheath, is preferable.

[0036] Particularly, in order to assuredly integrate a down ball-like portion into cotton, a sheath fiber and a low melting point heat-adhesion fiber yarn is preferably combined.

[0037] The polyester multi-filament has an advantage of causing less bulkiness loss.

[0038] The ratio of the fusion fiber to the non-fusion fiber is, e.g. 0 to 90%:10 to 100%.

[0039] Meanwhile, illustrative example of the non-fusion fiber includes polyester, nylon and polypropylene.

[0040] Further, a silicone treating agent is preferably heat set to the axial fiber 2 and the float 3. In this case, the amount of a silicone treating agent to be attached is preferably 0.1 to 5.0%, and more preferably 0.5 to 3.0%, relative to the total weight of the axial fiber 2 and the float 3.

[0041] Additionally, an acrylic resin or an urethane resin may be fixed to the axial fiber 2 and the float 3 to adjust the hardness.

[0042] Moreover, the weight of a long-fiber air entangled yarn is 0.01 to 3g/m, and preferably 0.02 to 1.5g/m.

[0043] Subsequently, a method for producing the down-like cotton material 1 according to this Example will be described with reference to a flow chart shown in

Fig. 3 and Figs. 4 to 18.

[0044] A method for producing the down-like cotton material 1 according to this Example, as shown in Fig. 3, comprises a step of feeding the axial fiber 2 and the float 3, a step of entangling by air by the unit for air entangling 21, a step of reeling, a step for processing a silicone resin, a first heating step, a second heating step and a step of cooling.

[0045] The unit for air entangling 21 will be described in detail as follows.

(1) (Step of feeding axial fiber 2 and float 3)

[0046] First, as shown in Fig. 4, the axial fiber 2 is fed into the unit for air entangling 21 by using a feed roller 11, and the float 3 which is wound beforehand on a supply roller 13 supported by a creel stand 12 is fed into the unit for air entangling 21 by using a guide barrel 14 and a feed roller 15. Then, the float 3 is twisted automatically by using the guide barrel 14 and the feed roller 15 and continually twisted and fed into the unit for air entangling 21 in order to further receive the air resistance in the unit for air entangling 21.

[0047] As shown in Fig. 4, an Example of using the guide barrel 14 is shown, but in the present invention, the guide barrel 14 is not always essentially employed.

[0048] In this case, the infeed angle θ of the float 3 to the unit for air entangling 21 is 30 to 160 degrees, and preferably 80 to 120 degrees, relative to the axial fiber 2. The infeed angle θ of the float 3 to the unit for air entangling 21 needs adjusting according to the type and shape of the float 3 and the axial fiber 2 used, the air volume and the air flow in the unit for air entangling 21, so that the axial fiber 2 and the float 3 are not entangled before they enter the unit for air entangling 21 as well. In fact, adjustment of the angle θ will eventually affect formation of a down ball-like mass.

[0049] Change in the infeed angle θ of the float 3, relative to the axial fiber 2, as shown in Fig. 4, can be made by changing the infeed angle θ of the float 3, relative to the unit for air entangling 21. In addition, by randomly changing the infeed angle θ of both the axial fiber 2 and the float 3, relative to the unit for air entangling 21 as well, the infeed angle θ of the float 3, relative to the axial fiber 2, can be changed.

[0050] In addition, the above infeed angle θ is employed to release air upward, because the axial fiber 2 and the float 3 avoid the influence of the pressure of air blowing upward from an inlet of the unit for air entangling 21.

[0051] The carrying speed of each of the feed rollers 11, 15 is, e.g. 10m to 1500m/min.

[0052] In the method for producing the down-like cotton material according to this Example, the axial fiber 2 fed by the feed roller 11 for the axial fiber 2 is fed at a low speed, and the float 3 fed by the feed roller 15 for the float 3 is fed at a high speed. Specifically, the amount of feeding the float 3 is set higher than that of the axial fiber 2.

[0053] More specifically, the float 3 whose length amount (ratio of feeding) is set at 10 to 40 times the axial fiber 2 is fed into the unit for air entangling 21. In this case, the rotational speed of the feed roller 15 for the float 3 is preferably 20 times to 40 times, relative to the feed roller 11 for the axial fiber 2 to form a favorable down ball-like mass.

(2) (Step of entangling by air)

[0054] Subsequently, as shown in Fig. 4, a step of entangling by air for the axial fiber 2 and the float 3 is performed by the unit for air entangling 21.

[0055] Herein, the unit for air entangling 21 will be described in detail.

[0056] The unit for air entangling 21, as shown in Figs. 4, 6, and 7, comprises a yarn and air supplier 31, a unit inner cylindrical body 51, a unit outer cylindrical body 61, a venturi 71 made of ceramics provided in the unit inner cylindrical body 51, a flat-plate collision board 81 downward disposed at a predetermined interval (approx. 25cm) from a lower end of the venturi 71 and an air supply source 91 capable of adjusting the pressure and the air volume for feeding air for air entangling (compressed air) into an air receiving plug 64 provided in the unit for air entangling 21 via an air pipe 92.

[0057] The unit for air entangling 21 in this Example doesn't always comprise the flat-plate collision board 81 downward disposed at a predetermined interval (approx. 25cm) from the lower end of the venturi 71 as shown in the diagram.

With no collision board 81 provided, the down-like cotton material 1 as a down ball-like mass discharged from the lower end of the venturi 71 and formed at a predetermined interval in a length direction may be reeled on the reeling roller 17 via a reeling feed roller 16.

[0058] The unit for air entangling 21, as shown in Figs. 7, 8 and 9, comprises a substantially unit outer cylindrical body 61 made of metal, and the unit outer cylindrical body 61 concentrically fastens and holds an upper portion of the substantially unit inner cylindrical body 51 made of metal which is mounted from above at an upper portion in the unit outer cylindrical body 61, and a lower portion of the unit inner cylindrical body 51 is downward protruded from a lower end surface central portion of the unit outer cylindrical body 61.

[0059] Also, the later-described venturi 71 is held at a lower portion in the unit inner cylindrical body 51, and a lower end surface of the venturi 71 is downward protruded from a lower end surface central portion of the unit inner cylindrical body 51.

[0060] Further, a tip nozzle portion 33 downward protruded from a lower end center of a nozzle tube portion 32 made of metal provided at an lower portion of the yarn and air supplier 31 mounted in the unit inner cylindrical body 51 from an upper portion of the unit outer cylindrical body 61 faces the venturi 71, and air flow is formed in a space between the tip nozzle portion 33 and a mortar-

like wall surface portion 72 of the later-described venturi 71.

[0061] The yarn and air supplier 31, the unit inner cylindrical body 51, the unit outer cylindrical body 61 and the venturi 71 will be described in more detail.

[0062] The yarn and air supplier 31, as shown in Figs. 6 and 7, comprises the substantially cylindrical nozzle tube portion 32 and the tip nozzle portion 33 downward protruded from a lower end center of the nozzle tube portion 32.

[0063] A circular handle portion 38 is integrally mounted at an upper end of the nozzle tube portion 32 via a nozzle receiving cylindrical portion 38a. A circular recessed portion 38b for a circular upper portion of a unit outer cylindrical body 61 to enter is provided on a bottom surface of the circular handle portion 38.

[0064] In addition, a through hole 35 is provided from a central portion of an upper end of the nozzle tube portion 32 to a lower end central portion of the nozzle tube portion 32.

[0065] A substantially cylindrical inlet tube portion 36 made of a synthetic resin material having a projection-circular portion 37 and an insertion hole 36a is mounted at an upper portion of the through hole 35, and the axial fiber 2 and the float 3 are fed into the insertion hole 36a of the inlet tube portion 36.

[0066] A large-diameter tube portion 39 composed of a later-described positioning and securing mechanism 41 is provided at the nozzle tube portion 32, and a portion ranging from a lower portion of a large-diameter tube portion 39 to a lower end thereof is defined as a small-diameter tube portion 40.

[0067] An upper portion of the through hole 35 is formed into a small-size tapered shape in a depth direction, a range just from beneath the portion in the tapered shape to a position equivalent to a lower end of the large-diameter tube portion 39 is defined as corresponds to a straight hole 35a, and a taper hole 35b with reduced diameter toward a downward range from just beneath the same to the vicinity of a lower end in the small-diameter tube portion 40 is provided.

[0068] Further, a lower circular stepped portion 42 is provided at a central portion of a lower end of the small-diameter tube portion 40, and an upper end portion of the tip nozzle portion 33 is concentrically mounted and fastened in the central position of the lower circular stepped portion 42.

[0069] The tip nozzle portion 33, as shown in Fig. 9, is provided with a nozzle taper hole 33a, and the hole diameter of a lower-most end of the taper hole 35b in the through hole 35 and the hole diameter of an upper-most portion of the nozzle taper hole 33a are set at a same value to provide no step, and the axial fiber 2 and the float 3 are smoothly fed into the venturi 71 from the through hole 35 via the nozzle taper hole 33a.

[0070] The small-diameter tube portion 40 is provided with an air receiving concave portion 43 whose angle range is 120 degrees around the center, which is posi-

tioned outside the taper hole 35b. For example, two air holes 43a for blowing air downward by connecting a lower surface of the air receiving concave portion 43 and the lower circular stepped portion 42 are provided.

[0071] The unit inner cylindrical body 51, as shown in Figs. 6 and 7, is substantially overall cylindrical, and a plan-view circular protruding tube portion 52 to be laterally protruded is provided at an upper portion thereof, and an insertion tube portion 53 having a smaller diameter than the protruding tube portion 52 is concentrically projected downward from the protruding tube portion 52.

[0072] A circular large-diameter tube portion receiving stepped portion 54 for fitting a lower portion of the large-diameter tube portion 39 of the yarn and air supplier 31 is provided on an upper surface of the protruding tube portion 52 of the unit inner cylindrical body 51, and a unit inner cylindrical body through hole 55 from a central portion of the large-diameter tube portion receiving stepped portion 54 to a lower end thereof via the inside of the insertion tube portion 53 is provided.

[0073] A circular protruding portion 55a whose internal diameter is smaller than the internal diameter of the unit inner cylindrical body through hole 55 is provided at a lower end of the unit inner cylindrical body through hole 55, and it is inwardly protruded from the unit inner cylindrical body through hole 55 to receive a lower end of the venturi 71.

[0074] An O ring 56 is attached to a side wall of the protruding tube portion 52 of the unit inner cylindrical body 51. When the protruding tube portion 52 is mounted at a circular receiving hole portion 62 of the unit outer cylindrical body 61, the O ring 56 is closely spaced on an inner wall surface of the circular receiving hole portion 62.

[0075] An air through hole 57 is provided at a side wall portion of an insertion tube portion 53 in the unit inner cylindrical body 51, so that the air through hole 57 comes to the position of the mounting receiving hole 65 for the air receiving plug 64 when the unit inner cylindrical body 51 is mounted on the unit outer cylindrical body 61.

[0076] The unit outer cylindrical body 61, as shown in Figs. 6 and 7, is substantially cylindrical, and the circular receiving hole portion 62 for mounting the protruding tube portion 52 of the unit inner cylindrical body 51 is provided at an inner peripheral portion of a circular upper portion 61a thereof, and a through insertion hole 63 for penetrating the insertion tube portion 53 of the unit inner cylindrical body 51 formed with a smaller diameter than the circular receiving hole portion 62 which is through to a lower end is provided at a lower portion of the circular receiving hole portion 62.

[0077] A mounting receiving hole 65 for an air receiving plug 64 which is connected to an air supply source 91 via the air pipe 92 is provided at a side wall portion of the unit outer cylindrical body 61.

[0078] The circular recessed portion 61b, which opens at the circular receiving hole portion 62, is provided at an inner peripheral portion of the circular upper portion 61a

of the unit outer cylindrical body 61, and a flat C ring 102 is mounted at the circular recessed portion 61b.

