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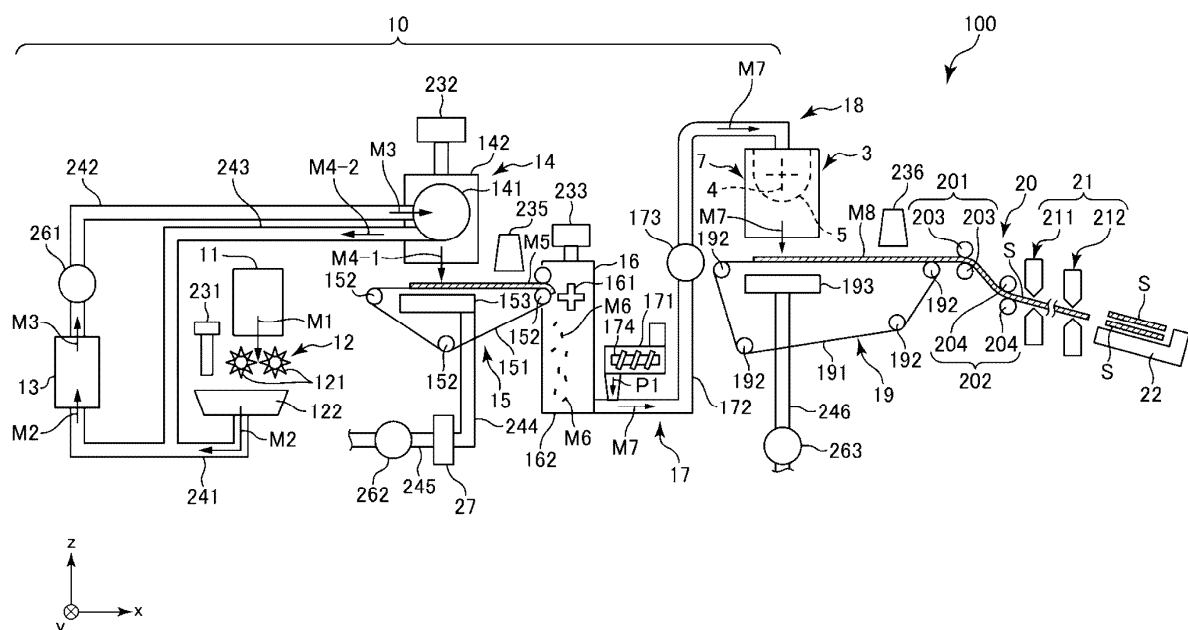
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**(54) FIBER BODY MANUFACTURING APPARATUS AND METHOD FOR PRODUCING FIBER BODY**

(57) Provided is a fiber body manufacturing apparatus including: a supply unit configured to supply fibers; a mesh portion having a plurality of holes configured to allow the fibers supplied from the supply unit to pass through; a deposition member configured to allow the fibers passing through the holes to be deposited thereon;

a forming unit configured to bind the deposited fibers together to generate a fiber body; and a switching unit configured to switch an interval between the holes according to information on a type of the fibers supplied by the supply unit.

**FIG. 1**



## Description

**[0001]** The present application is based on, and claims priority from JP Application Serial Number 2025-057995, filed March 31, 2025, the disclosure of which is hereby incorporated by reference herein in its entirety.

## BACKGROUND

### 1. Technical Field

**[0002]** The present disclosure relates to a fiber body manufacturing apparatus and a method for producing a fiber body.

### 2. Related Art

**[0003]** As disclosed in JP-A-2021-188206, a fiber structure manufacturing apparatus including a fibrous web forming machine that deposits fibers to generate a web and a heating-and-pressing mechanism that heats and pressurizes the accumulated web is known.

**[0004]** The fibrous web forming machine includes a forming drum having a small-hole screen. A defibrated material passing through small holes of the small-hole screen is dispersed in the air and is deposited on a deposition member located below.

**[0005]** JP-A-2021-188206 is an example of the related art.

**[0006]** However, in the fiber structure manufacturing apparatus disclosed in JP-A-2021-188206, when a defibrated material of relatively long fibers is supplied to the forming drum, the fibers may be caught across two small holes of the small-hole screen.

## SUMMARY

**[0007]** A fiber body manufacturing apparatus according to an application example of the present disclosure includes:

a supply unit configured to supply fibers;  
a mesh portion having a plurality of holes configured to allow the fibers supplied from the supply unit to pass through;  
a deposition member configured to allow the fibers passing through the holes to be deposited thereon;  
a forming unit configured to bind the deposited fibers together to generate a fiber body; and  
a switching unit configured to switch an interval between the holes according to information on a type of the fibers supplied by the supply unit.

**[0008]** A method for producing a fiber body according to an application example of the present disclosure includes:

an acquisition step of acquiring information on a type

of fibers;

a switching step of switching an interval between a plurality of holes in the mesh portion having the holes configured to allow the fibers to pass through according to the information acquired in the acquisition step;

a supply step of supplying the fibers;

a dispersion step of causing the supplied fibers to pass through the holes of the switched interval, and dispersing the fibers in the air;

a deposition step of depositing the dispersed fibers; and

a production step of binding the deposited fibers together to produce a fiber body.

## BRIEF DESCRIPTION OF THE DRAWINGS

### [0009]

FIG. 1 is a schematic side view illustrating a fiber body manufacturing apparatus according to a first embodiment of the present disclosure.

FIG. 2 is a block diagram of the fiber body manufacturing apparatus illustrated in FIG. 1.

FIG. 3 is a perspective view of a dispersion unit illustrated in FIG. 1.

FIG. 4 is a cross-sectional view of the dispersion unit and a deposition unit illustrated in FIG. 1.

FIG. 5 is a plan view (a developed view) of a mesh-like body illustrated in FIG. 1.

FIG. 6 is a plan view (a developed view) of the mesh-like body illustrated in FIG. 1.

FIG. 7 is a plan view (a developed view) of another example of the mesh-like body illustrated in FIG. 1.

FIG. 8 is a flowchart illustrating a method for manufacturing a fiber body according to the first embodiment of the present disclosure.

FIG. 9 is a perspective view of a dispersion unit provided in a fiber body manufacturing apparatus according to a second embodiment of the present disclosure.

FIG. 10 is a partially enlarged perspective view of the dispersion unit provided in the fiber body manufacturing apparatus illustrated in FIG. 9.

FIG. 11 is a partially enlarged cross-sectional view of the dispersion unit provided in the fiber body manufacturing apparatus illustrated in FIG. 9.

FIG. 12 is a perspective view illustrating another example of the dispersion unit provided in the fiber body manufacturing apparatus according to the second embodiment of the present disclosure.

FIG. 13 is a perspective view of a dispersion unit and a switching unit provided in a fiber body manufacturing apparatus according to a third embodiment of the present disclosure.

FIG. 14 is a schematic diagram of a dispersion unit and a switching unit provided in a fiber body manufacturing apparatus according to a fourth embodiment of the present disclosure.

FIG. 15 is a block diagram of a fiber body manufacturing apparatus according to a fifth embodiment of the present disclosure.

## DESCRIPTION OF EMBODIMENTS

**[0010]** Hereinafter, a fiber body manufacturing apparatus and a method for producing a fiber body according to the present disclosure will be described in detail based on preferred embodiments illustrated in the accompanying drawings.

### First Embodiment

**[0011]** FIG. 1 is a schematic side view illustrating a fiber body manufacturing apparatus according to a first embodiment of the present disclosure. FIG. 2 is a block diagram of the fiber body manufacturing apparatus illustrated in FIG. 1. FIG. 3 is a perspective view of a dispersion unit illustrated in FIG. 1. FIG. 4 is a cross-sectional view of the dispersion unit and a deposition unit illustrated in FIG. 1. FIG. 5 is a plan view (a developed view) of a mesh-like body illustrated in FIG. 1. FIG. 6 is a plan view (a developed view) of the mesh-like body illustrated in FIG. 1. FIG. 7 is a plan view (a developed view) of another example of the mesh-like body illustrated in FIG. 1. FIG. 8 is a flowchart illustrating a method for manufacturing a fiber body according to the first embodiment of the present disclosure.

**[0012]** Hereinafter, for convenience of description, as illustrated in FIGS. 1 and 3 to 7 (the same applies to FIGS. 9 to 13), three axes orthogonal to each other are defined as an x axis, a y axis, and a z axis. An x-y plane including the x axis and the y axis is a horizontal plane, and the z axis is vertical. A direction in which an arrow of each axis faces is referred to as "+", and a direction opposite thereto is referred to as "-". An upper side in FIGS. 1, 3, and 4 is referred to as "upper" or "above", and a lower side is referred to as "lower" or "below". In each drawing, a direction in which a material containing fibers flows, that is, a direction in which the material advances over time is referred to as "downstream", and an opposite side thereof is referred to as "upstream".

**[0013]** A fiber body manufacturing apparatus 100 illustrated in FIG. 1 is an apparatus that generates a sheet S, which is an example of a fiber body, from a raw material M1, which is waste paper such as used copy paper. The fiber body manufactured by the fiber body manufacturing apparatus 100 is not limited to the sheet S, and may be a plate-shaped member or a block-shaped member, and products such as a bag, a slipper, and a mask processed from the sheet S are also included in the fiber body.

**[0014]** As illustrated in FIGS. 1 and 2, the fiber body manufacturing apparatus 100 includes a raw material supply unit 11, a crushing unit 12, a defibration unit 13, a sorting unit 14, a first web generation unit 15, a sub-division unit 16, a mixing unit 17, a dispersion unit 18, a deposition unit 19, a forming unit 20, a cutting unit 21, a stock unit 22, a collection unit 27, and a control device 28.

**[0015]** Each unit provided in the fiber body manufacturing apparatus 100 is electrically coupled to the control device 28 illustrated in FIG. 2. Operations of each unit are controlled by the control device 28.

**[0016]** The control device 28 includes a control unit 281, a storage unit 282, and a communication unit 283. The control unit 281 is implemented by, for example, at least one processor such as a central processing unit (CPU), and can perform various determinations, various commands, and the like. The storage unit 282 stores, for example, various programs such as a program for manufacturing the sheet S, various calibration curves, tables, and the like.

**[0017]** The communication unit 283 has a function of communicating with the fiber body manufacturing apparatus 100. The communication unit 283 also functions as an acquisition unit that performs an acquisition step of acquiring information on a type of fiber from an input device 284 to be described later.

**[0018]** The control device 28 may be built in the fiber body manufacturing apparatus 100 or may be provided in an external device, such as an external computer.

**[0019]** Hereinafter, a configuration of each unit will be described.

**[0020]** The raw material supply unit 11 is a unit that performs a raw material supply step (a supply step) of supplying the raw material M1 to the crushing unit 12. The raw material M1 is a sheet-shaped material made of a fiber-containing material containing cellulose fibers. The raw material M1 may be a fiber-containing material containing any fiber such as a chemical fiber. A shape of the raw material M1 is not limited to a sheet shape, and may be a cotton shape, a lump shape, or the like.

**[0021]** The crushing unit 12 is a unit that performs a crushing step (a supply step) of crushing the raw material M1 supplied from the raw material supply unit 11 in the air, such as the atmosphere. The crushing unit 12 includes a pair of crushing blades 121 and a chute 122.

**[0022]** The pair of crushing blades 121 can rotate in opposite directions relative to each other to crush the raw material M1 therebetween, that is, cut the raw material M1 into a crushed piece M2. A shape and a size of the

crushed piece M2 are preferably suitable for defibration processing in the defibration unit 13. Examples of the shape of the crushed piece M2 include a small piece having a square planar shape and a small piece having a rectangular shape, particularly a strip-shaped shape. The size of the crushed piece M2 is, for example, preferably a small piece having an average length of one side of 100 mm or less, and more preferably a small piece having an average length of one side of 3 mm or more and 70 mm or less. A shape of the small piece may be other than a square or a rectangle. A thickness is preferably 0.07 mm or more and 0.10 mm or less.

**[0023]** The chute 122 is disposed below the pair of crushing blades 121 and has, for example, a conical shape or a funnel shape. Accordingly, the chute 122 can receive the crushed piece M2 that is crushed by the crushing blades 121 and falls.

**[0024]** Above the chute 122, a humidifying unit 231 is disposed adjacent to the pair of crushing blades 121. The humidifying unit 231 humidifies the crushed piece M2 in the chute 122. The humidifying unit 231 includes a filter (not illustrated) containing moisture, and is implemented by a vaporization-type humidifier that supplies humidified air with increased humidity to the crushed piece M2 by passing air through the filter. By supplying the humidified air to the crushed piece M2, it is possible to prevent the crushed piece M2 from adhering to the chute 122 due to an electrostatic force.

**[0025]** The chute 122 is coupled to the defibration unit 13. The crushed piece M2 collected by the chute 122 is supplied to the defibration unit 13. The defibration unit 13 is a unit that performs a defibration step (a supply step) of defibrating the crushed piece M2 in the air, that is, in a dry manner. By the defibration processing in the defibration unit 13, a defibrated material M3 can be generated from the crushed piece M2. Here, "defibrating" means loosening the crushed piece M2, in which a plurality of fibers are bonded, into individual fibers. A loosened material is formed into the defibrated material M3. A shape of the defibrated material M3 is a linear shape or a band shape. The defibrated materials M3 may be present in a state of being entangled with each other to form a mass, that is, in a state of forming a so-called "lump".

**[0026]** The defibration unit 13 can generate, by rotation of a rotor (not illustrated), an air flow toward the sorting unit 14, that is, a flow of air. Accordingly, the crushed piece M2 can be introduced from a pipe 241 to an upstream side of the defibration unit 13, and after the defibration processing, the defibrated material M3 can be fed via the pipe 242 to the sorting unit 14.

**[0027]** The pipe 242 is coupled downstream of the defibration unit 13. A blower 261, for example, implemented as a turbo-type fan, is provided in the middle of the pipe 242. The blower 261 is an air flow generation device that generates an air flow toward the sorting unit 14. Accordingly, the introduction of the crushed piece M2 into the defibration unit 13 and the feeding of the defibrated material M3 to the sorting unit 14 are promoted. In

the defibration unit 13, the passage and the defibration processing of the crushed piece M2, which is the raw material, are smoothly performed due to the structure, but the passage and the defibration processing of the crushed piece M2 in the defibration unit 13 are promoted by an operation of the blower 261 provided downstream of the defibration unit 13. The blower 261 may be provided upstream of the defibration unit 13.

**[0028]** The sorting unit 14 is a unit that performs a sorting step (a supply step) of sorting fibers to be used in a subsequent step from the defibrated material M3. In the sorting unit 14, the defibrated material M3 is sorted into a first sorted material M4-1 and a second sorted material M4-2 having a fiber length larger than that of the first sorted material M4-1. The first sorted material M4-1 has a size suitable for the sheet S and for manufacturing the sheet S thereafter. Alternatively, the second sorted material M4-2 includes, for example, those in which defibration is insufficient, and those in which defibrated fibers are excessively aggregated with each other.

**[0029]** The sorting unit 14 includes a drum unit 141 and a housing unit 142 that houses the drum unit 141.

**[0030]** The drum unit 141 is a sieve that is implemented by a net body having a circular cylinder shape and rotates around a center axis thereof. The defibrated material M3 flows into the drum unit 141. As the drum unit 141 rotates, the defibrated material M3 that is less than a mesh opening is sorted as the first sorted material M4-1, and the defibrated material M3 having a size larger than the mesh opening is sorted as the second sorted material M4-2.

**[0031]** The first sorted material M4-1 falls from the drum unit 141.

**[0032]** In contrast, the second sorted material M4-2 is fed to a pipe 243 coupled to the drum unit 141. An end portion of the pipe 243 on a side opposite to the drum unit 141, that is, on a downstream side, is coupled to the middle of the pipe 241. The second sorted material M4-2 passing through the pipe 243 merges with the crushed piece M2 in the pipe 241 and flows into the defibration unit 13 together with the crushed piece M2. Accordingly, the second sorted material M4-2 returns to the defibration unit 13 and is subjected to the defibration processing together with the crushed piece M2.

**[0033]** The first sorted material M4-1 that falls from the drum unit 141 falls while being dispersed in the air and heads toward the first web generation unit 15 located below the drum unit 141. The first web generation unit 15 is a unit that performs a first web generation step (a supply step) of generating a first web M5 from the first sorted material M4-1. The first web generation unit 15 includes a mesh belt 151, three tension rollers 152, and a suction unit 153.

**[0034]** The mesh belt 151 is an endless belt on which the first sorted material M4-1 is deposited. This mesh belt 151 is wound around the three tension rollers 152. Then, by a rotational drive of the tension rollers 152, the first sorted material M4-1 on the mesh belt 151 is transported downstream.

**[0035]** The first sorted material M4-1 has a size equal to or larger than an opening of the mesh belt 151. Accordingly, the first sorted material M4-1 is restricted from passing through the mesh belt 151, and can therefore deposit on the mesh belt 151. The first sorted material M4-1 is transported along with the mesh belt 151 downstream while being deposited on the mesh belt 151, and therefore, is generated as the layer-shaped first web M5.

**[0036]** For example, dust or dirt may be mixed in the first sorted material M4-1. Dust or dirt may be generated by, for example, crushing or defibration. Such dust or dirt is collected by the collection unit 27 to be described later.

**[0037]** The suction unit 153 is a suction mechanism that suctions air from below the mesh belt 151. Accordingly, dust or dirt that passes through the mesh belt 151 can be suctioned together with the air.

**[0038]** The suction unit 153 is coupled to the collection unit 27 via a pipe 244. The dust or dirt suctioned by the suction unit 153 is collected by the collection unit 27.

**[0039]** A pipe 245 is further coupled to the collection unit 27. A blower 262 is provided in the middle of the pipe 245. With an operation of the blower 262, a suction force can be generated in the suction unit 153. Accordingly, the generation of the first web M5 on the mesh belt 151 can be promoted. The first web M5 is obtained with the dust or dirt removed. The dust or dirt reaches the collection unit 27 after passing through the pipe 244 with the operation of the blower 262.

**[0040]** The housing unit 142 is coupled to a humidifying unit 232. The humidifying unit 232 is implemented by a vaporization-type humidifier. Accordingly, the humidified air is supplied into the housing unit 142. The first sorted material M4-1 can be humidified by the humidified air, and therefore, it is possible to prevent the first sorted material M4-1 from adhering to an inner wall of the housing unit 142 due to the electrostatic force.

**[0041]** A humidifying unit 235 is disposed downstream of the sorting unit 14. Accordingly, moisture can be supplied to the first web M5, thereby adjusting a moisture content of the first web M5. By this adjustment, adsorption of the first web M5 onto the mesh belt 151 due to the electrostatic force can be prevented. Accordingly, the first web M5 is easily peeled off from the mesh belt 151 at positions where the mesh belt 151 is folded back by the tension rollers 152.

**[0042]** The subdivision unit 16 is disposed downstream of the humidifying unit 235. The subdivision unit 16 is a unit that performs a dividing step (a supply step) of dividing the first web M5 peeled off from the mesh belt 151. The subdivision unit 16 includes a rotatably supported propeller 161 and a housing unit 162 that houses the propeller 161. The first web M5 can be divided by the rotating propeller 161. The divided first web M5 becomes subdivided bodies M6. The subdivided body M6 descends in the housing unit 162.

**[0043]** The housing unit 162 is coupled to a humidifying unit 233. The humidifying unit 233 is implemented by a vaporization-type humidifier. Accordingly, humidified air

is supplied into the housing unit 162. It is possible to prevent the subdivided body M6 from adhering to the propeller 161 or an inner wall of the housing unit 162 due to an electrostatic force by the humidified air.

**[0044]** The mixing unit 17 is disposed downstream of the subdivision unit 16. The mixing unit 17 is a unit that performs a mixing step (a supply step) of mixing the subdivided body M6 and an additive. The mixing unit 17 includes an additive supply unit 171, a pipe 172, and a blower 173. The pipe 172 connects the housing unit 162 of the subdivision unit 16 and a housing 3 of the dispersion unit 18, and is a flow path through which a mixture M7 of the subdivided body M6 and the additive passes.

**[0045]** The additive supply unit 171 is coupled to the middle of the pipe 172. The additive supply unit 171 includes a housing unit in which the additive is accommodated and a screw feeder 174 provided inside the housing unit. By the rotation of the screw feeder 174, the additive inside the housing unit is pushed out from the housing unit and supplied into the pipe 172. The additive supplied into the pipe 172 is mixed with the subdivided body M6 to form the mixture M7.

**[0046]** Here, examples of the additive supplied from the additive supply unit 171 include a binder for binding fibers to each other, a coloring agent for coloring the fibers, an aggregation inhibitor for inhibiting aggregation of the fibers, a flame retardant for making the fibers difficult to burn, and a paper strengthening agent for strengthening a paper strength of the sheet S, and one or more of these can be used in combination. Hereinafter, as an example, a case in which the additive is the binder P1 will be described. Since the additive contains the binder P1 for binding the fibers to each other, a strength of the sheet S can be increased.

**[0047]** Examples of the binder P1 include various polyolefins, thermoplastic resins such as acrylic resins, polyvinyl chloride, polyester, and polyamide, various thermoplastic elastomers, and natural product-derived components such as starch, dextrin, glycogen, amylose, hyaluronic acid, kudzu, konjac, potato starch, etherified starch, esterified starch, natural gum paste, fiber-induced paste, seaweeds, and animal protein, and one or more selected from these can be used in combination.

**[0048]** In the middle of the pipe 172, the blower 173 is provided downstream of the additive supply unit 171. Mixing of the subdivided body M6 and the binder P1 is promoted by an action of a rotation unit such as blades of the blower 173. The blower 173 can generate an air flow toward the dispersion unit 18. By this air flow, the subdivided body M6 and the binder P1 can be stirred in the pipe 172. Accordingly, the mixture M7 is transported to the dispersion unit 18 in a state in which the subdivided body M6 and the binder P1 are uniformly dispersed. The subdivided body M6 in the mixture M7 is loosened in a process of passing through the pipe 172 and becomes a finer fiber.

**[0049]** Although not illustrated, the blower 173 is electrically coupled to the control device 28, and an operation

thereof is controlled. An amount of air supplied into the dispersion unit 18 can be adjusted by adjusting an air flow rate of the blower 173.

**[0050]** The dispersion unit 18 illustrated in FIG. 1 is a unit that executes a dispersion step of dispersing the mixture M7 in the air. A configuration of the dispersion unit 18 will be described in detail later. The mixture M7 dispersed by the dispersion unit 18 is directed toward the deposition unit 19 located below.

**[0051]** The deposition unit 19 is a unit that executes a deposition step of depositing the mixture M7 dispersed by the dispersion unit 18 to generate a second web M8 as a deposit. The deposition unit 19 includes a mesh belt 191, which is an example of a deposition member, tension rollers 192, and a suction unit 193.

**[0052]** The mesh belt 191 is an endless belt on which the mixture M7 is deposited. The mesh belt 191 is wound around the four tension rollers 192. Then, by a rotational drive of the tension rollers 192, the mixture M7 or the second web M8 on the mesh belt 191 is transported downstream.

**[0053]** At least one of the tension rollers 192 is coupled to a motor 194 as a rotational drive source. As illustrated in FIG. 2, the motor 194 is electrically coupled to the control device 28, and the control device 28 can adjust an operation, in particular, a rotation speed, of the motor 194 by controlling energization conditions to the motor 194. A speed reducer and an encoder (not illustrated) may be coupled to the motor 194.