[0079] The venturi 71, as shown in Figs. 8 and 9, is substantially overall cylindrical, and the mortar-like wall surface portion 72 whose diameter is reduced toward a downward region from an upper end surface where the axial fiber 2 and the float 3 each enter is provided at an upper portion in the center of the inside thereof, and the venturi through hole 73 of a taper shape whose diameter is expanded toward a lower end penetrated, so that the axial fiber 2 and the float 3 can pass from a deepest portion of the mortar-like wall surface portion 72 to a lower end surface thereof, is provided.

[0080] The tip nozzle portion 33, as shown in Fig. 9, is substantially overall cylindrical, and the nozzle taper hole 33a whose diameter is reduced from an upper end surface to a lower end surface, which is through from an upper end surface to a lower end surface, is provided.

[0081] Subsequently, the positioning and securing mechanism 41 will be described in detail with reference to Figs. 10 to 13.

[0082] The positioning and securing mechanism 41 comprises a large-diameter tube portion 39 of the yarn and air supplier 31 and a retaining ring 101 disposed on the unit inner cylindrical body 51 in the unit outer cylindrical body 61.

[0083] The retaining ring 101, as shown in Fig. 10, includes a circular hole portion 103 whose diameter is slightly larger than the external diameter of the large-diameter tube portion 39 of the yarn and air supplier 31, and a semicircular or trapezoidal small projection 104, which is inwardly protruded and functions as a positioning and abutting receiving portion, is provided at part of the circular hole portion 103.

[0084] As shown in Fig. 11, while the unit inner cylindrical body 51 is mounted on the unit outer cylindrical body 61, the flat annular retaining ring 101 is abutted on an upper end surface of the protruding tube portion 52 of the unit inner cylindrical body 51, and the outer peripheral portion of the C ring 102 disposed on the retaining ring 101 is mounted on the circular recessed portion 61b so as to fasten and hold the unit inner cylindrical body 51 in the unit outer cylindrical body 61.

[0085] The yarn and air supplier 31, as shown in Fig. 12, is provided with a semicircular or trapezoidal concave portion 44 which can be fitted into the large-diameter tube portion receiving stepped portion 54 of the unit inner cylindrical body 51 so that a lower portion of the large-diameter tube portion 39 is not blocked by the small projection 104 while positioning the small projection 104 at the large-diameter tube portion 39, and an inclined outer peripheral portion 45 for forming an inclined groove 46 between the concave portion 44 and a lower surface outer peripheral portion of the nozzle receiving cylindrical portion 38a provided from one end of the concave portion 44 to a position at an angle of 180 degrees in a circumferential direction of the large-diameter tube portion 39.

[0086] The inclined outer peripheral portion 45 is

formed so that the wall thickness thereof is small at the concave portion 44 and the wall thickness becomes larger as it is away from the concave portion 44, thereby making a lower surface of the inclined groove 46 inclined.

[0087] Fig. 13 shows (left diagram) that the yarn and air supplier 31 is not secured to the unit outer cylindrical body 61, and Fig. 13 shows (right diagram) that the yarn and air supplier 31 is secured and fastened to the unit outer cylindrical body 61 by the positioning and securing mechanism 41 by rotating the circular handle portion 38 of the yarn and air supplier 31.

[0088] Specifically, after the unit inner cylindrical body 51 is mounted and fastened in the unit outer cylindrical body 61, as shown in Fig. 13 (left diagram) the yarn and air supplier 31 is positioned to be mounted in the unit inner cylindrical body 51, and subsequently by rotating the circular handle portion 38, as shown in Fig. 13 (right diagram), a lower surface of the inclined groove 46 of the positioning and securing mechanism 41 is pressed against a lower surface of the small projection 104 of the retaining ring 101, thereby securing and fastening the yarn and air supplier 31 to the unit outer cylindrical body 61.

[0089] In this case, an air receiving concave portion 43 of the yarn and air supplier 31 faces a side face of the air through hole 57 of the unit inner cylindrical body 51.

[0090] In Fig. 13, the small projection 104 is shown by an imaginary line.

[0091] Herein, the angle and size of each portion of the unit for air entangling 21 to be set will be described with reference to Figs. 14 and 15.

[0092] The protruding length H1 (Fig. 14) of the tip nozzle portion 33 is set at e.g. 5.8mm to 6.5mm.

[0093] In the venturi 71, an opening of the mortar-like wall surface portion 72 is $\phi 12\text{mm}$ in diameter, the height thereof is 15.5mm to 18mm, and the inclined surface angle $\theta 1$ of the mortar-like wall surface portion 72 is 60 degrees.

[0094] The inclined surface of the mortar-like wall surface portion 72 is polish finished so as to make the unevenness $10\mu\text{m}$ or less, and the float 3 is smoothly swiveled to readily achieve air entangling.

[0095] The size H2 of the venturi through hole 73 (Fig. 14) from a deepest portion of the mortar-like wall surface portion 72 to a lower end surface thereof is e.g. 10mm.

[0096] The interval of the gap between an end of the tip nozzle portion 33 and the mortar-like wall surface portion 72 of the venturi 71 is 2.0 to 4.0mm (preferably 2.5 to 3.5mm).

[0097] It was confirmed that if the gap interval is small, the diameter ϕ of a down ball-like mass is small and if the diameter is large, the diameter ϕ of the down ball-like mass is large.

[0098] If the gap interval is large, the length of a portion with air pressure on the float 3 and air receiving duration become longer, the float 3 will be more disturbed and entangled in the axial fiber 2, resulting in larger diameter ϕ of the down ball-like mass.

[0099] The size H3 (Fig. 15) from an end of the tip nozzle portion 33 and an outlet of the venturi through hole 73 of the venturi 71 is e.g. 9 to 12.2mm. The size H3 from an end of the tip nozzle portion 33 to an outlet of the venturi through hole 73 of the venturi 71 can randomly be changed.

[0100] The pressure of air fed into the unit for air entangling 21 is e.g. 3.5 to 4.0MPa.

[0101] A collision board 81 of the unit for air entangling 21 shown in Fig. 4 is placed from a lower end of the unit for air entangling 21 at an interval of e.g. 21 to 29cm (preferably 25cm).

[0102] If the collision board 81 is 21cm or more away from the unit for air entangling 21, the down ball-like mass is smoothly formed, but if the collision board 81 is over 29cm therefrom, the following step of reeling is prone to a problem.

[0103] The collision board 81 to be prepared allows reduction in blowing of the down-like cotton material 1 by air blowing from the unit for air entangling 21 after the down-like cotton material 1 comes out of the unit for air entangling 21. If the down-like cotton material 1 is blown too much, it can fail to go into the following step of reeling in an appropriate timing and it is attached to other machine parts to make a process of producing problematic. Installation of the collision board 81 can achieve smooth reeling of the down-like cotton material 1 formed.

[0104] Additionally, if the volume of air bouncing when the collision board 81 comes close to the down-like cotton material 1 is too large, the collision board 81 can bounce too much air blowing from an end of the tip nozzle portion 33 in a yarn-feeding direction. This affects the air flow and the air pressure in the unit for air entangling 21, thereby deteriorating formation of the down ball-like mass and reeling of the down-like cotton material 1 formed.

[0105] If the volume of air bouncing when the collision board 81 comes close to the down-like cotton material 1 is too large, formation of the down ball-like mass can be deteriorated, and the axial fiber 2 and the float 3 fed via the feed rollers 11, 15 by the pressure of bouncing air don't enter the unit for air entangling 21, and are blown upward and don't reach the unit for air entangling 21.

[0106] The above-described angle and size are merely one example, and not restricted thereto.

[0107] Subsequently, a step of entangling by air by the above unit for air entangling 21 will be described in detail with reference to Figs. 5 and 16 as well.

[0108] The axial fiber 2 and the float 3 fed into the unit for air entangling 21 via the above-described step of feeding an axial fiber 2 and a float 3 enter the mortar-like wall surface portion 72 in the venturi 71 via the inlet tube portion 36, the through hole 35 and the tip nozzle portion 33 of the yarn and air supplier 31.

[0109] Meanwhile, air fed into the air receiving plug 64 leads to the air receiving concave portion 43 in the unit for air entangling 21, and fed into a space formed by the mortar-like wall surface portion 72 via the air hole 43a, and blown on an inclined surface of the mortar-like wall

surface portion and dispersed as shown in Fig. 16.

[0110] Accordingly, the float 3 which enters a space formed by the mortar-like wall surface portion 72 of the venturi 71 is disturbed by the flow of air dispersed in the space, and filaments of the axial fiber 2 and the float 3 are united to be entangled (by air entangling), connected and integrated, and has a down ball-like mass in an aligned form shown in Fig. 1 (a) and (b) to form a down-like cotton material 1 in a cotton-like form and has a down ball-like mass in an aligned form to form a down-like cotton material 1 in a cotton-like form.

[0111] Specifically, during air entangling in the space, as shown in Fig. 5, S-twisted and Z-twisted portions of the float 3 are alternately and repeatedly entangled and connected around the axial fiber 2, and the diameter ϕ of the down ball-like mass is about 1.0 to 8cm, particularly about 1.5 to 4cm, and preferably 1.0 to 3.5cm. Composed of down ball-like masses, the down-like cotton material 1 in a continually aligned cotton-like form is formed at an interval D of approx. 10cm or less (Fig. 22) in a length direction of the axial fiber.

[0112] Afterward, the down-like cotton material 1 passes in the venturi through hole 73 of the venturi 71, and is released downward from the unit for air entangling 21, leading to the collision board 81. Since air is blown to the collision board 81 from the venturi through hole 73, the down-like cotton material 1 is dispersed or fed near or around the collision board 81.

[0113] Fig. 17 shows that a flat annular interval adjustment ring (shim ring) 105 is arranged between a lower end of the yarn and air supplier 31 and an upper end surface of the venturi 71, and the gap interval between an end of the tip nozzle portion 33 and the mortar-like wall surface portion 72 of the venturi 71 is adjusted. Obviously, the present invention can be accomplished regardless of whether the portion of the interval adjustment ring (shim ring) 105 is prepared or not.

[0114] Fig. 17 (left diagram) shows an example where the gap interval between an end of the tip nozzle portion 33 and a deepest portion of the mortar-like wall surface portion 72 of the venturi 71 is defined as D1 when the interval adjustment ring 105 is not used, and Fig. 17 (right diagram) shows an example where the gap interval between an end of the tip nozzle portion 33 and a deepest portion of the mortar-like wall surface portion 72 of the venturi 71 is defined as D2 ($D2 > D1$) when the interval adjustment ring 105 is used.

[0115] Regardless of whether the interval adjustment ring 105 is used or not, it was found that for example, the interval adjustment ring 105 is used to adjust the gap interval between an end of the tip nozzle portion 33 and a deepest portion of the mortar-like wall surface portion 72 of the venturi 71 (D1 or D2), thereby adjusting the size of a down ball-like mass of the down-like cotton material 1, the interval between down ball-like masses and the float density accordingly. Since the gap interval between an end of the tip nozzle portion 33 and a deepest portion of the mortar-like wall surface portion 72 of the venturi

71 can be adjusted by changing the thickness of the interval adjustment ring 105 (not shown) as well, it was found that the size of the down ball-like mass, the interval between down ball-like masses and the float density can be adjusted accordingly.

[0116] In the method for producing the down-like cotton material 1 having a down ball-like mass according to this Example above described, production factors include the ratio of feeding the float to the axial fiber, the air volume and the air pressure from the air supply source 91, whether the interval adjustment ring is disposed between the nozzle portion and the venturi or not, and adjustment of the interval between the tip nozzle portion and the mortar-like wall surface portion of the venturi by changing the thickness. By combining these, the size of the down ball-like mass, the interval between down ball-like masses and the float density are changed in various ways and a down-like cotton material having a down ball-like mass in a desired form can be produced.