**[0054]** Most of the mixture M7 on the mesh belt 191 has a size equal to or larger than an opening of the mesh belt 191. Accordingly, the mixture M7 is prevented from passing through the mesh belt 191, and can therefore deposit on the mesh belt 191. The mixture M7 is transported along with the mesh belt 191 downstream while being deposited on the mesh belt 191, and therefore, is formed as the layer-shaped second web M8.

**[0055]** The suction unit 193 is a suction mechanism that suctions air from below the mesh belt 191. That is, by an operation of the suction unit 193, an air flow toward a -z axis direction is formed in the vicinity of an upper portion of the mesh belt 191. Accordingly, the mixture M7 can be suctioned onto the mesh belt 191, and accordingly, the deposition of the mixture M7 on the mesh belt 191 is promoted.

**[0056]** A pipe 246 is coupled to the suction unit 193. A blower 263 is provided in the middle of the pipe 246. With an operation of the blower 263, a suction force by the suction unit 193 can be generated.

**[0057]** A humidifying unit 236 is disposed downstream of the dispersion unit 18. The humidifying unit 236 is implemented by, for example, an ultrasonic humidifier. Accordingly, moisture can be supplied to the second web M8, and accordingly, a moisture content of the second web M8 can be adjusted appropriately. By this adjustment, adsorption of the second web M8 onto the mesh belt 191 due to the electrostatic force can be prevented. Accordingly, the second web M8 is easily peeled off from

the mesh belt 191 at positions where the mesh belt 191 is folded back by the tension rollers 192.

**[0058]** For example, a total moisture content from the humidifying units is preferably 0.5 parts by mass or larger and 20 parts by mass or less with respect to 100 parts by mass of a material before humidifying.

**[0059]** The forming unit 20 is disposed downstream (on a right side) of the dispersion unit 18. The forming unit 20 is a unit that performs a forming step of forming the sheet S by binding the fibers of the second web M8. The forming unit 20 includes a pressurizing unit 201, a heating unit 202, and the cutting unit 21.

**[0060]** The pressurizing unit 201 includes a pair of calendar rollers 203 and can pressurize the second web M8 between the calendar rollers 203 without heating the second web M8. Accordingly, a density of the second web M8 is improved. A degree of heating when heating the second web M8 is preferably, for example, such that the binder P1 is not melted. Then, the second web M8 is transported toward the heating unit 202. One of the pair of calendar rollers 203 is a driving roller driven by an operation of a motor (not illustrated), and the other is a driven roller.

**[0061]** The heating unit 202 includes a pair of heating rollers 204 downstream of the pressurizing unit 201, and can pressurize the second web M8 while heating the second web M8 between the heating rollers 204. By this heating and pressurizing, the binder P1 is melted in the second web M8, and the fibers are bonded to each other via the melted binder P1. Accordingly, the sheet S is generated. Then, the sheet S is transported toward the cutting unit 21. One of the pair of heating rollers 204 is a driving roller driven by an operation of a motor (not illustrated), and the other is a driven roller.

**[0062]** The cutting unit 21 is disposed downstream of the heating unit 202. The cutting unit 21 is a unit that performs a cutting step of cutting the sheet S. The cutting unit 21 includes a first cutter 211 and a second cutter 212. The first cutter 211 cuts the sheet S in a direction intersecting a transport direction of the sheet S, particularly in a direction orthogonal thereto. The second cutter 212 cuts the sheet S in a direction parallel to the transport direction of the sheet S, downstream of the first cutter 211. This cutting is to adjust a width of the sheet S by removing unnecessary portions at both side end portions of the sheet S in a width direction.

**[0063]** With the cutting by such a first cutter 211 and second cutter 212, the sheet S having a desired shaped and size can be obtained. The stock unit 22 is provided downstream (on a right side) of the cutting unit 21. The sheet S obtained through the cutting unit 21 is further transported downstream, fed to the stock unit 22, and stored in the stock unit 22. The stock unit 22 is a unit that temporarily stores the sheets S in a state of being stacked in a thickness direction. The number of sheets stored in the stock unit 22 is not particularly limited, but can be, for example, about 5 to 100.

**[0064]** When a raw material in a state in which fibers

can be dispersed in the dispersion unit 18 is fed, the fiber body manufacturing apparatus 100 may not include the crushing unit 12, the defibration unit 13, the sorting unit 14, the first web generation unit 15, and the subdivision unit 16, and the fed raw material may be immediately supplied to the mixing unit 17. When the fibers are melted and the fibers are bonded to each other, it is not necessary to add the binder P1, and the mixing unit 17 may be omitted. That is, a configuration of a supply unit depends on the raw material, and is not limited to the above-described configuration.

**[0065]** The forming unit 20 can be designed according to a target object to be produced. The forming unit 20 has a configuration of including the pressurizing unit 201, the heating unit 202, and the cutting unit 21 is an example of a configuration suitable for generating the sheet S, and is not limited thereto.

**[0066]** Next, the configuration of the dispersion unit 18 will be described.

**[0067]** The dispersion unit 18 illustrated in FIGS. 3 and 4 includes the housing 3, a stirring member 4, and a mesh portion 5.

**[0068]** As illustrated in FIG. 4, the housing 3 includes a top plate 31 and a side wall 32.

**[0069]** The top plate 31 has an intake port 311 implemented by a through hole for taking in the mixture M7. The pipe 172 of the mixing unit 17 is coupled to the intake port 311. The pipe 172 functions as a supply unit 10 that supplies the fibers. An upstream side of the pipe 172 and the pipe 172 (the raw material supply unit 11, that is, the crushing unit 12, the defibration unit 13, the sorting unit 14, the first web generation unit 15, the subdivision unit 16, and the mixing unit 17) may be regarded as the supply unit 10.

**[0070]** The top plate 31 further has an air intake port 311 implemented by a through hole for taking in the mixture M7. Accordingly, outside air can be taken into the housing 3, and an air flow in the housing 3 can be stabilized.

**[0071]** A first mesh-like body 51 to be described later is fixed to a lower surface of the top plate 31.

**[0072]** The side wall 32 is a plate-shaped portion vertically provided on a -z-axis side from an edge portion of a surface of the top plate 31 on the -z-axis side. The side wall 32 includes a wall portion 321 located on a +x-axis side, a wall portion 322 located on a -x-axis side, a wall portion 323 located on a +y-axis side, and a wall portion 324 located on a -y-axis side.

**[0073]** Each of the wall portion 321 and the wall portion 322 has a through hole 325 through which a second mesh-like body 52 to be described later passes. The through hole 325 extends along a y-axis direction.

**[0074]** The mesh portion 5 has holes 50 through which the fibers supplied from the supply unit 10, that is, the mixture M7 passes. In the embodiment, the mesh portion 5 includes the first mesh-like body 51 and the second mesh-like body 52. The first mesh-like body 51 has holes 501 through which the mixture M7 passes. The second

mesh-like body 52 has holes 502 through which the mixture M7 passes. A portion where the hole 501 in the first mesh-like body 51 and the hole 502 in the second mesh-like body 52 overlap is the hole 50.

**[0075]** The first mesh-like body 51 is implemented by a plate-shaped body including a curved portion curved toward the -z-axis side. Two end portions of the first mesh-like body 51 are fixed to the surface of the top plate 31 on the -z-axis side. The first mesh-like body 51 is provided such that the intake port 311 is located between the two end portions (two end portions located on a +z-axis side) of the first mesh-like body 51. Accordingly, the mixture M7 supplied from the intake port 311 can be loosened in a space SA between the first mesh-like body 51 and the top plate 31.

**[0076]** The first mesh-like body 51 is implemented by a plate-shaped body having relatively high rigidity. That is, the first mesh-like body 51 has such rigidity that the first mesh-like body 51 does not deform and maintains its shape even when receiving a force due to its own weight or movement of the second mesh-like body 52 to be described later. Accordingly, the mesh portion 5 allows the mixture M7 to be stably dispersed in the air.

**[0077]** An end portion of the first mesh-like body 51 located on the +y-axis side may be fixed to the wall portion 323. An end portion of the first mesh-like body 51 located on the -y-axis side may be fixed to the wall portion 324.

**[0078]** As illustrated in FIGS. 5 and 6, an arrangement pattern of the holes 501 in the first mesh-like body 51 is staggered. However, the arrangement pattern is not limited thereto and can be appropriately selected. For example, the arrangement pattern may be a grid pattern, a spiral pattern, or a combination of at least two of these.

**[0079]** An opening surface of the hole 501 is circular. However, the opening surface is not limited thereto, and may be, for example, another shape such as an oval, a triangle, a rectangle, a polygon with more sides, or an ellipse. All the holes 501 may not have the same shape.

**[0080]** An opening diameter of the hole 501 is not particularly limited, but, for example, is preferably 0.1 mm or more and 100 mm or less, and more preferably 0.2 mm or more and 90 mm or less. Accordingly, as to be described later, it is possible to more effectively prevent unintentional retention of the mixture M7 in the space SA.

**[0081]** A separation distance between the closest holes 501 is not particularly limited, but may be appropriately selected according to the fiber length to be used. In general, for example, it is preferably 0.1 mm or more and 100 mm or less, and more preferably 0.2 mm or more and 90 mm or less. Accordingly, as to be described later, it is possible to more effectively prevent unintentional retention of the mixture M7 in the space SA.

**[0082]** The second mesh-like body 52 is disposed to overlap the first mesh-like body 51 on the -z-axis side. That is, the first mesh-like body 51 and the second mesh-like body 52 are stacked and disposed. The second mesh-like body 52 is implemented by a flexible sheet.

Accordingly, it is possible to curve following the curved shape of the first mesh-like body 51. As to be described later, the second mesh-like body 52 can move in a curved state.

**[0083]** An end portion of the second mesh-like body 52 that is located on the +x-axis side is located outside through the through hole 325 in the wall portion 321 and is fixed to a roller 81. An end portion of the second mesh-like body 52 that is located on the -x-axis side is located outside through the through hole 325 in the wall portion 322 and is fixed to a roller 82.

**[0084]** An end portion of the second mesh-like body 52 that is located on the +y axis side is not fixed to the wall portion 323 and is provided separated from the wall portion 323, and an end portion thereof located on the -y axis side is not fixed to the wall portion 324 and is provided separated from the wall portion 324.

**[0085]** As illustrated in FIGS. 5 and 6, an arrangement pattern of the holes 502 in the second mesh-like body 52 is staggered, similarly to that of the holes 501. However, the arrangement pattern is not limited thereto and can be appropriately selected. For example, the arrangement pattern may be a grid pattern, a spiral pattern, or a combination of at least two of these.

**[0086]** Like the hole 501, an opening surface of the hole 502 is circular. However, the opening surface is not limited thereto, and may be, for example, another shape such as an oval, a triangle, a rectangle, a polygon with more sides, or an ellipse. All the holes 502 may not have the same shape.

**[0087]** In the embodiment, an opening diameter of the hole 502 is the same as that of the hole 501.

**[0088]** The arrangement pattern, opening shape, and opening diameter of the holes 502 may be different from those of the holes 501.

**[0089]** The first mesh-like body 51 and the second mesh-like body 52 are not limited to the above-described configuration, and may be implemented by, for example, a mesh member in which wires are woven.

**[0090]** As illustrated in FIGS. 3 and 4, the stirring member 4 is provided in the space SA.

**[0091]** The stirring member 4 has a function of promoting dispersion of the mixture M7 supplied into the space SA from the holes 50 in the mesh portion 5 while stirring and loosening the mixture M7 by rotating in the space SA. The stirring member 4 may be any member capable of stirring, and includes here four blades 41 arranged at equal angular intervals around a rotation shaft O, but is not limited thereto. The blade 41 is implemented by a long plate material extending in the y-axis direction. The blade 41 has an opening extending along the rotation shaft O.