(3) (Step of reeling)

[0117] As described above, the down-like cotton material 1 bended laterally from the collision board 81, as shown in Fig. 4, is reeled by the reeling roller 17 via the reeling feed roller 16.

(4) (Step for processing silicone resin)

[0118] Subsequently, the down-like cotton material 1 formed as described above, as shown in Fig. 18, is dipped into a silicone agent in a container 111.

[0119] The step for processing a silicone resin, as shown in Fig. 18, may dip the down ball-like and cotton-like down-like cotton material 1 and spray a cotton-like long fiber with a silicone agent by spraying means (not shown). This Example is primarily aimed at spraying a long fiber with a silicone agent by spraying means (not shown).

[0120] Since the axial fiber 2 and the float 3 in the down-like cotton material 1 has an uneven surface, the amount of the silicone agent is 0.1 to 5.0%, and preferably 0.5 to 3.0%, relative to the total of an opened cotton, specifically, the down-like cotton material 1 (the axial fiber 2 and the float 3).

(5) (First heating step)

[0121] Subsequently, a first heating step is performed on the down-like cotton material 1 after the step for processing a silicone resin is completed.

[0122] Specifically, a first heating step is performed by using a dryer (not shown) on a condition of a heating duration of 1 to 10 minutes (preferably 3 to 5 minutes) and a heating temperature of 100 to 149°C (particularly preferably 130°C) to remove moisture when a silicone agent is diluted. In order to remove the moisture when the silicone agent is diluted, the temperature should be

100°C or more. In order to remove the moisture with a shorter period of time for higher production efficiency, the temperature is appropriately 100 to 149°C.

[0123] In addition, since a heating duration of 1 to 2 minutes is slightly too short and the moisture is not sufficiently removed when the silicone agent is diluted and a heating duration of over 10 minutes can cause the silicone agent overheating and discoloration, the heating duration is preferably 3 to 5 minutes.

(6) (Second heating step)

[0124] Subsequently, a second heating step is performed on the down-like cotton material 1 after a first heating step is completed.

[0125] Specifically, a second heating step is performed by using a dryer (not shown) on a condition of a heating duration of 1 to 10 minutes (preferably 3 to 5 minutes) and a heating temperature of 150 to 200°C (particularly preferably 180°C), and the down-like cotton material 1 is subjected to curing (silicone agent fixation) and thermal contraction. Accordingly, the down-like cotton material 1 is coated by a silicone agent to have a favorable sense of slip, adjacent floats 3 are hardly entangled by slip, and a sense of featheriness can be obtained.

[0126] Further, thermal contraction can be found on the axial fiber 2 and the float 3 in the down-like cotton material 1 by performing the second heating step. As shown in Fig. 19, the shape changes (contracts), and the shape after thermal contraction is stably maintained. Further, each diameter becomes large and the down-like cotton material 1 becomes solid. The product is bulky as well, more repulsive and has washing resistance (stable shape is maintained by washing) (shrink-resistant processing).

[0127] Fig. 20 shows conditions of a thermal shrinkage test performed on the down-like cotton material 1 (6 yarns A to F) after a second heating step, and Fig. 21 shows shrinkage ratios of the thermal shrinkage test (with and without tension).

(7) (Step of cooling)

[0128] After the second heating step is completed, the down-like cotton material 1 is cooled at a temperature of 50 to 90°C (particularly preferably 70 to 85°C), for example, by using a dryer to make a product.

[0129] This cooling step after thermal contraction can prevent the shape of the down-like cotton material 1 from changing.

[0130] In the method for producing the down-like cotton material 1 according to this Example, the above-described step for processing a silicone resin is not always necessary.

[0131] In this case, the down-like cotton material 1 formed as described is heated only once on a condition of a heating duration of 1 to 10 minutes (preferably 3 to 5 minutes) and a heating temperature of 150 to 200°C

(particularly preferably 180°C), and thereafter, a step of cooling is implemented at a temperature of 50 to 90°C (particularly preferably 70 to 85°C) by using e.g. a dryer to make a product.

[0132] Fig. 22 conceptually shows the size of the down ball-like mass integrated with the axial fiber 2 according to this Example and the interval between down ball-like masses. Filaments of the axial fiber 2 and the float 3 are united to be entangled and connected integrate, and masses of the float 3 whose interval D is about 10cm or less and whose diameter ϕ is about 1.0 to 3.5cm is formed, relative to the axial fiber 2 in the down-like cotton material 1 in an aligned form.

[0133] Fig. 23 shows a qualitative relationship between the shape size of a down ball-like mass according to this Example and the air pressure in the step of entangling by air, and it was found that the shape size of the down ball-like mass becomes larger as the air pressure changes from a high value to a low value.

[0134] Fig. 24 shows a qualitative relationship between the density of the down ball-like mass according to this Example and the ratio of feeding the float 3 to the axial fiber 2. It was found that the density of the down ball-like mass becomes higher as the ratio of feeding the axial fiber 3 to the float 2 grows (as the amount of the float 3 to be fed relative to the axial fiber 2 grows). Specifically, it was found that as the ratio of feeding the float 3 to the axial fiber 2 grows, the density of the down ball-like mass becomes high.

[0135] According to the down-like cotton material 1 having a down ball-like mass of this Example above described, the down ball-like mass is totally different from a conventional cotton material described in prior art documents, and the present invention can provide specific actions and effects which cannot be achieved by these conventional cotton materials (Even the thickness can be changed in conventionally existing cotton materials.).

[0136] Specifically, since down ball-like masses in the down-like cotton material 1 of this Example are formed at a constant interval, the down-like cotton material 1 has favorable hygroscopic property, and good diaphoretic property and emanative property.

[0137] Using the down-like cotton material 1 of this Example, quilt having a different density of a material can be formed according to various quilt users such as elderly people, the sick, pregnant women and children. The down-like cotton material 1 of this Example is totally different from those produced by conventional Taslan processing.

[0138] In addition, the down-like cotton material 1 may be hung on a rod to let wind therethrough to remove extra moisture. The wind may be cool or warm.

[0139] In order to assuredly remove moisture from the down-like cotton material 1, the down-like cotton material is preferably unraveled with a hand by equally letting wind therethrough.

[0140] In this case, the float 3 as a mass of down ball shape may be rubbed with a hand so as to be more open

and bulky.

[0141] This process is to open the float 3 as a mass of down ball shape and enhance volume feeling (to be more bulky).

[0142] A step of using a machine such as a hand dryer for removing moisture from a surface by air pressure and removing as much extra moisture as possible before feeding into a heater and a cooler may be prepared. The wind may be cool or warm.

[0143] Further, after the above-described steps are completed, the down-like cotton material 1 may be rubbed with a hand to contain more air. Also, it may further be rubbed with a hand to open a portion of the down ball-like mass. Accordingly, when many down-like cotton materials 1 are arranged, no gap between down-like cotton materials 1 is generated and a heat-retaining property can be improved.

[0144] The down-like cotton material 1 according to this Example above described is specifically described.

The axial fiber 2 and the float 3, composed of a polymer of a non-down material as a raw yarn, are integrated in a cotton-like form by air entangling in air flow in a space formed by the mortar-like wall surface portion 72, and the axial fiber 2 and the float 3 are entangled and connected to form the down-like cotton material 1 as a cotton-like long fiber having a down ball-like mass shown in Fig. 1. Therefore, the present invention can accomplish a novel cotton material artificially produced in the conventionally unknown and novel down-like form which is bulky, excellent in washing resistance, heat-retaining property and heat insulation property and provides volume feeling, without the above-described problems with a conventionally used natural down with which quilt is packed or odor from animals.

[0145] Also, according to the method for producing a down-like cotton material of this Example, the down-like cotton material 1 can simply be produced by a step of feeding the axial fiber 2 and the float 3 into the unit for air entangling 21, a step of entangling by air in the unit for air entangling 21 in air flow and a step of reeling, and a method for producing the down-like cotton material 1 artificially produced in the form of down capable of providing the above effects can be accomplished and provided.

INDUSTRIAL APPLICABILITY

[0146] The down-like cotton material according to the present invention is used for storing and packing quilt in particular, and is obviously applicable as a material for textiles and knitting, and can widely be applied as clothing such as clothes, blankets, sleeping bags, pillows and cushions.

EXPLANATIONS OF LETTERS AND NUMERALS

[0147]

1 Down-like cotton material
 2 Axial fiber
 3 Float
 11 Feed roller
 12 Creel stand
 13 Supply roller
 14 Guide barrel
 15 Feed roller
 16 Reeling feed roller
 17 Reeling roller
 21 Unit for air entangling
 31 Yarn and air supplier
 32 Nozzle tube portion
 33 Tip nozzle portion
 33a Nozzle taper hole
 35 Through hole
 35a Straight hole
 35b Taper hole
 36 Inlet tube portion
 36a Insertion hole
 37 Projection-circular portion
 38 Circular handle portion
 38a Nozzle receiving cylindrical portion
 38b Circular recessed portion
 39 Large-diameter tube portion
 40 Small-diameter tube portion
 41 Positioning and securing mechanism
 42 Lower circular stepped portion
 43 Air receiving concave portion
 43a Air hole
 44 Concave portion
 45 Inclined outer peripheral portion
 46 Inclined groove
 51 Unit inner cylindrical body
 52 Protruding tube portion
 53 Insertion tube portion
 54 Large-diameter tube portion receiving stepped portion
 55 Unit inner cylindrical body through hole
 55a Circular protruding portion
 56 O ring
 57 Air through hole
 61 Unit outer cylindrical body
 61a Circular upper portion
 61b Circular recessed portion
 62 Circular receiving hole portion
 63 Through insertion hole
 64 Air receiving plug
 65 Mounting receiving hole
 71 Venturi
 72 Mortar-like wall surface portion
 73 Venturi through hole
 81 Collision board
 91 Air supply source
 92 Air pipe
 101 Retaining ring
 102 C ring
 103 Circular hole portion

104 Small projection
 105 Interval adjustment ring
 111 Container
 D Interval between each down ball-like mass and mass
 5
 H1 Protruding length
 H2 Size of venturi through hole
 H3 Size from end of tip nozzle portion to outlet of venturi through hole
 10 D1 Gap interval
 D2 Gap interval
 θ Infeed angle
 $\theta 1$ Inclined surface angle
 φ Diameter
 15

Claims

1. A down-like cotton material comprising an axial fiber and a float each composed of a polyester raw yarn, wherein filaments of the axial fiber and the float are united by air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass, wherein the down ball-like mass has a predetermined diameter in an aligned form, and the down ball-like mass is continually aligned at a predetermined interval in a length direction of the axial fiber to form a cotton-like long fiber.
2. A down-like cotton material comprising an axial fiber and a float each composed of a polyester raw yarn, wherein filaments of the axial fiber and the float are united by air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass, wherein the diameter of the down ball-like mass in an aligned form is 1.0 to 3.5cm, and the down ball-like mass is continually aligned at an interval of up to about 10cm or less in a length direction of the axial fiber to form a cotton-like long fiber.
3. A down-like cotton material comprising an axial fiber and a float each composed of a polyester raw yarn, wherein filaments of the axial fiber and the float are united by air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass, wherein the diameter of the down ball-like mass in an aligned form is 1.0 to 3.5cm, and the down ball-like mass is continually aligned at an interval of up to about 10cm or less in a length direction of the axial fiber to form a cotton-like long fiber, and a silicone resin is fixed to the cotton-like long fiber to thermally stabilize the shape.
4. The down-like cotton material according to any one of claims 1 to 3, wherein the float is selected from a light-weight hollow yarn, a type C cross-section yarn and a modified cross-section yarn whose surface area is larger than that of the circular cross-section

yarn.

5. A method for producing a down-like cotton material comprising: a step of each feeding an axial fiber and a float each composed of a polyester raw yarn into a unit for air entangling;
a step of entangling by air to unite filaments of the axial fiber and the float by air entangling in a unit for air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass, wherein a down ball-like mass in an aligned form has a predetermined diameter, and the down ball-like mass is continually aligned at a predetermined interval in a length direction of the axial fiber to provide a down-like cotton material as a cotton-like long fiber; and
a step of reeling the down-like cotton material.
6. A method for producing a down-like cotton material comprising: a step of each feeding an axial fiber and a float each composed of a polyester raw yarn into a unit for air entangling;
a step of entangling by air to unite filaments of the axial fiber and the float by air entangling in a unit for air entangling in air flow to be entangled, connected and integrated to have a down ball-like mass, wherein the diameter of a down ball-like mass in an aligned form is 1.0 to 3.5cm, and the down ball-like mass is continually aligned at an interval of up to about 10cm or less in a length direction of the axial fiber to provide a down-like cotton material as a cotton-like long fiber; and
a step of reeling the down-like cotton material.
7. A method for producing a down-like cotton material comprising: a step of each feeding an axial fiber and a float each composed of a polyester raw yarn into a unit for air entangling;
a step of entangling by air to unite filaments of the axial fiber and the float to be entangled, connected and integrated to have a down ball-like mass by air entangling in air flow externally fed formed between a tip nozzle portion of a nozzle tube portion and a mortar-like wall surface portion of a venturi in a unit for air entangling, wherein the diameter of a down ball-like mass in an aligned form is 1.0 to 3.5cm, and the down ball-like mass is continually aligned at an interval of up to about 10cm or less in a length direction of the axial fiber to provide a down-like cotton material as a cotton-like long fiber;
a step of reeling the cotton-like long fiber;
a step for processing a silicone resin for applying a silicone agent to the down-like cotton material;
a first heating step for heating the down-like cotton material having the silicone agent to remove moisture;
a second heating step for heating the down-like cotton material having no moisture and stabilizing the

shape by thermal contraction; and
a step of cooling for cooling the down-like cotton material after a second heating step is completed.

8. The method for producing a down-like cotton material according to claim 7, wherein the heating temperature of the first heating step is 100 to 149°C, and preferably 130°C, and the heating temperature of the second heating step is 150 to 200°C, and preferably 180°C.
9. The method for producing a down-like cotton material according to claim 7 or 8, wherein the size of the down ball-like mass, the interval between down ball-like masses and the float density are changed in various ways by combining production factors such as the ratio of feeding the float to the axial fiber, the air volume and the air pressure for air entangling in the unit for air entangling, adjustment of the interval between a tip nozzle portion in the unit for air entangling and a mortar-like wall surface portion of a venturi to obtain a down ball-like mass in a desired form.
10. The method for producing a down-like cotton material according to any one of claims 5 to 9, wherein the float is selected from a light-weight hollow yarn, a type C cross-section yarn and a modified cross-section yarn whose surface area is larger than that of the circular cross-section yarn.
11. The method for producing a down-like cotton material according to any one of claims 5 to 10, wherein the unit for air entangling is connected an air supply source capable of adjusting the air pressure and the air volume for feeding compressed air for air entangling into an air receiving plug provided in the unit for air entangling via an air pipe comprising:
 - a yarn and air supplier;
 - a unit inner cylindrical body made of metal;
 - a unit outer cylindrical body made of metal; and
 - a venturi held in the unit inner cylindrical body, wherein
 an upper portion of the unit inner cylindrical body upward mounted is concentrically fastened and held to an upper portion in the unit outer cylindrical body, and a lower portion of the unit inner cylindrical body is downward protruded from a lower end surface central portion of the unit outer cylindrical body, a lower end surface of the venturi held in an inner lower portion of the unit inner cylindrical body is downward protruded from a lower end surface central portion of the unit inner cylindrical body, a tip nozzle portion downward protruded from a lower end center of a nozzle tube portion made of metal provided at a lower portion of the yarn and air supplier mounted in the unit inner cylindrical body from an

upper portion of the unit outer cylindrical body faces the venturi, and air flow is formed in a space between the tip nozzle portion and a mortar-like wall surface portion of the venturi,

the yarn and air supplier comprises a cylindrical nozzle tube portion and a tip nozzle portion downward protruded from a lower end center of the nozzle tube portion, and a circular handle portion is integrally attached to an upper end of the nozzle tube portion via a nozzle receiving cylindrical portion, a circular recessed portion for a circular upper portion of the unit outer cylindrical body to enter is provided on a bottom surface of the circular handle portion, a through hole from a central portion of an upper end of the nozzle tube portion to a lower end central portion of the nozzle tube portion is provided, a large-diameter tube portion comprising a positioning and securing mechanism is provided at the nozzle tube portion, and a portion from the lower portion of the large-diameter tube portion to a lower end thereof is provided as a small-diameter tube portion,

the upper portion of a through hole from a central portion of an upper end of the nozzle tube portion in the yarn and air supplier to a lower end central portion of the nozzle tube portion has a projection-circular portion, and a cylindrical inlet tube portion having an insertion hole is mounted therein and the axial fiber and the float are fed into an insertion hole of the inlet tube portion, an upper portion of the through hole is formed into a small-size tapered shape in a depth direction, a range from just beneath a portion of a tapered shape to a position equivalent to an end of the large-diameter tube portion is defined as a straight hole, and a taper hole whose diameter is reduced along a downward range from just beneath thereof to the vicinity of a lower end in the small-diameter tube portion is defined, a lower circular stepped portion is provided at a central portion of a lower end of the small-diameter tube portion, an upper end portion of the tip nozzle portion is concentrically mounted and fastened in a central position of the lower circular stepped portion, a nozzle taper hole is provided at the tip nozzle portion, the hole diameter of a lower-most end of the taper hole in the through hole and the hole diameter of an upper-most portion of the nozzle taper hole are set at the same to provide no step, and the axial fiber and the float are smoothly fed into the venturi from the through hole via the nozzle taper hole,

an air receiving concave portion positioned outside the taper hole capable of axially rotating is provided at a small-diameter tube portion of the nozzle tube portion in the yarn and air supplier, and a lower surface of the air receiving concave portion and the lower circular stepped portion are connected to provide two air holes for blowing air downward,

the unit inner cylindrical body provides a plan-view circular protruding tube portion which is laterally pro-

truded at an upper portion thereof, an insertion tube portion whose diameter is smaller than that of a protruding tube portion is concentrically protruded downward from the protruding tube portion, a circular large-diameter tube portion receiving stepped portion into which a lower portion of the large-diameter tube portion of the yarn and air supplier is fitted is provided on an upper surface of the protruding tube portion of the unit inner cylindrical body, a unit inner cylindrical body through hole is provided from a central portion of the large-diameter tube portion receiving stepped portion to a lower end thereof via the inside of the insertion tube portion, a circular protruding portion whose internal diameter is smaller than the internal diameter of the unit inner cylindrical body through hole is provided at a lower end of the unit inner cylindrical body through hole of the unit inner cylindrical body to be inwardly protruded to the unit inner cylindrical body through hole to accept a lower end of the small-diameter tube portion of the yarn and air supplier, an O ring is attached to a side wall of the protruding tube portion of the unit inner cylindrical body, the O ring is closely spaced on an inner wall surface of the circular receiving hole portion when the protruding tube portion is mounted in a circular receiving hole portion of the unit outer cylindrical body, and an air through hole is provided at a side wall portion of the insertion tube portion in the unit inner cylindrical body, so that the air through hole comes to the position of a mounting receiving hole for the air receiving plug when the unit inner cylindrical body is mounted on the unit outer cylindrical body,

the unit outer cylindrical body is cylindrical, and a circular receiving hole portion at which the protruding tube portion of the unit inner cylindrical body is mounted is provided at an inner peripheral portion of the circular upper portion, and a through insertion hole whose diameter is smaller than that of the circular receiving hole portion to be through up to a lower end to penetrate the insertion tube portion of the unit inner cylindrical body is provided at a lower portion of the circular receiving hole portion, a mounting receiving hole for an air receiving plug which is connected to an air supply source via an air pipe is provided at a side wall portion of the unit outer cylindrical body, a circular recessed portion at which the circular receiving hole portion is opened is provided at an inner peripheral portion of a circular upper portion of the unit outer cylindrical body, and a flat C ring is mounted at the circular recessed portion, the venturi held in the unit inner cylindrical body is overall cylindrical, a mortar-like wall surface portion whose diameter is reduced from an upper end surface on which the axial fiber and the float each enter in a downward direction is provided at an upper portion of the center inside thereof, a venturi through hole of a taper shape whose diameter is expanded

toward a penetrated lower end is provided, so that the axial fiber and the float can pass from a deepest portion of the mortar-like wall surface portion to a lower end surface,

a tip nozzle portion of the yarn and air supplier is substantially overall cylindrical, and the nozzle taper hole which is through from an upper end surface to a lower end surface and whose diameter is reduced from an upper end surface to a lower end surface is provided,

a positioning and securing mechanism at the nozzle tube portion of the yarn and air supplier comprises the large-diameter tube portion of the yarn and air supplier and a retaining ring disposed on the unit inner cylindrical body in the unit outer cylindrical body, the retaining ring has a circular hole portion whose diameter is slightly larger than the external diameter of the large-diameter tube portion of the yarn and air supplier, and a small projection which functions as a semicircular or a trapezoidal positioning and abutting receiving portion which is inwardly protruded is provided at part of the circular hole portion,

a flat annular retaining ring is abutted against an upper end surface of the protruding tube portion of the unit inner cylindrical body while the unit inner cylindrical body is mounted to the unit outer cylindrical body, and the unit inner cylindrical body is held in the unit outer cylindrical body to be fastened by mounting an outer peripheral portion of the C ring disposed on the retaining ring at the circular recessed portion,

the yarn and air supplier is provided with a semicircular or a trapezoidal concave portion capable of being fitted into the large-diameter tube portion receiving stepped portion of the unit inner cylindrical body so that a lower portion of the large-diameter tube portion is not blocked by the small projection while the small projection is positioned to the large-diameter tube portion, and an inclined outer peripheral portion for forming an inclined groove from one end of the concave portion to a lower surface outer peripheral portion of the nozzle receiving cylindrical portion provided in a position at an angle of 180 degrees in a circumferential direction of the large-diameter tube portion, and the inclined outer peripheral portion is formed so that the wall thickness is small at the concave portion and the wall thickness becomes large as it is away from the concave portion, thereby making a lower surface of an inclined groove inclined, accordingly the unit inner cylindrical body is mounted on the unit outer cylindrical body to be fastened, and thereafter the yarn and air supplier are positioned to be mounted in the unit inner cylindrical body, subsequently by rotating the circular handle portion, a lower surface of the inclined groove of the positioning and securing mechanism is pressed against a lower surface of the small projection of the

retaining ring, so that the yarn and air supplier can be secured and fastened to the unit outer cylindrical body, and the air receiving concave portion of the yarn and air supplier faces the air through hole of the unit inner cylindrical body,

the axial fiber and the float fed into the unit for air entangling via a step of feeding an axial fiber and a float in the yarn and air supplier pass through an inlet tube portion, a through hole and a tip nozzle portion of the yarn and air supplier to enter the mortar-like wall surface portion in the venturi, air fed into the air receiving plug reaches the air receiving concave portion in the unit for air entangling, and the air is fed into a space formed by the mortar-like wall surface portion via the air hole, and it is blown to an inclined surface of the mortar-like wall surface portion and dispersed, accordingly the float which enters the space formed by the mortar-like wall surface portion of the venturi is disturbed by air flow which is dispersed in the space, and filaments of the axial fiber and the float are united to be entangled, connected and integrated to form the down-like cotton material in a cotton-like form having a down ball-like mass in an aligned form, and

the size of the down ball-like mass of the down-like cotton material, the interval between down ball-like masses and the float density are changed in various ways by combining production factors such as the ratio of feeding the float to the axial fiber, the air volume and the air pressure from the air supply source in the unit for air entangling, the gap interval from an end of the tip nozzle portion of the yarn and air supplier to a deepest portion of the mortar-like wall surface portion of the venturi to produce the down-like cotton material.