**[0092]** As illustrated in FIG. 3, the stirring member 4 is coupled to the motor 194. As illustrated in FIG. 2, the motor 194 is electrically coupled to the control device 28, and the operation thereof is controlled by the control device 28. A speed reducer and an encoder (not illustrated) may be coupled to the motor 194.

**[0093]** As illustrated in FIG. 4, by the rotation of the

stirring member 4, each blade 41 stirs and loosens the mixture M7 in the space SA, and presses an appropriate amount of the mixture M7 against the mesh portion 5. Accordingly, it is possible to discharge and disperse the mixture M7 satisfactorily and evenly from the entire area of the mesh portion 5 while preventing occurrence of clogging in the mesh portion 5 due to excessive supply of the mixture M7.

**[0094]** The stirring member 4 rotates in a state in which each blade 41 is separated from the top plate 31 and the mesh portion 5. Accordingly, the rotation of the stirring member 4 is smoothly performed, and it is possible to prevent excessive pressure from being applied to the mixture M7 between the blades 41 and the mesh portion 5, and it is possible to perform more favorable dispersion.

**[0095]** In the embodiment, a case in which four blades 41 are provided is described, but the present disclosure is not limited thereto, and the number of blades 41 may be, for example, one to three or four or more.

**[0096]** Next, a switching unit 7 will be described.

**[0097]** When the fiber contained in the mixture M7 is relatively long, it is assumed that a phenomenon occurs in which one end portion of the fiber is caught by an edge portion of one hole 50 and the other end portion is caught by an edge portion of another hole 50. In this case, the mixture M7 undesirably stays in the space SA, and unevenness in a dispersion amount of the mixture M7 in the dispersion unit 18 may occur. As a result, a quality of the second web M8 and therefore a quality of the sheet S, may be degraded. In contrast, in the present disclosure, the above-described problem can be solved by an action of the switching unit 7.

**[0098]** Specifically, as illustrated in FIGS. 5 and 6, the switching unit 7 performs a switching step of switching an interval D (a shortest separation distance) between the holes 50 according to information on a type of the fiber supplied by the supply unit 10 (a type of the fiber contained in the mixture M7). That is, when the fiber length of the fiber supplied by the supply unit 10 is relatively long, the switching unit 7 increases the interval D between the holes 50 to prevent or reduce both end portions of the fiber from being caught by the edge portions of the holes 50. Accordingly, it is possible to prevent the above-described unintentional retention and reduce the unevenness in the dispersion amount of the mixture M7 in the dispersion unit 18.

**[0099]** This will be described in detail below.

**[0100]** As illustrated in FIGS. 2 to 4, the switching unit 7 includes a drive unit 8, the control unit 281, and the communication unit 283.

**[0101]** As illustrated in FIGS. 3 and 4, the drive unit 8 includes the roller 81 to which the end portion of the second mesh-like body 52 on the +x-axis side is fixed, the roller 82 to which the end portion of the second mesh-like body 52 on the -x-axis side is fixed, a motor 83 that is a drive source for rotating the roller 81, and a motor 84 that is a drive source for rotating the roller 82.

**[0102]** The roller 81 is provided on the +x-axis side of

the wall portion 321. The roller 82 is provided on the -x-axis side of the wall portion 322. The roller 81 and the roller 82 are provided such that rotation shafts thereof extend in the y-axis direction. The roller 81 and the roller 82 can rotate in both forward and reverse directions. That is, the roller 81 and the roller 82 can rotate in both the clockwise direction and the counterclockwise direction in FIG. 4.

**[0103]** The motor 83 is coupled to the roller 81 and outputs a driving force for rotating the roller 81. The motor 84 is coupled to the roller 82 and outputs a driving force for rotating the roller 82. Each of the motor 83 and the motor 84 is electrically coupled to the control device 28. The control device 28 controls rotation directions, rotation speeds, and the like of the motor 83 and the motor 84 by controlling energization conditions to the motor 83 and the motor 84.

**[0104]** The communication unit 283 has a function of acquiring information on the type of the fiber input by a user using the input device 284. The input device 284 is not particularly limited, and examples thereof include a personal computer, a smartphone, and a tablet terminal. The fiber body manufacturing apparatus 100 may include a touch panel or the like and also serve as an input device.

**[0105]** The communication unit 283 acquires the information on the type of the fiber, and the control unit 281 stores the information on the type of the fiber in the storage unit 282.

**[0106]** The information on the type of the fiber is information indicating what kind of fiber supplied from the supply unit 10 to the dispersion unit 18 is. Specifically, the information on the type of the fiber is information on the fiber length of the fiber or information that can be used to estimate the fiber length of the fiber. The information that can be used to estimate the fiber length of the fiber is, for example, any one of information on a constituent material of the fiber, information on a form of the fiber, and information on the supply unit 10, or a combination of these pieces of information, but is not limited thereto.

#### Information on Fiber Length of Fiber

**[0107]** The information on the fiber length of the fiber is, for example, a real value of a length measured by the user.

**[0108]** For example, the user takes out the fiber supplied from the supply unit 10 to the dispersion unit 18, measures the fiber length of the fiber, and performs input.

#### Information on Constituent Material of Fiber

**[0109]** The information on the constituent material of the fiber is, for example, information on what kind (product) the raw material M1 is derived from, that is, information on a raw material. Examples thereof include cellulose, cotton, wool, silk, hemp, collagen fibers, rayon, polynosic, cupra, lyocell, nylon, polyester, acrylic, vinylon, and polyurethane.

**[0110]** The tendency of the fiber length when being supplied to the dispersion unit 18 is found from the constituent material of the fiber. Therefore, the interval D preferable for each constituent material of the fiber is stored in the storage unit 282 as a table or a calibration curve. Then, by referring to the input information on the constituent material of the fiber and the table or the calibration curve, it is possible to determine an appropriate interval D between the holes 50.

#### Information on Form of Fiber

**[0111]** The information on the form of the fiber is not particularly limited, and examples thereof include woven fabric, knitted fabric, non-woven fabric, Japanese paper, and Western paper. When the raw material M1 is a scrap of cloth, a model number of the cloth may be used. The tendency of the fiber length when being supplied to the dispersion unit 18 is found from the form of the fiber in the raw material M1. Therefore, the interval D preferable for each form of the fiber is stored in the storage unit 282 as a table or a calibration curve. Then, by referring to the input information on the form of the fiber and the table or the calibration curve, it is possible to determine an appropriate interval D between the holes 50.

**[0112]** For example, when the fiber is derived from woven fabric or knitted fabric, the switching unit 7 switches the interval D between the holes 50 to widen the interval D between the holes 50 as compared with a case in which the fiber is derived from a non-woven fabric. Accordingly, the interval D between the holes 50 can be adjusted according to the form of the fiber in the raw material M1. Therefore, it is possible to make both end portions of the fiber less likely to be caught by the edge portions of the holes 50, and it is possible to more effectively prevent unintentional retention of the mixture M7 in the space SA.

#### Information on Supply Unit 10

**[0113]** The information on the supply unit 10 is not particularly limited, and examples thereof include set crushing conditions of the crushing unit 12 (a rotation speed of the crushing blade 121, a size of the obtained crushed piece M2, and the like) and set defibrating conditions (a rotation speed of a rotor, a flow velocity in the pipe, a passing speed in the defibration unit 13, a shape of a defibrating blade, an amount of gap between a rotating inner blade and an outer blade, and the like). The information on the supply unit 10 may be other information related to processing performed by the supply unit 10.

**[0114]** For example, when the user designates the crushing conditions or the defibrating conditions, it is possible to estimate the tendency of the fiber length when being supplied to the dispersion unit 18 based on the crushing conditions or the defibrating conditions, and an appropriate interval D between the holes 50 is determined such that the above-described problems do not

occur. Examples of a method thereof include a method of obtaining the table or the calibration curve indicating the above-described relationship and storing it in the storage unit 282, and referring to it.

**[0115]** Examples of the information on the type of the fiber include, but are not limited to, the information on the fiber length of the fiber, the information on the constituent material of the fiber, and the information on the form of the fiber.

**[0116]** When the information on the type of the fiber includes two or more pieces of information, it is preferable to store, in the storage unit 282, a table or a calibration curve in which these pieces of information are considered in combination.

**[0117]** When the communication unit 283 acquires the information on the type of the fiber, the control unit 281 determines the interval D between the holes 50 based on the information on the type of the fiber, that is, with reference to the information on the type of the fiber and a determination rule such as the above-described table or calibration curve. Then, operations of the motor 83 and the motor 84 are controlled such that the interval D is obtained.

**[0118]** In a state illustrated in FIG. 5, the first mesh-like body 51 and the second mesh-like body 52 are in a state in which the holes 501 in the first mesh-like body 51 and the holes 502 in the second mesh-like body 52 are entirely overlapped with each other. In this state, the opening surface of the hole 501 or the hole 502 becomes the hole 50. The interval D between the holes 50 is D1. In the embodiment, this state is referred to as a normal state. There is no gap between the first mesh-like body 51 and the second mesh-like body 52 large enough for fibers to enter.

**[0119]** When the fiber length is relatively long, the second mesh-like body 52 is shifted from the first mesh-like body 51 by operating the motor 83 and the motor 84 from the normal state. Accordingly, the hole 501 in the first mesh-like body 51 and the hole 502 in the second mesh-like body 52 are in a long fiber state with partial overlapping. When the fiber is in the long fiber state from the beginning, the shift is not performed. A portion where the hole 501 and the hole 502 overlap with each other (a hatched region in FIG. 6) is the substantially effective hole 50. In this state, the interval D between the holes 50 is D2, which is larger than D1. Accordingly, even when the fiber is relatively long, both end portions are less likely to be caught by the edge portions of the holes 50. Accordingly, it is possible to more effectively prevent unintentional retention of the mixture M7 in the space SA.

**[0120]** In contrast, when the fiber length is relatively short, the second mesh-like body 52 is shifted from the first mesh-like body 51 to obtain the normal state by operating the motor 83 and the motor 84 from the long fiber state. When the fiber is in the normal state from the beginning, the shift is not performed. In this state, the interval D between the holes 50 is D1, which is less than D2. Accordingly, the number of holes 50 increases, and

an amount of fibers passing through the holes 50 increases. This leads to an increase in the production efficiency of the fiber body.

**[0121]** The control unit 281 determines a movement amount of the second mesh-like body 52, that is, how much the motor 83 and the motor 84 are operated, according to the information on the type of the fiber. Accordingly, the interval D between the holes 50 can be adjusted as desired according to the type of the fiber, and both end portions of the fiber can be less likely to be caught by the edge portions of the holes 50. Accordingly, it is possible to more effectively prevent unintentional retention of the mixture M7 in the space SA. It is possible to prevent a decrease in production efficiency due to ensuring the interval D between the holes 50 larger than necessary.

**[0122]** The control unit 281 may be configured to adjust the interval D between the holes 50 in two or more stages according to the information on the type of the fiber, or may be configured to continuously adjust the interval D. When the interval D between the holes 50 is adjusted stepwise, the control can be simplified. In contrast, when the interval D between the holes 50 is continuously adjusted, the interval D can be more appropriately adjusted.

**[0123]** It is preferable that an edge portion of the hole 501 in the first mesh-like body 51 is chamfered, that is, rounded. Accordingly, it is possible to more effectively prevent the fiber from being caught by the edge portions of the holes 501.

**[0124]** For the same reason, it is preferable that an edge portion of the hole 502 in the second mesh-like body 52 is chamfered, that is, rounded.

**[0125]** It is preferable that both the edge portion of the hole 501 in the first mesh-like body 51 and the edge portion of the hole 502 in the second mesh-like body 52 are chamfered, that is, rounded. Accordingly, it is possible to more effectively prevent the fibers from being caught by the edge portions of the holes 50 regardless of a degree of overlap between the hole 501 and the hole 502. The holes 501 in the first mesh-like body 51 and the holes 502 in the second mesh-like body 52 may be formed by punching, etching, or other methods.

**[0126]** The control unit 281 also functions as a speed adjustment unit that adjusts a moving speed of the mesh belt 191 according to the interval D between the holes 50. The control unit 281 adjusts the energization condition of the motor 194 according to the information on the type of the fiber. Specific descriptions will be given below.

**[0127]** For example, when the interval D is D1 (see FIG. 5), a moving speed V of the mesh belt 191 is set to V1, and when the interval D is D2 (see FIG. 6), the moving speed V of the mesh belt 191 is set to V2, which is less than V1. Since an opening area of the hole 50 is smaller when the interval D is D2 than when the interval D is D1, the dispersion amount of the fibers is smaller. Therefore, when the moving speed V of the mesh belt 191 is decreased, a thickness of the second web M8 can be kept

more uniform.

**[0128]** A table or a calibration curve indicating a relationship between the interval D and the moving speed V is created in advance and stored in the storage unit 282 such that the thickness of the second web M8 is the same. Then, the moving speed V can be set to an appropriate value by referring to the interval D determined as described above and the table or the calibration curve.

**[0129]** The control unit 281 may be configured to adjust a rotation speed of the stirring member 4 according to the interval D between the holes 50. In this case, the control unit 281 functions as a rotation speed adjustment unit that adjusts the rotation speed of the stirring member 4. Specifically, the control unit 281 may be configured to adjust the energization condition to the motor 194 according to the information on the type of the fiber. For example, control is performed to increase the rotation speed of the stirring member 4 when the interval D is large, and to decrease the rotation speed of the stirring member 4 when the interval D is small. Accordingly, the dispersion amount of the mixture M7 can be more effectively kept uniform regardless of the size of the interval D.

**[0130]** As described above, the fiber body manufacturing apparatus 100 includes the supply unit 10 that supplies the mixture M7 containing the fibers, the mesh portion 5 having the plurality of holes 50 through which the fibers supplied from the supply unit 10 pass, the mesh belt 191 that is an example of the deposition member on which the fibers passing through the holes 50 are deposited, the forming unit 20 that binds the deposited fibers to generate the sheet S that is an example of the fiber body, and the switching unit 7 that switches the interval D between the holes 50 according to the information on the type of the fibers supplied by the supply unit 10. Accordingly, the interval D between the holes 50 can be adjusted according to the type of fiber. Therefore, it is possible to make both end portions of the fiber less likely to be caught by the edge portions of the holes 50, and it is possible to more effectively prevent unintentional retention of the mixture M7 in the dispersion unit 18. As a result, it is possible to reduce unevenness in the dispersion amount of the fibers in the dispersion unit 18 and to improve the quality of the sheet S.

**[0131]** The mesh portion 5 includes the first mesh-like body 51 and the second mesh-like body 52, of which at least a part is stacked with the first mesh-like body 51, a portion where the hole in the first mesh-like body 51 and the hole in the second mesh-like body 52 overlap is a hole in the mesh portion through which the fiber passes, and the switching unit 7 switches the interval D between the holes 50 in the mesh portion 5 by relatively moving the first mesh-like body 51 and the second mesh-like body 52 according to the information on the type of the fiber. Accordingly, the interval D between the holes 50 can be adjusted by a simple method of relatively moving the first mesh-like body 51 and the second mesh-like body 52. Since the movement amount of the first mesh-like body 51 or the second mesh-like body 52 when

adjusting the interval D between the holes 50 is relatively small, the interval D between the holes 50 can be quickly adjusted.

**[0132]** The switching unit 7 may not include the drive unit 8 and the control unit 281. In this case, it is preferable that the interval D between the holes 50 is adjusted by the user operating an operation unit (not illustrated) that relatively moves the first mesh-like body 51 and the second mesh-like body 52.

**[0133]** A shape of the hole 501 in the first mesh-like body 51 and a shape of the hole 502 in the second mesh-like body 52 are not limited to the illustrated configuration. For example, as illustrated in FIG. 7, the hole 502 in the second mesh-like body 52 may be rectangular. When the holes 502 in the second mesh-like body 52 are rectangular, it is also possible to alternate each row such that all of the holes 501 in the first mesh-like body 51 in one row are closed and all of the holes 501 in the first mesh-like body 51 in another row are open.

**[0134]** The information on the type of the fiber includes at least one of the information on the fiber length of the fiber, the information on the constituent material of the fiber, and the information on the form of the fiber. When the interval D between the holes 50 is adjusted according to such information on the type of the fiber, more appropriate adjustment can be performed.

**[0135]** The information on the type of the fiber includes the information on the form of the fiber. When the fiber is derived from woven fabric or knitted fabric, the switching unit 7 switches the interval D between the holes 50 to widen the interval D between the holes 50 as compared with a case in which the fiber is derived from a non-woven fabric. Accordingly, the interval D between the holes 50 can be adjusted according to the form of the fiber in the raw material M1. Therefore, it is possible to make both end portions of the fiber less likely to be caught by the edge portions of the holes 50, and it is possible to more effectively prevent unintentional retention of the mixture M7 in the space SA.

**[0136]** The fiber body manufacturing apparatus 100 includes the communication unit 283 as an acquisition unit that acquires the information on the type of the fiber input by the user. Accordingly, the user can input desired information, and the interval D between the holes 50 can be adjusted more accurately.

**[0137]** As described above, the mesh belt 191, which is a deposition member, deposits the fibers while moving at the moving speed V corresponding to the interval D between the holes 50. Accordingly, the thickness of the second web M8, which is a deposit, can be kept more uniform regardless of the size of the interval D between the holes 50.

**[0138]** In the fiber body manufacturing apparatus 100, the moving speed V of the mesh belt 191 may not be adjusted according to the interval D between the holes 50. That is, the moving speed V of the mesh belt 191 may be constant regardless of the size of the interval D between the holes 50.

**[0139]** Next, an example of the method for producing a fiber body according to the present disclosure will be described with reference to FIG. 8.

**[0140]** The method for producing a fiber body according to the present disclosure includes an acquisition step (step S101), a switching step (step S102), a supply step (step S103), a dispersion step (step S104), a deposition step (step S105), and a forming step (step S106).

**[0141]** First, in step S101, the information on the type of the fiber input by the user using the input device 284 is acquired. As described above, this step is executed by the communication unit 283 as the acquisition unit.

**[0142]** Next, in step S102, the interval D between the holes 50 in the mesh portion 5 is switched according to the information on the type of the fiber acquired in step S101. This step is executed by the switching unit 7 as described above. In this step, the moving speed V of the mesh belt 191 is also determined.

**[0143]** Next, in step S103, the mixture M7 is supplied to the dispersion unit 18. This step is executed by the supply unit 10 as described above.

**[0144]** Next, in step S104, the mixture M7 is dispersed, using the mesh portion 5, in the air from the holes 50 whose interval D is adjusted. In this step, both end portions of the fiber are less likely to be caught by the edge portions of the holes 50, and unevenness in the dispersion amount of the mixture M7 can be effectively reduced.

**[0145]** Next, in step S105, the mixture M7 that passes through the holes 50 is deposited to generate the second web M8 as a deposit. This step is executed by the deposition unit 19 as described above.

**[0146]** Next, in step S106, the fibers of the second web M8 are bonded to each other to generate the sheet S as a fiber body. This step is executed by the forming unit 20 as described above.

**[0147]** Through such steps S101 to S106, a high-quality sheet S can be obtained regardless of the type of fibers.

**[0148]** By adjusting the interval D between the holes 50 in advance before operating the fiber body manufacturing apparatus 100, it is possible to effectively reduce unevenness in the dispersion amount of the mixture M7 generated from the raw material M1 supplied first. Therefore, the quality of the sheet S can be more effectively improved. Of course, the quality of the second and subsequent sheets S can be similarly improved.

**[0149]** In this way, the method for producing a fiber body according to the present disclosure includes the acquisition step of acquiring the information on the type of the fiber, the switching step of switching the interval D between the holes 50 in the mesh portion 5 having the plurality of holes 50 through which the fiber passes according to the information acquired in the acquisition step, the supply step of supplying the fiber, the dispersion step of dispersing the fiber supplied through the holes 50 with the switched interval D in the air, the deposition step of depositing the dispersed fiber to generate the second web M8 which is a deposit, and a production step of

producing the sheet S which is an example of the fiber body by binding the deposited fibers. Accordingly, the interval D between the holes 50 can be adjusted according to the type of fiber. Therefore, it is possible to make both end portions of the fiber less likely to be caught by the edge portions of the holes 50, and it is possible to more effectively prevent unintentional retention of the mixture M7 in the dispersion unit 18. As a result, it is possible to effectively reduce the unevenness in the dispersion amount of the fibers in the dispersion unit 18, and to improve the quality of the sheet S.

## Second Embodiment

**[0150]** FIG. 9 is a perspective view of a dispersion unit provided in a fiber body manufacturing apparatus according to a second embodiment of the present disclosure. FIG. 10 is a partially enlarged perspective view of the dispersion unit provided in the fiber body manufacturing apparatus illustrated in FIG. 9. FIG. 11 is a partially enlarged cross-sectional view of the dispersion unit provided in the fiber body manufacturing apparatus illustrated in FIG. 9. FIG. 12 is a perspective view illustrating another example of the dispersion unit provided in the fiber body manufacturing apparatus according to the second embodiment of the present disclosure.

**[0151]** Hereinafter, the fiber body manufacturing apparatus and a method for producing a fiber body according to the second embodiment of the present disclosure will be described with reference to FIGS. 9 to 12, differences from the first embodiment described above will be mainly described, and descriptions of similar matters will be omitted.

**[0152]** In FIGS. 9 to 12, holes 501A (the holes 50) in a first mesh-like body 51A, holes 502A (the holes 50) in a second mesh-like body 52A, and holes 503A (the holes 50) in a third mesh-like body 53A are not illustrated.

**[0153]** As illustrated in FIG. 9, a mesh portion 5A includes the first mesh-like body 51A, the second mesh-like body 52A, and the third mesh-like body 53A, which are coupled in this order. That is, the first mesh-like body 51A, the second mesh-like body 52A, and the third mesh-like body 53A are each implemented as a separate region of a flexible sheet, and are coupled in this order. Therefore, the mesh portion 5A is implemented by a single flexible sheet. The mesh-like body will be described using three examples, and is not limited thereto. The number of mesh-like bodies may be two, or four or more, and these may be switched.

**[0154]** Further, the holes 501A (the holes 50) in the first mesh-like body 51A, the holes 502A (the holes 50) in the second mesh-like body 52A, and the holes 503A (the holes 50) in the third mesh-like body 53A have different intervals D, respectively. Although not illustrated, the intervals D of the holes 501A, 502A, and 503A increase in this order. The holes 501A in the first mesh-like body 51A, the holes 502A in the second mesh-like body 52A, and the holes 503A in the third mesh-like body 53A have

different opening diameters and the same arrangement pattern. However, the present disclosure is not limited to this configuration, and the holes 501A in the first mesh-like body 51A, the holes 502A in the second mesh-like body 52A, and the holes 503A in the third mesh-like body 53A may have the same opening diameter and different arrangement patterns.

[0155] Similarly to the first embodiment, the switching unit 7 includes the drive unit 8, the control unit 281, and the communication unit 283. The drive unit 8 includes the roller 81 to which a part of the mesh portion 5A is fixed, the roller 82 to which a part of the mesh portion 5A is fixed, the motor 83 that is a drive source for rotating the roller 81, and the motor 84 that is a drive source for rotating the roller 82. These are as described above.