Fig. 1

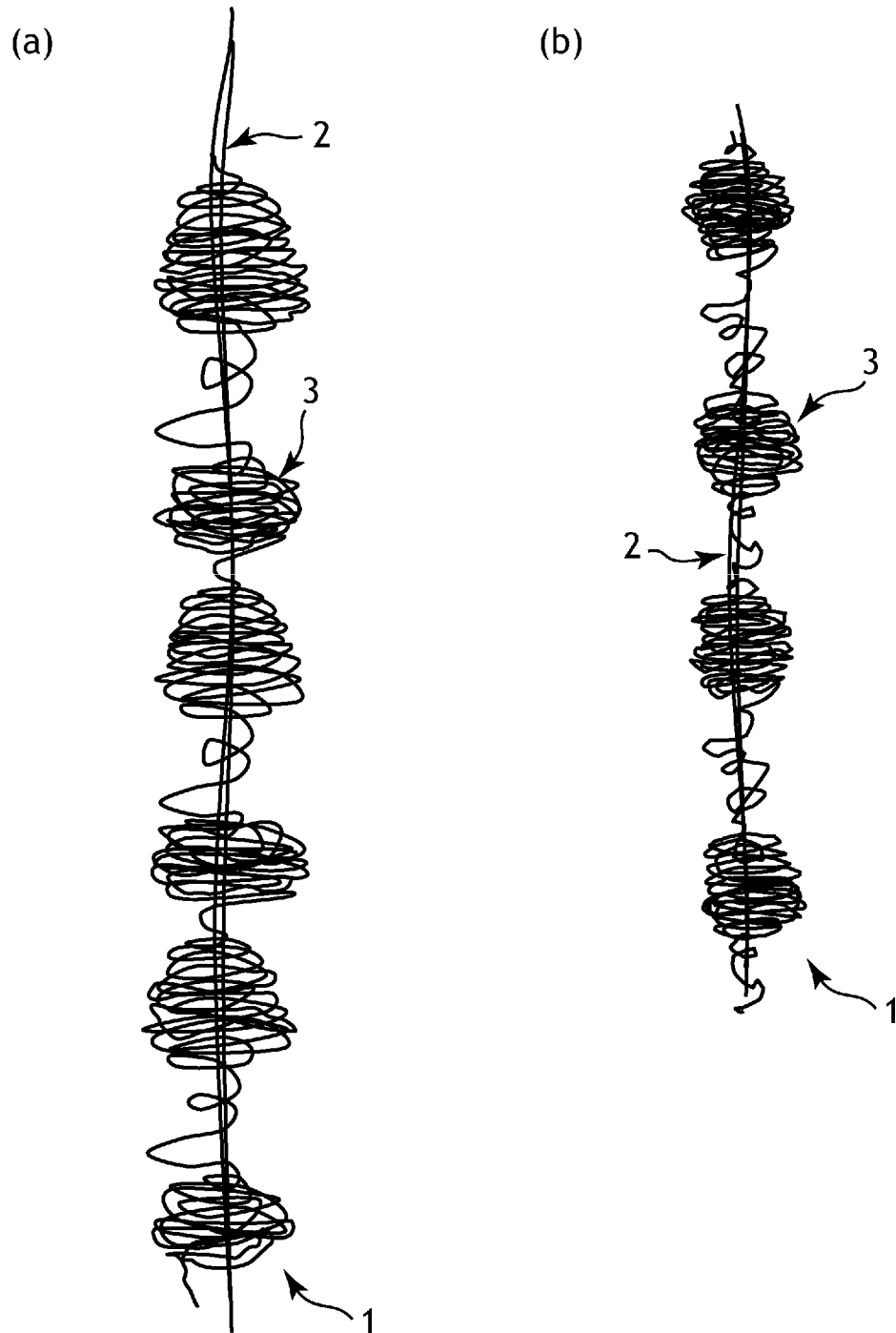


Fig. 2

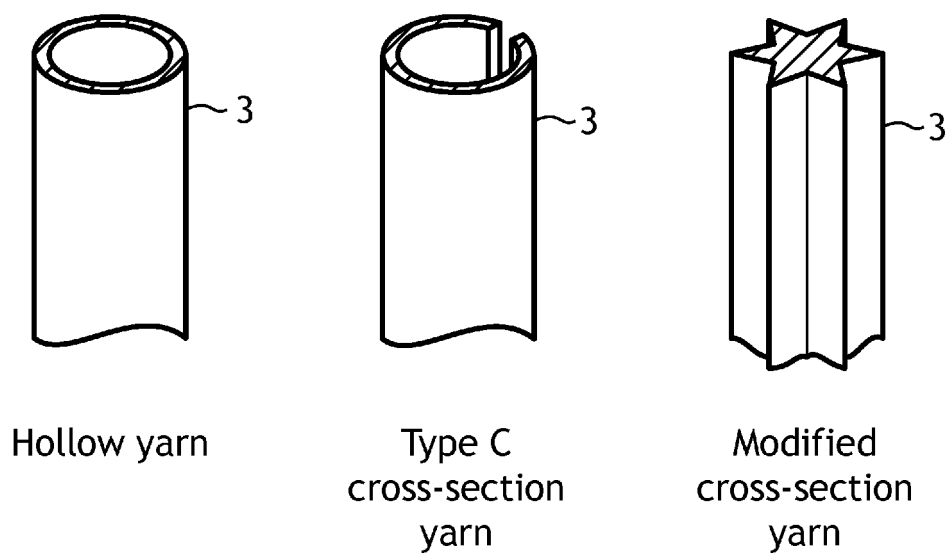


Fig. 3

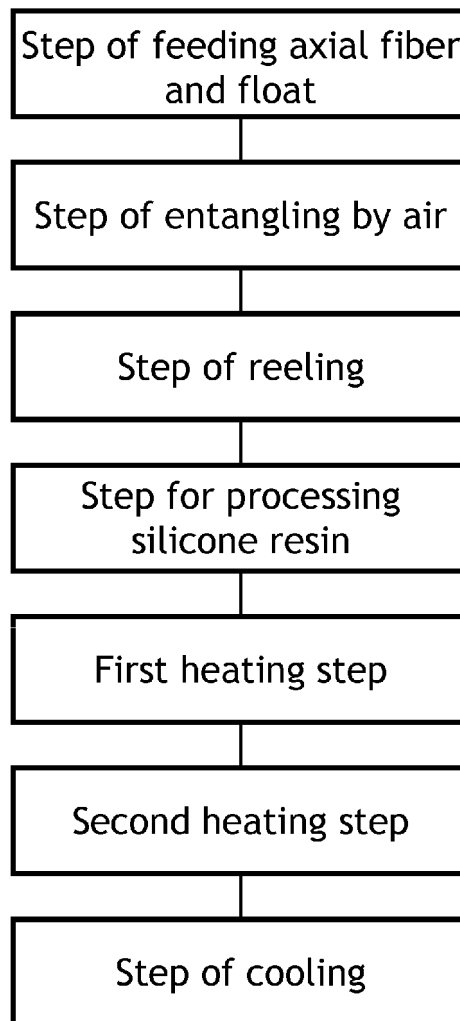


Fig. 4

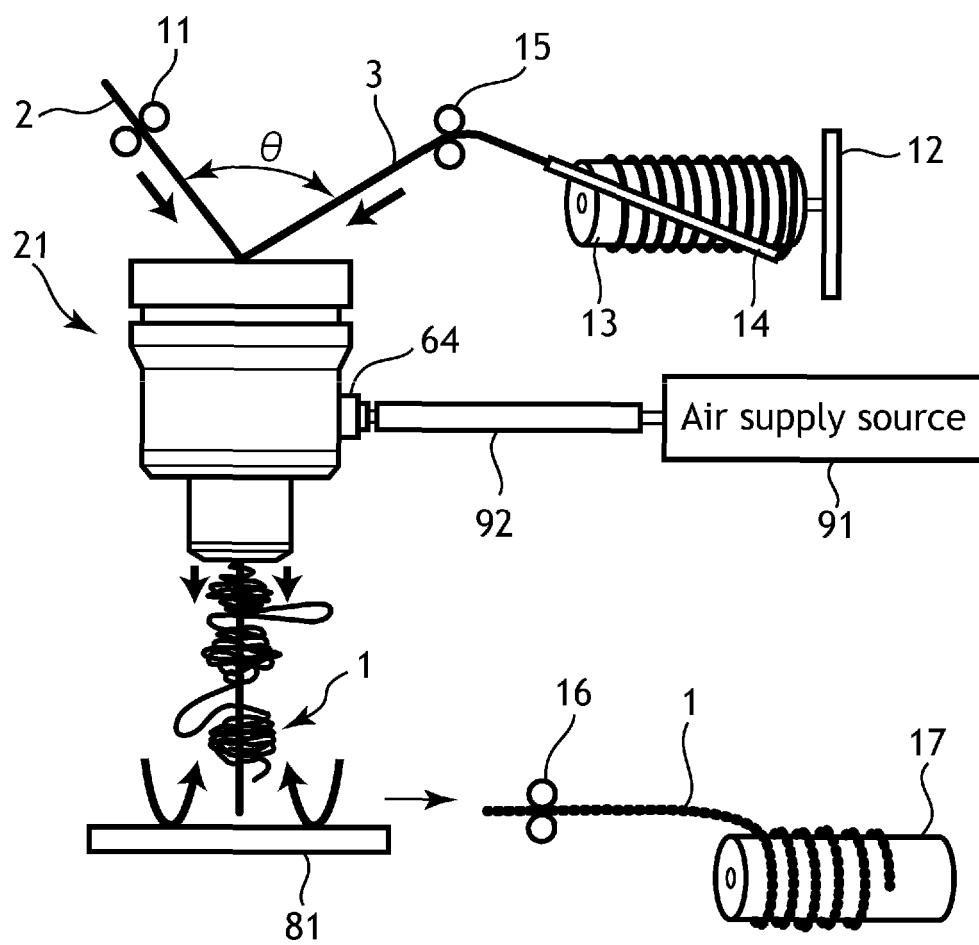


Fig. 5

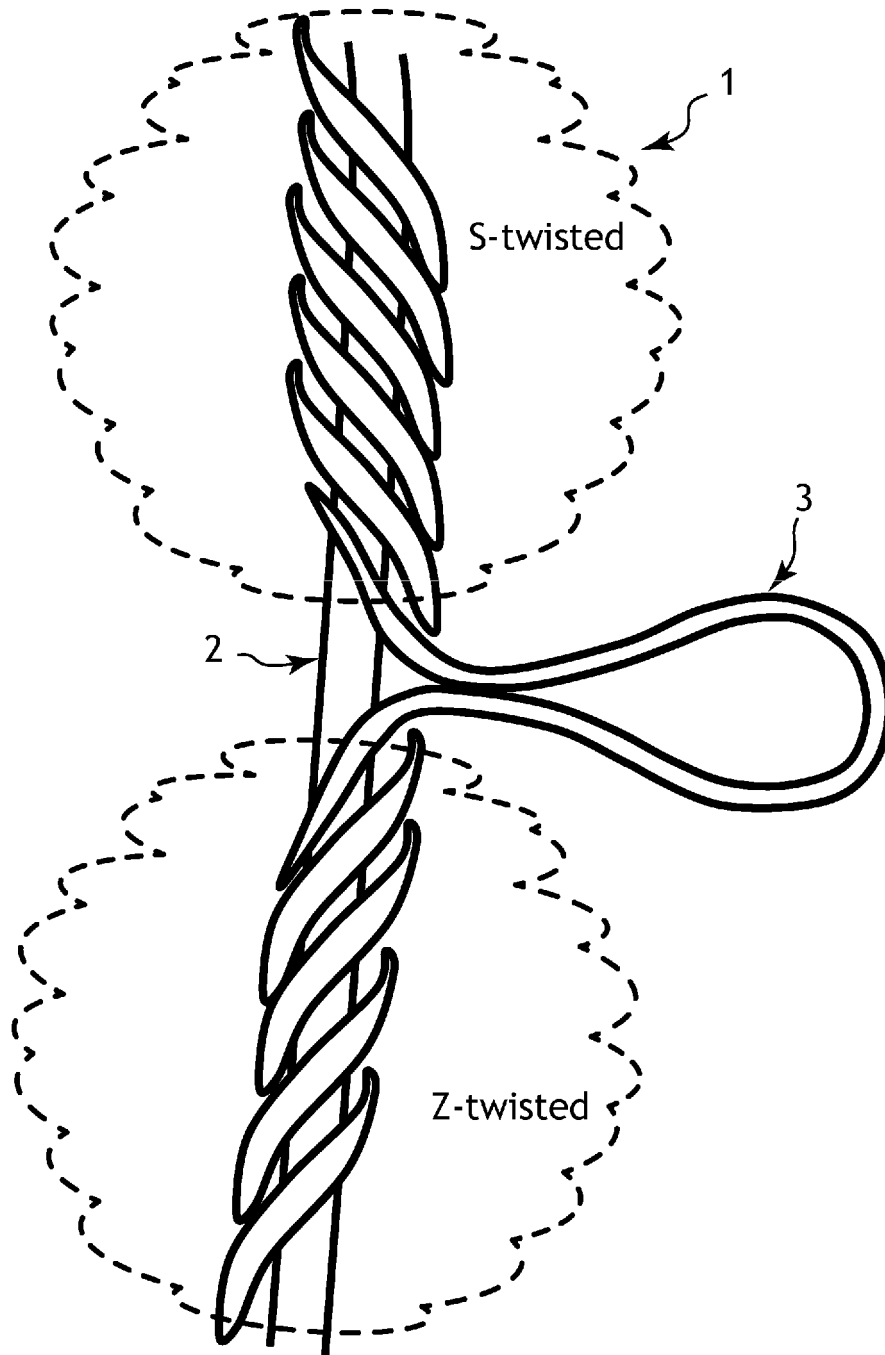


Fig. 6

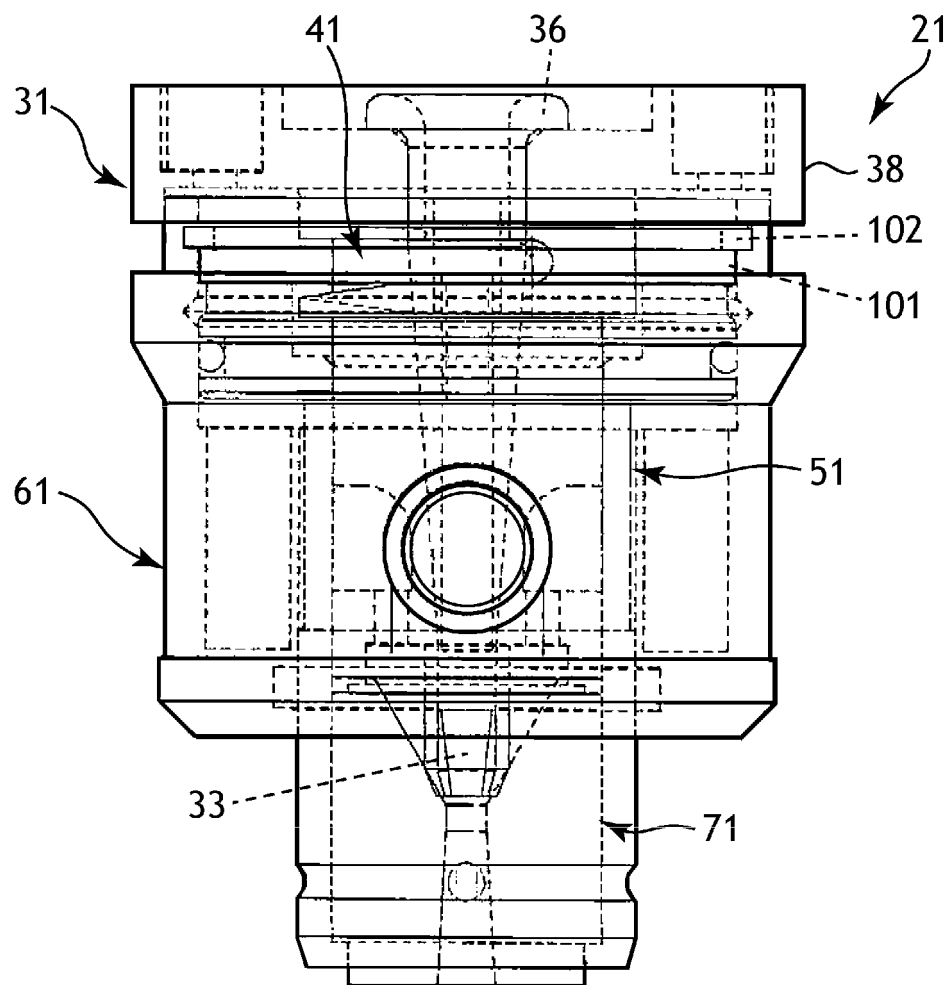


Fig. 7

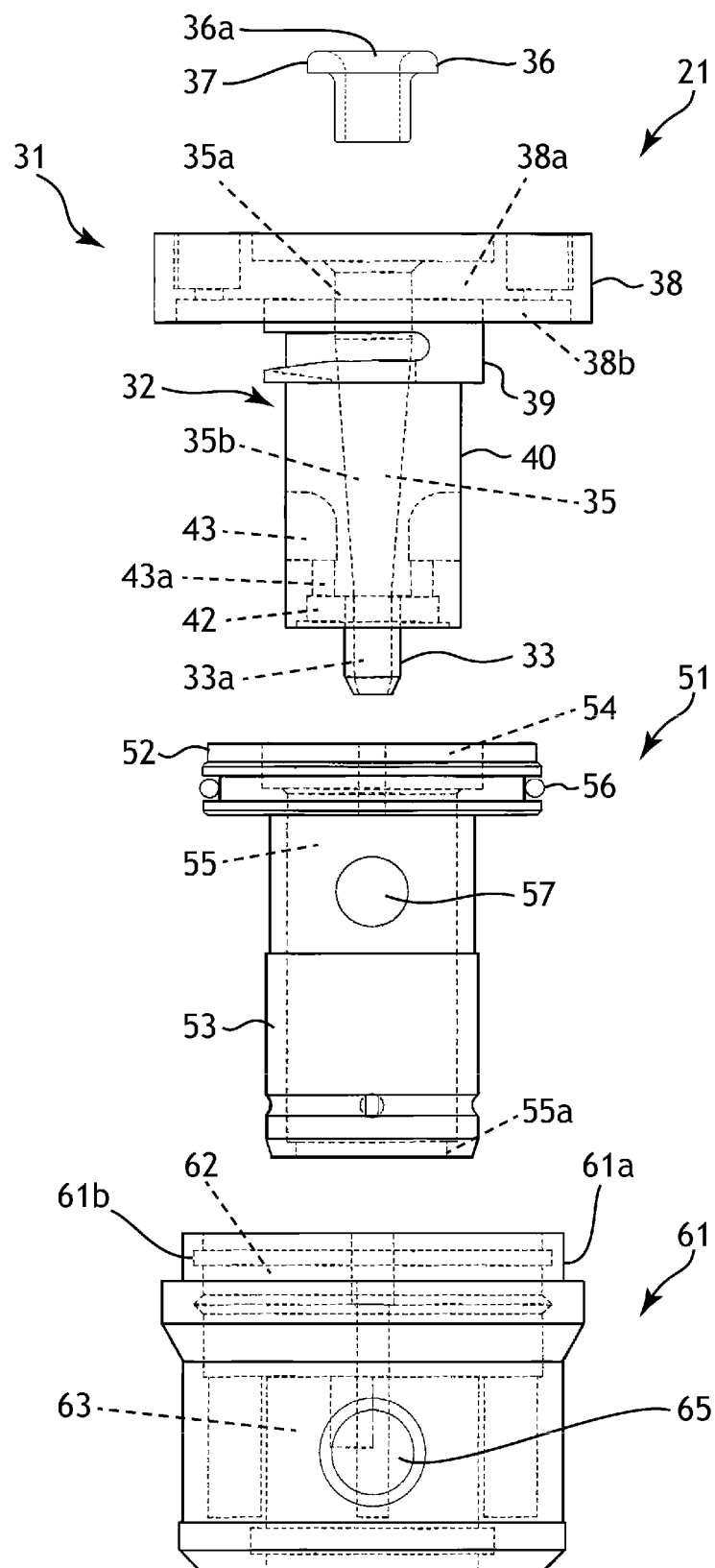


Fig. 8

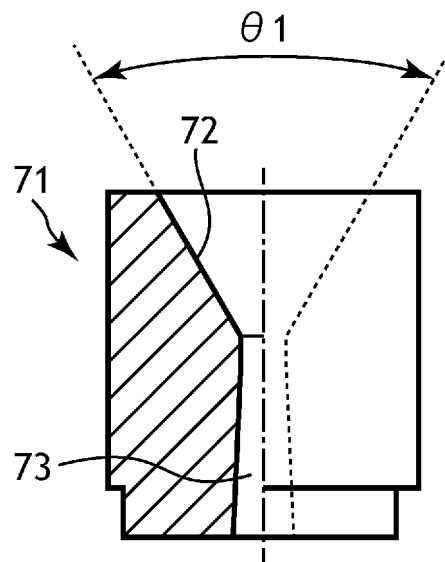


Fig. 9

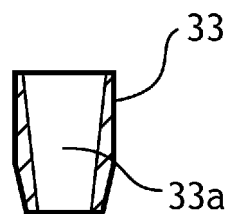


Fig. 10

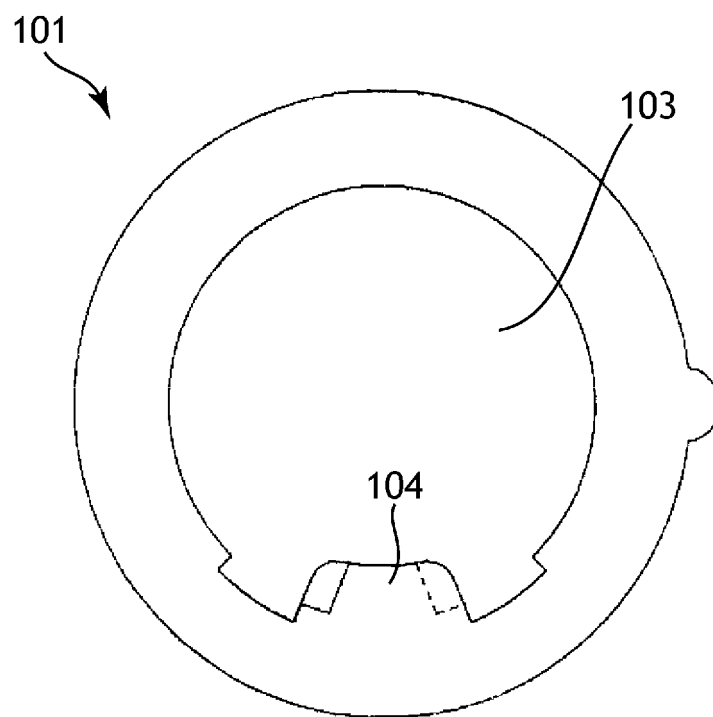


Fig. 11

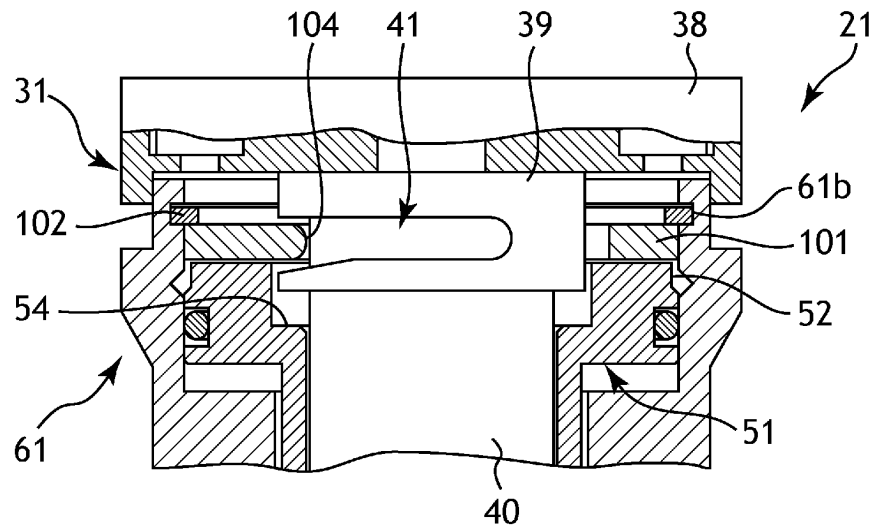


Fig. 12

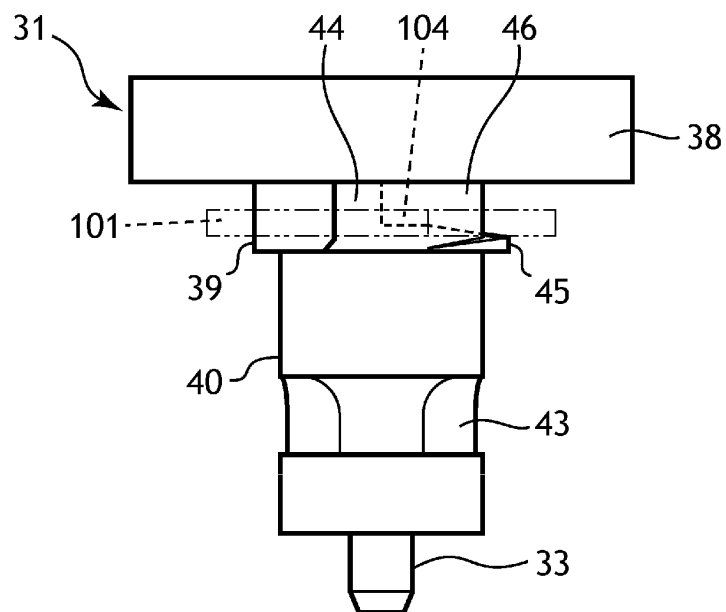


Fig. 13

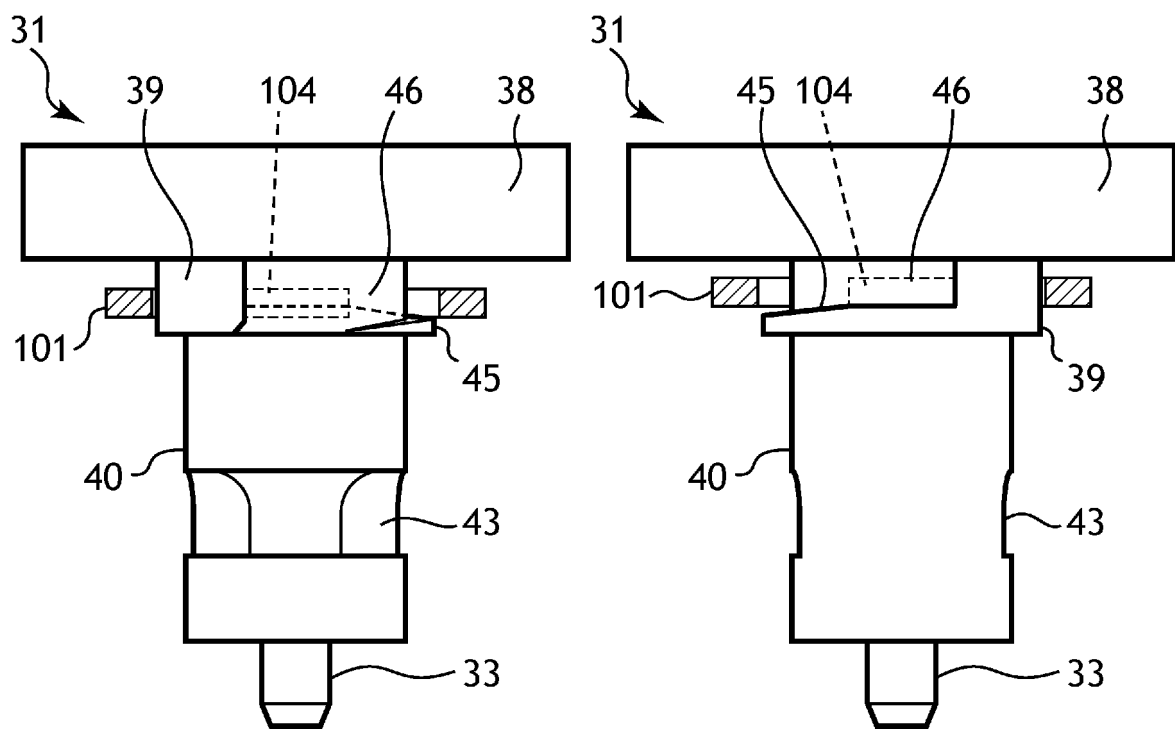


Fig. 14

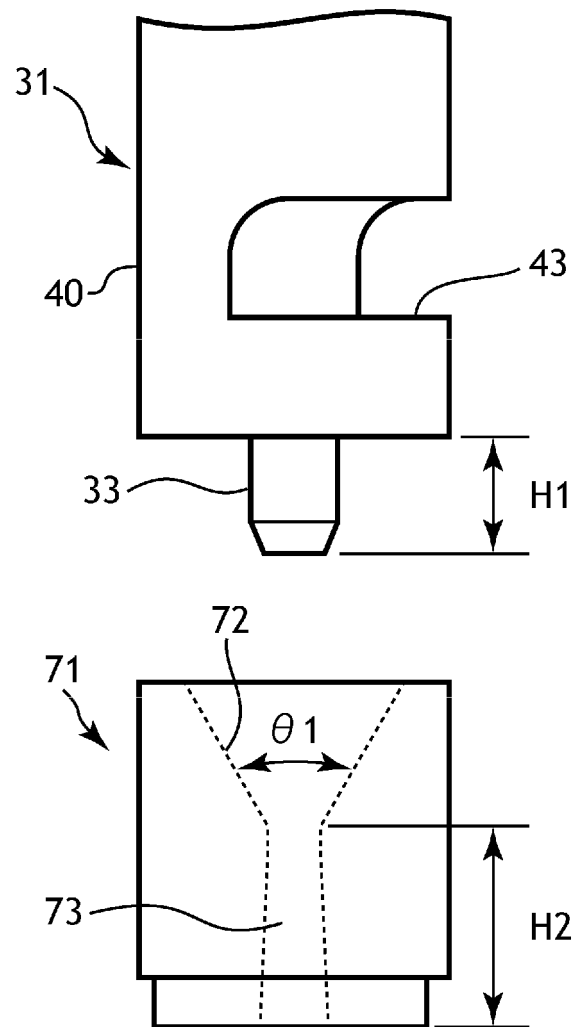


Fig. 15

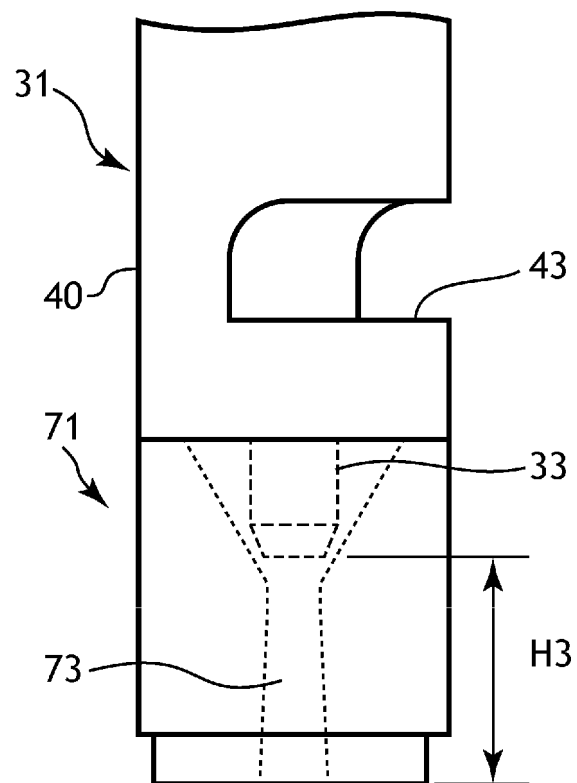


Fig. 16

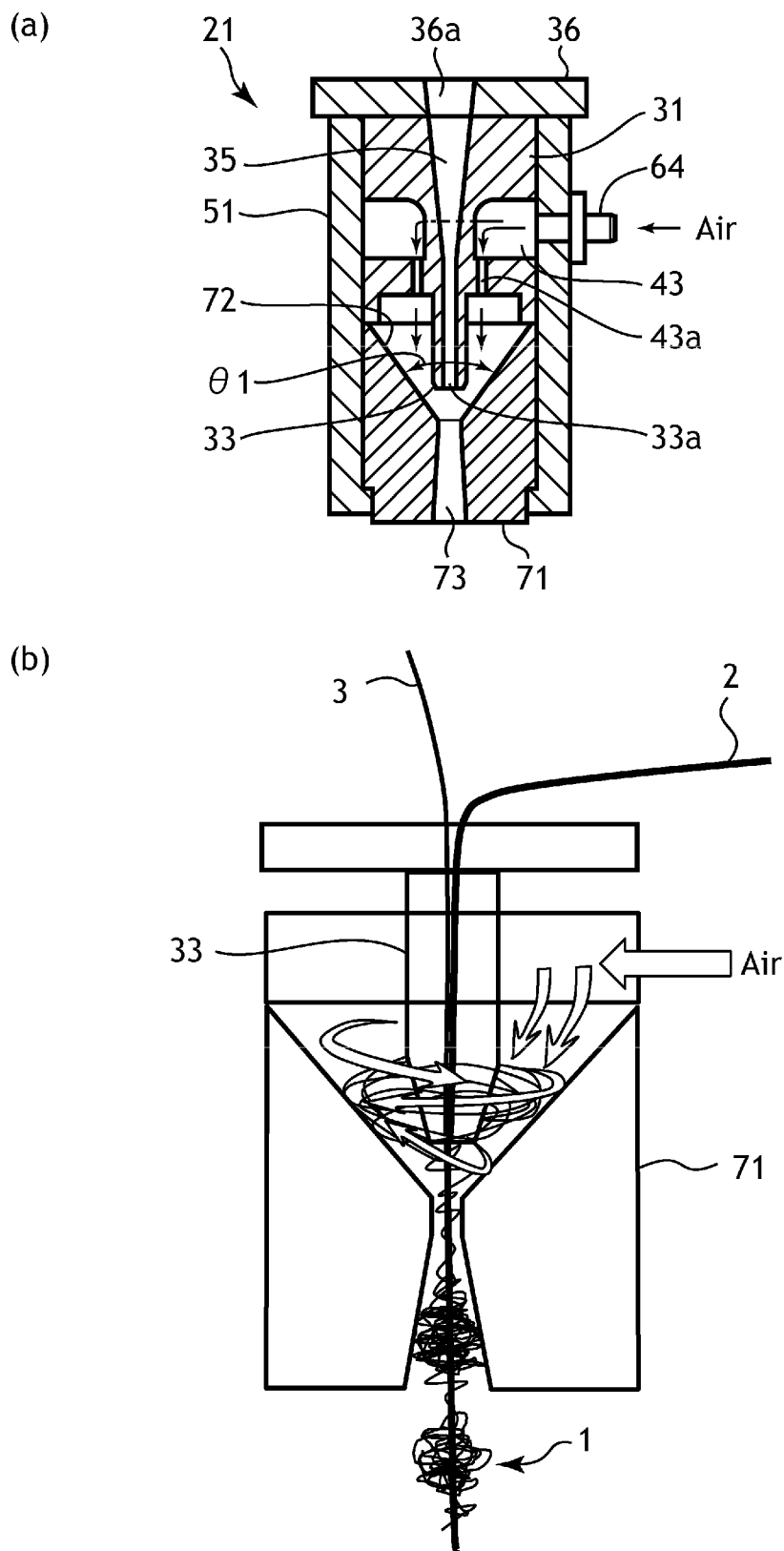


Fig. 17

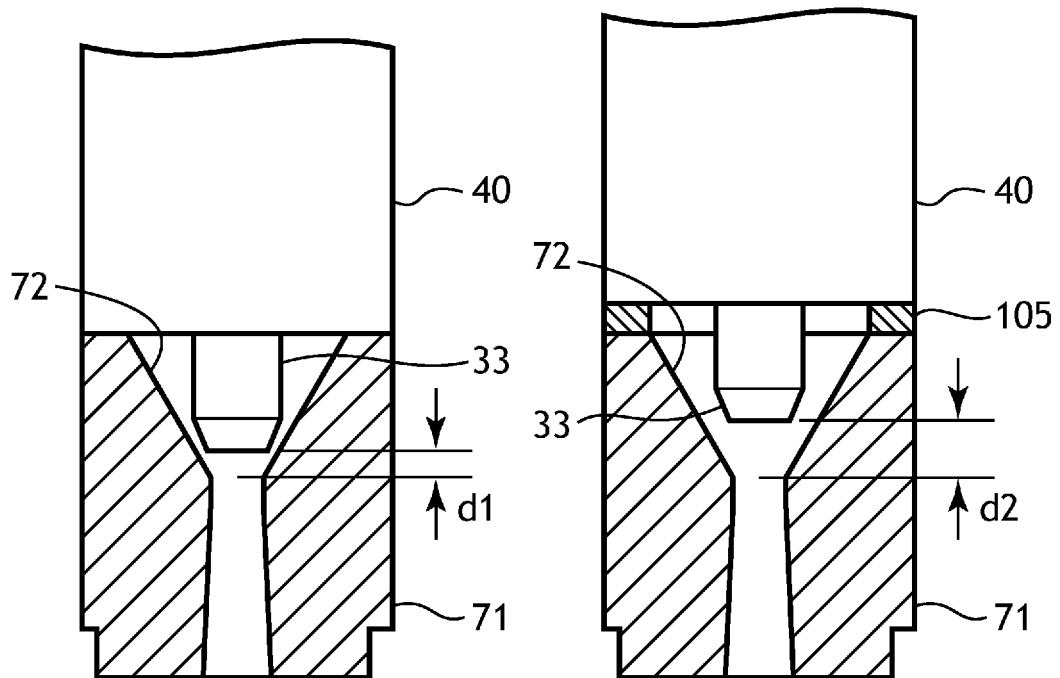


Fig. 18

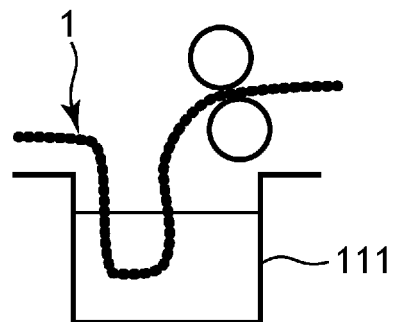
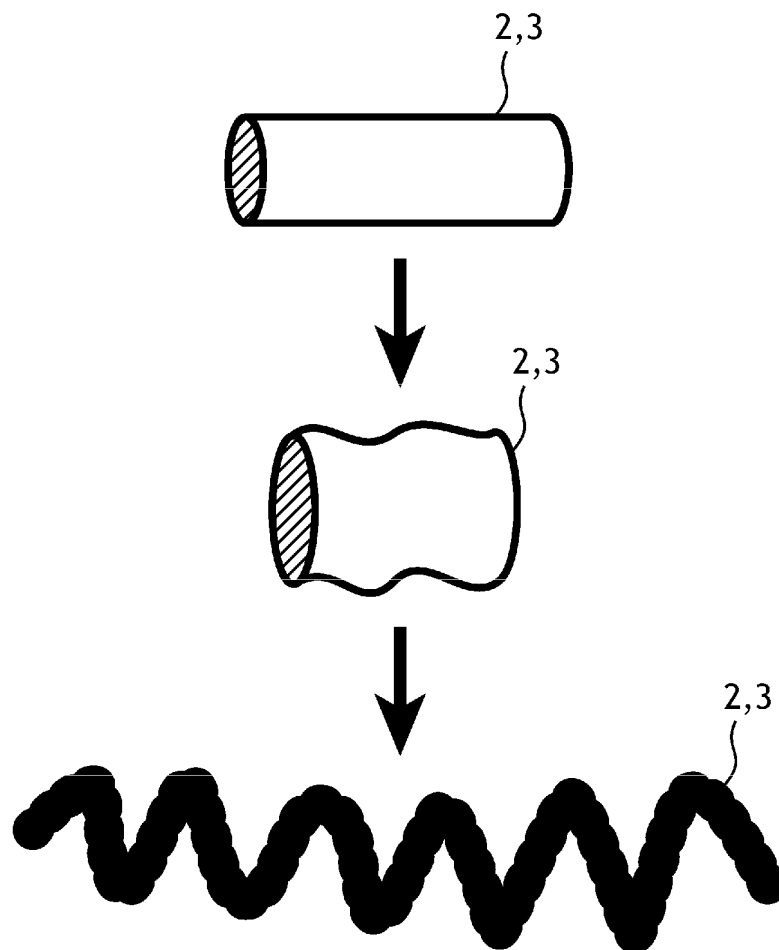


Fig. 19**Fig. 20**

Thermal shrinkage test
Condition:

Setting temperature in dryer	190°C
Drying duration set	1.6m/min
Heating duration	3 min.

Fig. 21

	Original length (cm)	With no tension		With tension	
		After drying (cm)	Shrinkage ratio	After drying (cm)	Shrinkage ratio
Yarn A	100	90	10%	92	8%
Yarn B	100	89.5	11%	93	7%
Yarn C	100	90	10%	92	8%
Yarn D	100	90.5	10%	92.5	8%
Yarn E	100	91	9%	91.5	9%
Yarn F	100	90	10%	91	9%

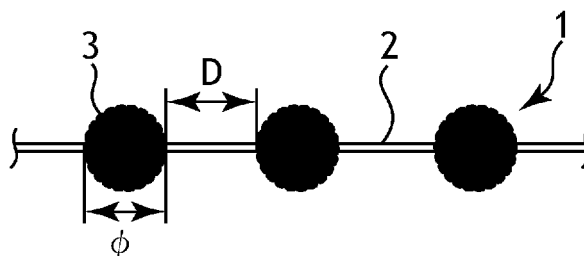
Fig. 22

Fig. 23

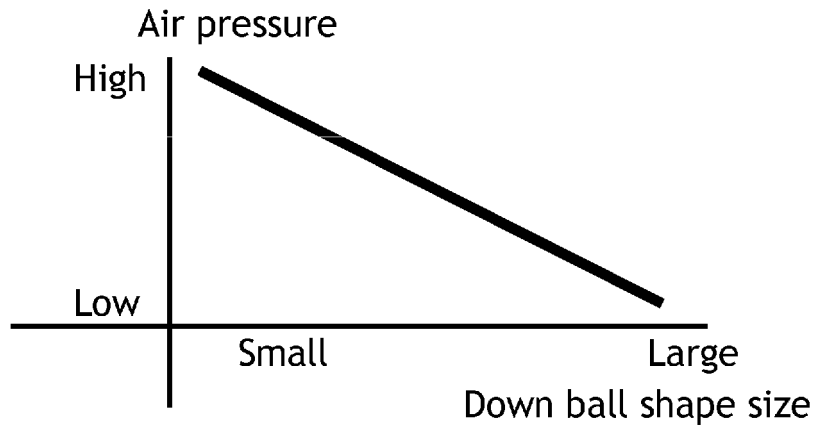
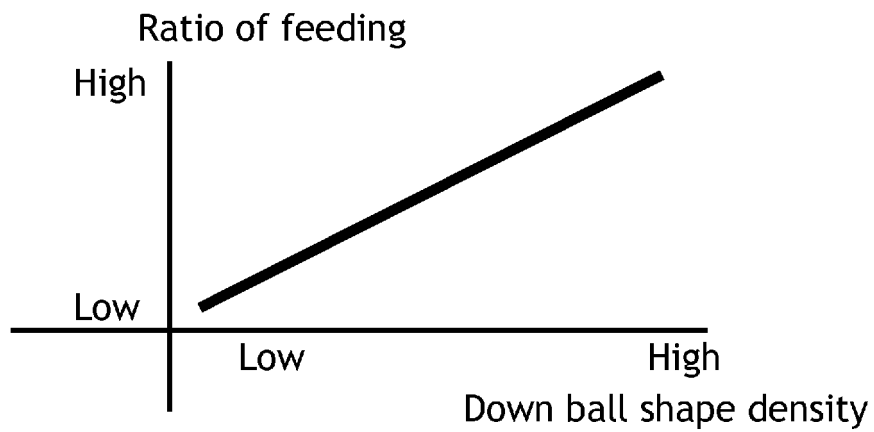


Fig. 24



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/065053

A. CLASSIFICATION OF SUBJECT MATTER

D02G3/34(2006.01)i, A41G11/00(2006.01)i, D02G3/04(2006.01)i, D06C7/02(2006.01)i, D06M15/643(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)

D02G3/34, A41G11/00, D02G3/04, D06C7/02, D06M15/643