[0156] A plurality of engagement holes 53 are provided in edge portions of the mesh portion 5A on the +y axis side and the -y axis side. The engagement holes 53 are arranged at equal intervals along the edge portions of the mesh portion 5A. Each engagement hole 53 is implemented by a through hole, and is provided in all of the first mesh-like body 51A, the second mesh-like body 52A, and the third mesh-like body 53A.

[0157] A plurality of protrusions 85 are provided on an outer peripheral portions of each of the roller 81 and the roller 82 at positions corresponding to the edge portions of the mesh portion 5A on the +y axis side and the -y axis side. Each of the protrusions 85 has a size and a shape enough to be inserted into the engagement hole 53.

[0158] In a state in which the protrusion 85 is inserted into the engagement hole 53, the roller 81 and the roller 82 are fixed to the mesh portion 5A. When the roller 81 and the roller 82 rotate in this state, the mesh portion 5A moves by the movement of the protrusion 85. As this movement continues, the protrusion 85 is inserted into the next engagement hole 53. By repeating such an operation, the roller 81 and the roller 82 can stably move the mesh portion 5A.

[0159] As illustrated in FIG. 11, the wall portion 323 is provided with a guide groove 326. The guide groove 326 is a portion between a pair of ribs 327. The pair of ribs 327 protrude from the wall portion 323 toward the -y-axis side, that is, toward an inside of the space SA. The pair of ribs 327 have an arc shape curved to protrude toward the -z-axis side, that is, protrude downward. The pair of ribs 327 are provided apart from each other to have the same interval at any position in a longitudinal direction.

[0160] An edge portion of the mesh portion 5A on the +y-axis side is inserted into the guide groove 326, and the guide groove 326 has a function of guiding the mesh portion 5A to a position where the mixture M7 passes in the inserted state. In the inserted state, unintentional movement of the edge portion of the mesh portion 5A on the +y-axis side is restricted by the pair of ribs 327, and the mesh portion 5A can move while maintaining an arc shape. Accordingly, the mesh portion 5A can smoothly move to the position where the mixture M7 passes.

[0161] Such guide grooves 326 may also be provided

in the wall portion 324.

[0162] When the motor 83 and the motor 84 are operated, the roller 81 and the roller 82 rotate, a position of the mesh portion 5A is shifted, and it is possible to select which mesh-like body among the first mesh-like body 51A, the second mesh-like body 52A, and the third mesh-like body 53A is disposed below the stirring member 4, that is, at the position where the mixture M7 passes. This selection is performed according to the information on the type of the fiber, as in the first embodiment. The holes in the mesh-like body arranged by the above-described selection are the holes 50.

[0163] In this way, the mesh portion 5A includes, in different region, the first mesh-like body 51A having the holes 501A and the second mesh-like body 52A having the holes 502A arranged at intervals different from those of the first mesh-like body 51A. The switching unit 7 moves the first mesh-like body 51A such that the first mesh-like body 51A is located at a position where the fiber passes in response to the information on the type of the fiber being information indicating a first type, and moves the second mesh-like body 52A such that the second mesh-like body 52A is located at a position where the fiber passes in response to the information on the type of the fiber being information indicating a second type. In other words, when a relatively long fiber is supplied, the first mesh-like body 51A having large intervals between holes is moved to the position where the fiber passes, and when a relatively short fiber is supplied, the second mesh-like body 52A having small intervals between holes is moved to the position where the fiber passes. Accordingly, the interval D between the holes 50 can be adjusted according to the type of fiber. Therefore, it is possible to make both end portions of the fiber less likely to be caught by the edge portions of the holes 50, and it is possible to more effectively prevent unintentional retention of the mixture M7 in the dispersion unit 18. As a result, it is possible to reduce unevenness in the dispersion amount of the fibers in the dispersion unit 18 and to improve the quality of the sheet S.

[0164] As illustrated in FIG. 12, portions (the first mesh-like body 51A and the third mesh-like body 53A) of the mesh portion 5A located outside the housing 3 may be wound around the roller 81 and the roller 82, respectively.

### Third Embodiment

[0165] FIG. 13 is a perspective view of a dispersion unit and a switching unit provided in a fiber body manufacturing apparatus according to a third embodiment of the present disclosure.

[0166] Hereinafter, a fiber body manufacturing apparatus and a method for producing a fiber body according to the third embodiment of the present disclosure will be described with reference to FIG. 13, differences from the first embodiment described above will be mainly described, and descriptions of similar matters will be omitted.

**[0167]** As illustrated in FIG. 13, the switching unit 7 includes a drive unit 9, the control unit 281 (not illustrated), and the communication unit 283 (not illustrated).

**[0168]** The drive unit 9 includes a support unit 91, a support unit 92, a solenoid 93, and a biasing unit 94.

**[0169]** The support unit 91 is provided on the -x-axis side of the housing 3, and includes a support base 911 fixed to an outside of the wall portion 322 and a pair of rail portions 912 provided on the support base 911 on the +y-axis side and the -y-axis side. Each rail portion 912 supports a frame member 54 provided on the -x-axis side of the second mesh-like body 52 to be movable along the x-axis direction.

**[0170]** The support unit 92 is provided on the +x-axis side of the housing 3, and includes a support base 921 fixed to an outside of the wall portion 321 and a pair of rail portions 922 provided on the support base 921 on the +y-axis side and the -y-axis side. Each rail portion 922 supports a frame member 55 provided on the +x-axis side of the second mesh-like body 52 to be movable along the x-axis direction.

**[0171]** The solenoid 93 is a drive source that moves the second mesh-like body 52, and is provided on the support base 911. The solenoid 93 is electrically coupled to the control device 28. When the control unit 281 controls an energization condition to the solenoid 93, the solenoid 93 can move the second mesh-like body 52. Specifically, in the solenoid 93, a shaft 931 in contact with the frame member 54 of the second mesh-like body 52 protrudes to the +x-axis side, and a protrusion amount thereof is adjusted by energization. By this adjustment, a position of the second mesh-like body 52 can be adjusted in the housing 3, and the interval D between the holes 50 can be adjusted as in the first embodiment.

**[0172]** The biasing unit 94 is provided on the support base 921. In the illustrated configuration, the biasing unit 94 includes a base 941 and a coil spring 942 provided between the base 941 and the frame member 55 of the second mesh-like body 52. As the second mesh-like body 52 is moved by the solenoid 93, a position of the frame member 55 of the second mesh-like body 52 in the x-axis direction is also displaced on the support unit 92. In particular, when the shaft 931 of the solenoid 93 retreats to the -x-axis side, the second mesh-like body 52 can be moved to the -x-axis side by a biasing force of the biasing unit 94. Therefore, the second mesh-like body 52 can be moved following the shaft 931 regardless of a position of the shaft 931 of the solenoid 93.

**[0173]** The biasing unit 94 is not limited to the above-described configuration, and the coil spring 942 may have another configuration such as a leaf spring. A drive source similar to the solenoid 93 may be provided instead of the biasing unit 94.

#### Fourth Embodiment

**[0174]** FIG. 14 is a schematic diagram of a dispersion unit and a switching unit provided in a fiber body manu-

facturing apparatus according to a fourth embodiment of the present disclosure.

**[0175]** Hereinafter, the fiber body manufacturing apparatus and a method for producing a fiber body according to the fourth embodiment of the present disclosure will be described with reference to FIG. 14, differences from the first embodiment described above will be mainly described, and descriptions of similar matters will be omitted.

**[0176]** As illustrated in FIG. 14, the dispersion unit 18 includes a first dispersion unit 18A and a second dispersion unit 18B. The dispersion unit will be described using two examples, and is not limited thereto. The number of dispersion units may be three or more, and these may be switched.

**[0177]** The first dispersion unit 18A includes a housing 3A, and the second dispersion unit 18B includes a housing 3B. The housing 3A and the housing 3B are arranged in this order from the +x-axis side along the x-axis direction. The housing 3A and the housing 3B are substantially the same as the housing 3 described in the above embodiment except that a through hole 325 is omitted and disposition positions thereof are different.

**[0178]** The mesh portion 5 includes a first mesh-like body 54A provided in the housing 3A and a second mesh-like body 54B provided in the housing 3B. That is, the first mesh-like body 54A and the second mesh-like body 54B are provided at different positions. The first mesh-like body 54A has the holes 50 (first holes). The second mesh-like body 54B has the holes 50 (second holes) provided at the interval D different from that of the holes 50 (the first holes). In the embodiment, an interval between the holes 50 in the second mesh-like body 54B is larger than the interval D between the holes 50 in the first mesh-like body 54A.

**[0179]** The supply unit 10 includes a first pipe 71 as a first supply unit and a second pipe 72 as a second supply unit. A downstream end portion of the first pipe 71 is coupled to the housing 3A of the first dispersion unit 18A, and a downstream end portion of the second pipe 72 is coupled to the housing 3B of the second dispersion unit 18B. Therefore, selecting whether to supply the mixture M7 to the first pipe 71 or the second pipe 72 means selecting whether to supply the mixture M7 to the first mesh-like body 54A or the second mesh-like body 54B.

**[0180]** The switching unit 7 includes a switching valve 285 and a control unit 281 (not illustrated).

**[0181]** The switching valve 285 is provided at a downstream end portion of the pipe 172, and has a function of switching whether to supply the mixture M7 to the first pipe 71 or the second pipe 72 branched from the pipe 172. The switching valve 285 is, for example, implemented by a solenoid valve, and is electrically coupled to the control device 28. The control unit 281 controls an operation of the switching valve 285 according to the information on the type of the fiber, and selects whether to supply the mixture M7 to the first pipe 71 or the second pipe 72.

**[0182]** For example, a table or a calibration curve in-

dicating a relationship between the information on the type of the fiber and information on which of the first mesh-like body 54A and the second mesh-like body 54B the mixture M7 is supplied to is obtained and stored in the storage unit 282. Then, the control unit 281 can determine to which of the first mesh-like body 54A and the second mesh-like body 54B the mixture M7 is supplied by referring to the above-described table or calibration curve according to the information on the type of the fiber.

[0183] In this way, the mesh portion 5 includes the first mesh-like body 54A having the holes 50 (the first holes) and the second mesh-like body 54B having the holes 50 (the second holes) provided at an interval different from that between the holes 50 (the first holes). The switching unit 7 switches the supply unit 10 to supply the fibers to the first pipe 71 as the first supply unit in response to the information on the type of the fiber being information indicating a first type, and switches the supply unit 10 to supply the fibers to the second pipe 72 as the second supply unit in response to the information on the type of the fiber being information indicating a second type. Accordingly, it is possible to select a mesh-like body having the holes 50 with an appropriate interval D according to the type of fiber. Therefore, it is possible to make both end portions of the fiber less likely to be caught by the edge portions of the holes 50, and it is possible to more effectively prevent unintentional retention of the mixture M7 in the dispersion unit 18 (the first dispersion unit 18A or the second dispersion unit 18B). As a result, it is possible to reduce unevenness in the dispersion amount of the fibers in the dispersion unit 18 (the first dispersion unit 18A or the second dispersion unit 18B) and to improve the quality of the sheet S.

#### Fifth Embodiment

[0184] FIG. 15 is a block diagram of a fiber body manufacturing apparatus according to a fifth embodiment of the present disclosure.

[0185] Hereinafter, the fiber body manufacturing apparatus and a method for producing a fiber body according to the fifth embodiment of the present disclosure will be described with reference to FIG. 15, differences from the first embodiment described above will be mainly described, and descriptions of similar matters will be omitted.

[0186] As illustrated in FIG. 15, the fiber body manufacturing apparatus 100 includes a detection unit 286 that detects information on the type of the fiber from fibers. The detection unit 286 detects the information on the type of the fiber from at least one of the raw material M1, the crushed piece M2, the defibrated material M3, the first sorted material M4-1, the second sorted material M4-2, the first web M5, the subdivided body M6, and the mixture M7. It is possible to appropriately select the detection target, the detection position, and the detection method. Hereinafter, a case in which the detection unit 286 provided in the drum unit 141 detects the information on the

type of the fiber from the first sorted material M4-1 will be described.