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base 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.
Y A	JP 2012-67430 A (Kurabo Industries Ltd.), 05 April 2012 (05.04.2012), claims; paragraphs [0007], [0012] to [0019], [0025], [0031] to [0037], [0044] to [0047]; fig. 1, 3, 4 & US 2013/0136892 A1 & WO 2012/026424 A1 & EP 2610211 A1 & CN 103097280 A & KR 10-2014-0018176 A	1-10 11
Y	JP 61-252331 A (Toray Industries, Inc.), 10 November 1986 (10.11.1986), claims; page 3, upper left column, lines 11 to 19; page 3, lower right column, lines 4 to 9; page 4, upper right column, line 4 to lower left column, line 18; fig. 1, 4 (Family: none)	1-10

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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
10 August 2015 (10.08.15)

Date of mailing of the international search report
18 August 2015 (18.08.15)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/065053

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 60-119242 A (Unitika Ltd.), 26 June 1985 (26.06.1985), claims; page 2, upper left column, lines 4 to 8; page 2, lower right column, line 7 to page 3, upper left column, line 5; page 3, lower left column, line 16 to lower right column, the last line; fig. 2 (Family: none)	1-10
Y	JP 6-65826 A (Toray Industries, Inc.), 08 March 1994 (08.03.1994), paragraphs [0001], [0005], [0015] to [0018], [0022] (Family: none)	1-10
P,X	JP 3197328 U (Hirakawa Corp.), 14 May 2015 (14.05.2015), entire text; all drawings (Family: none)	1-11
A	JP 8-510019 A (Heberlein Maschinenfabrik AG), 22 October 1996 (22.10.1996), entire text; all drawings & US 5640745 A & GB 9504044 A0 & WO 1995/023886 A1 & EP 696331 A & DE 19580019 A & RU 2119979 C & CN 1124045 A & TW 317578 B	1-11
A	JP 55-45829 A (Toyobo Co., Ltd.), 31 March 1980 (31.03.1980), entire text; all drawings (Family: none)	1-11

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2012067430 A [0006]