[0187] The detection unit 286 is implemented by, for example, a digital camera, and images the first sorted material M4-1 falling from the drum unit 141. The image captured by the detection unit 286 is transmitted to the control device 28 (not illustrated). The control unit 281 analyzes the image captured by the detection unit 286 and acquires, for example, information on a fiber length of fibers. After the information on the fiber length of the fibers is acquired, the subsequent processing is the same as in the first embodiment.

[0188] In this way, the fiber body manufacturing apparatus 100 includes a detection unit that automatically detects the information on the type of the fiber. Accordingly, as in the first embodiment, it is possible to omit the labor required for a user to input the information on the type of the fiber. As a result, it is possible to more easily reduce unevenness in the dispersion amount of the fibers in the dispersion unit 18 (the first dispersion unit 18A or the second dispersion unit 18B) and to improve the quality of the sheet S.

[0189] Although the fiber body manufacturing apparatus and the method for producing a fiber body according to the present disclosure have been described with reference to the illustrated embodiments, the present disclosure is not limited thereto, and the configuration of each unit can be replaced with any configuration having the same function. In the present disclosure, any other configuration may be added to each of the embodiments.

[0190] Any two or more of the features of the first embodiment to the fifth embodiment may be combined.

[0191] The switching unit 7 is not limited to performing switching using a motor, and may perform switching to a person through screen display or voice. For example, the control unit 281 may switch from the first mesh-like body to the second mesh-like body by instructing a person to replace the first mesh-like body with the second mesh-like body according to the information on the type of the fiber. Alternatively, the control unit 281 may block the holes in the mesh-like body and switch the interval between the holes by instructing a person to block any hole in the mesh-like body according to the information on the type of the fiber.

#### Claims

1. A fiber body manufacturing apparatus comprising:

- a supply unit configured to supply fibers;
- a mesh portion having a plurality of holes configured to allow the fibers supplied from the supply unit to pass through;
- a deposition member configured to allow the fibers passing through the holes to be deposited thereon;
- a forming unit configured to bind the deposited

- fibers together to generate a fiber body; and  
a switching unit configured to switch an interval  
between the holes according to information on a  
type of the fibers supplied by the supply unit.
2. The fiber body manufacturing apparatus according  
to claim 1, wherein
- the mesh portion includes a first mesh-like body  
and a second mesh-like body, of which at least a  
part is stacked with the first mesh-like body,  
a portion where holes in the first mesh-like body  
and holes in the second mesh-like body overlap  
becomes the holes in the mesh portion config-  
ured to allow the fiber to pass through, and  
the switching unit switches the interval between  
the holes in the mesh portion by relatively mov-  
ing the first mesh-like body and the second  
mesh-like body according to the information  
on the type of the fibers.
3. The fiber body manufacturing apparatus according  
to claim 1, wherein
- the mesh portion includes, in different regions, a  
first mesh-like body having the holes and a  
second mesh-like body having the holes ar-  
ranged at an interval different from an interval  
between the holes in the first mesh-like body,  
and  
the switching unit moves the first mesh-like body  
such that the first mesh-like body is located at a  
position through which the fibers pass in re-  
sponse to the information on the type of the  
fibers being information indicating a first type,  
and moves the second mesh-like body such that  
the second mesh-like body is located at a posi-  
tion through which the fibers pass in response to  
the information on the type of the fibers being  
information indicating a second type.
4. The fiber body manufacturing apparatus according  
to claim 1, wherein
- the mesh portion includes a first mesh-like body  
having the holes and a second mesh-like body  
having the holes arranged at an interval different  
from an interval between the holes in the first  
mesh-like body, and  
the switching unit switches the supply unit to  
supply the fibers to a first supply unit in response  
to the information on the type of the fibers being  
information indicating a first type, and switches  
the supply unit to supply the fibers to a second  
supply unit in response to the information on the  
type of the fibers being information indicating a  
second type.
5. The fiber body manufacturing apparatus according  
to claim 1, wherein  
the information on the type of the fibers includes at  
least one of information on a fiber length of each of  
the fibers, information on a constituent material of the  
fibers, and information on a form of the fibers.
6. The fiber body manufacturing apparatus according  
to claim 5, wherein  
the information on the type of the fibers includes  
the information on the form of the fibers, and  
the switching unit switches the interval between  
the holes to widen the interval between the holes  
when the fibers are derived from woven fabric or  
a knitted fabric as compared with a case in which  
the fibers are derived from non-woven fabric.
7. The fiber body manufacturing apparatus according  
to claim 5, wherein  
the switching unit switches the interval between the  
holes to be larger when the fiber length of each of the  
fibers indicated by the information on the type of the  
fibers is larger than a predetermined length than  
when the fiber length of each of the fibers indicated  
by the information on the type of the fibers is less than  
the predetermined length.
8. The fiber body manufacturing apparatus according  
to claim 1, further comprising:  
an acquisition unit configured to acquire the informa-  
tion on the type of the fibers input by a user.
9. The fiber body manufacturing apparatus according  
to claim 1, further comprising:  
a detection unit configured to detect the information  
on the type of the fibers from the fibers.
10. The fiber body manufacturing apparatus according  
to claim 1, wherein  
the deposition member allows the fibers to deposit  
while moving at a moving speed corresponding to  
the interval between the holes.
11. A method for producing a fiber body comprising:  
acquiring information on a type of fibers;  
switching an interval between a plurality of holes  
configured to allow the fibers to pass through  
according to the acquired information;  
supplying the fibers;  
causing the supplied fibers to pass through the  
holes of the switched interval, and dispersing the  
fibers in the air;  
depositing the dispersed fibers; and  
binding the deposited fibers together to produce  
a fiber body.

**FIG. 1**

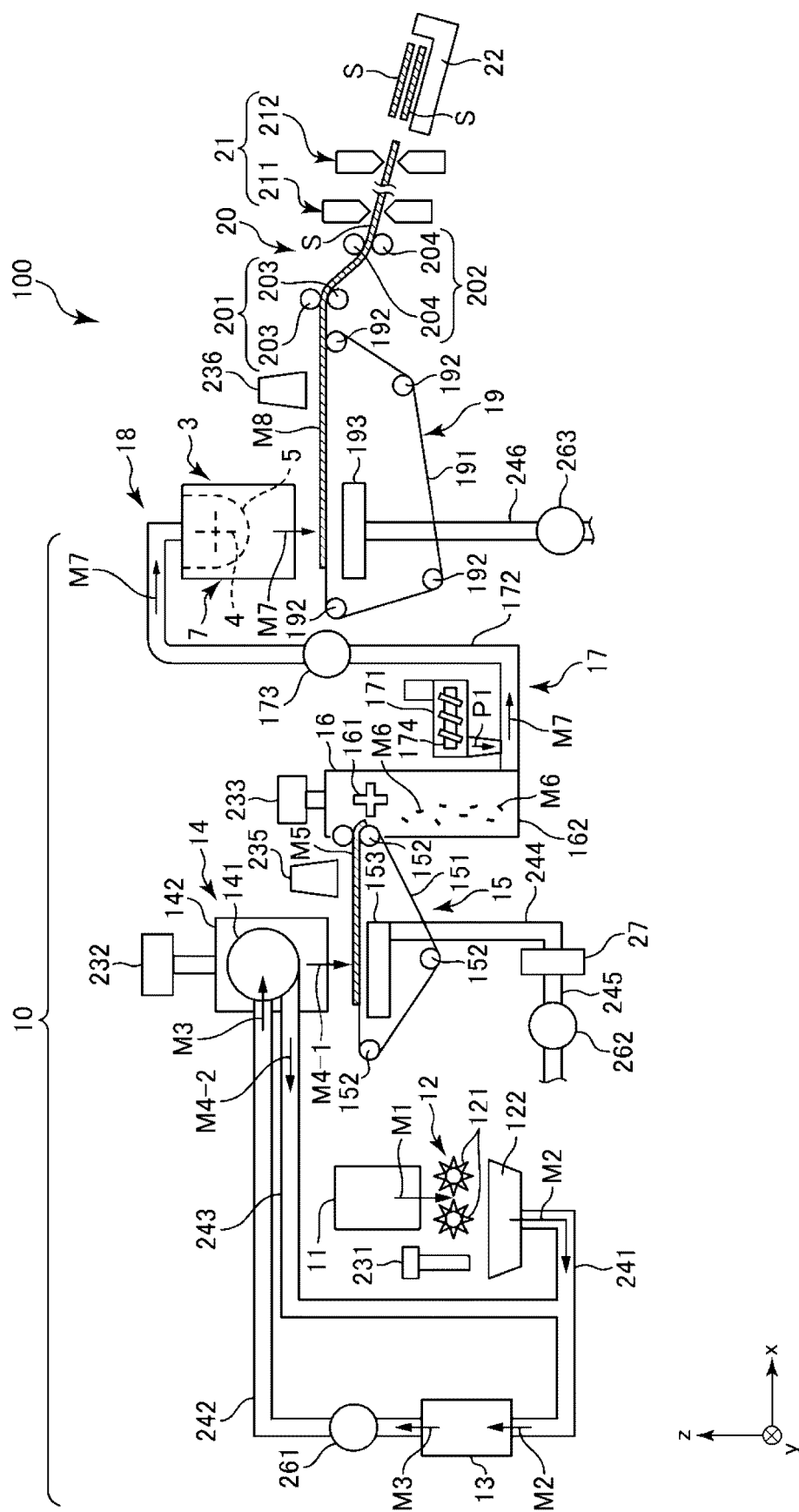


FIG. 2

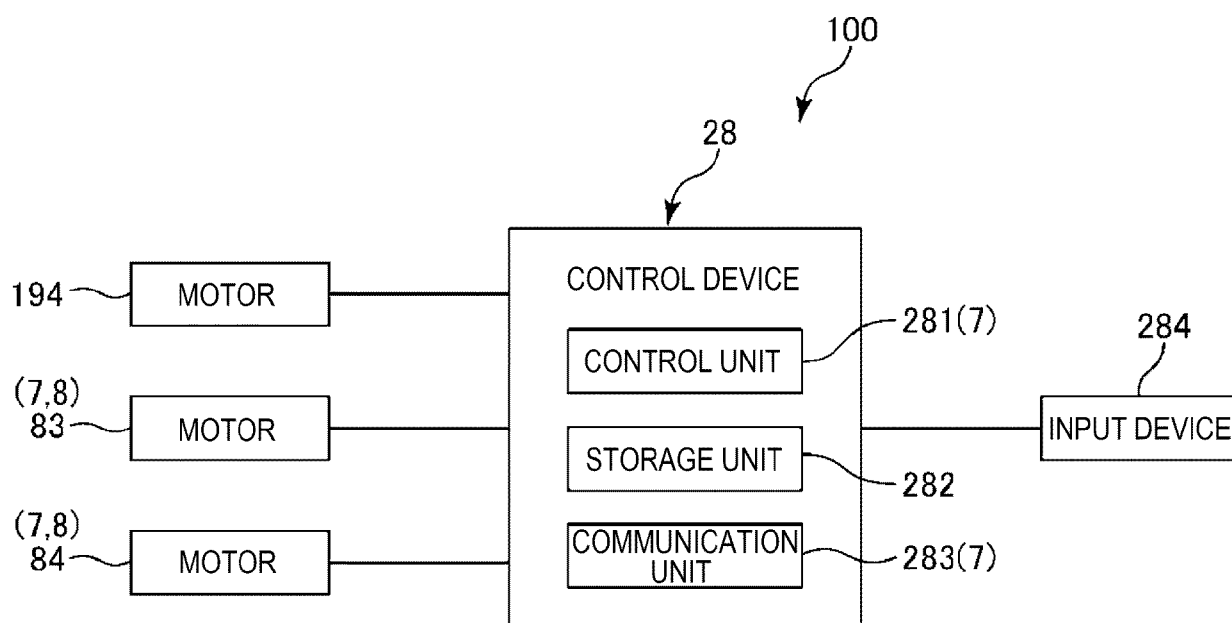


FIG. 3

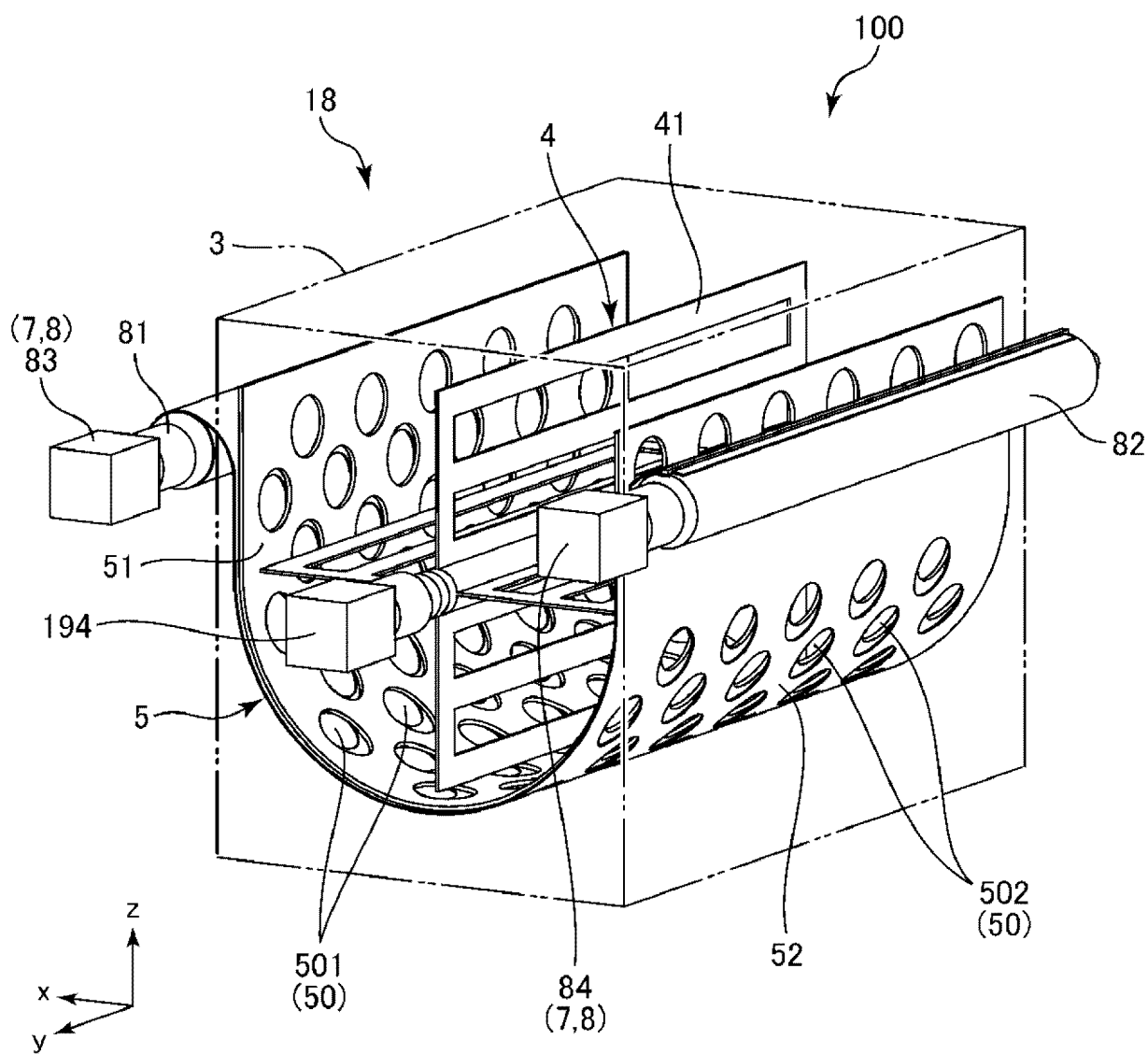


FIG. 4

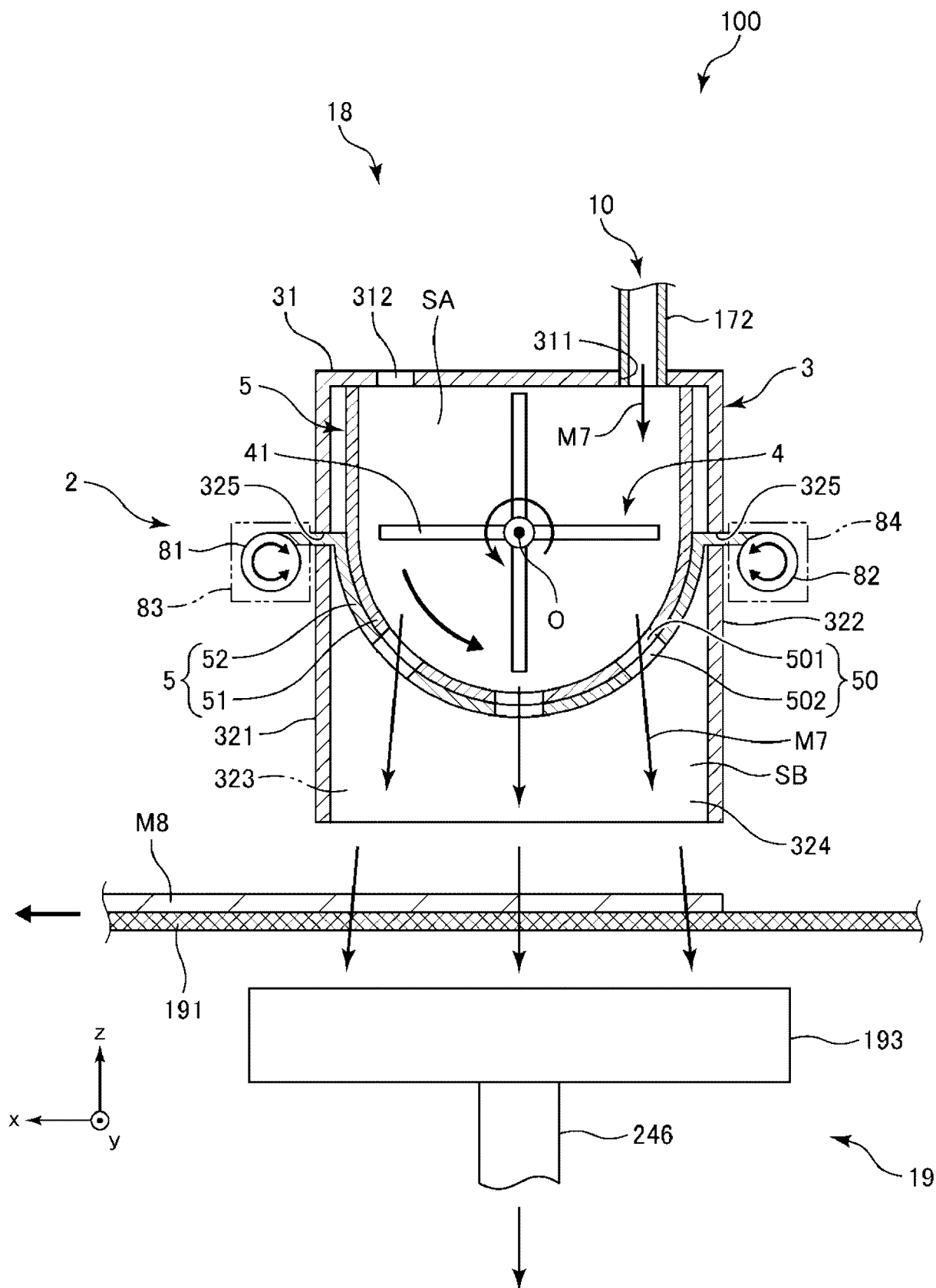


FIG. 5

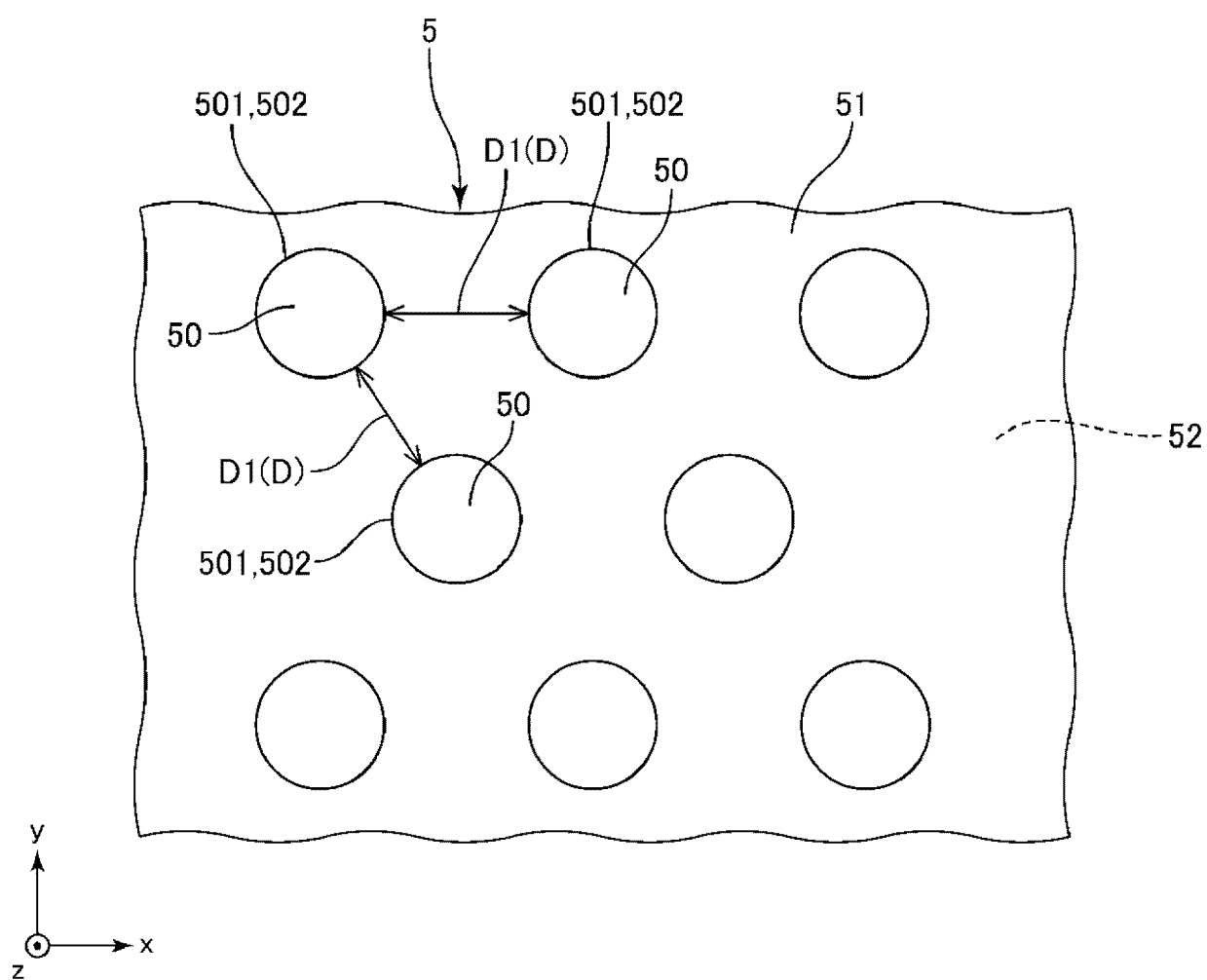


FIG. 6

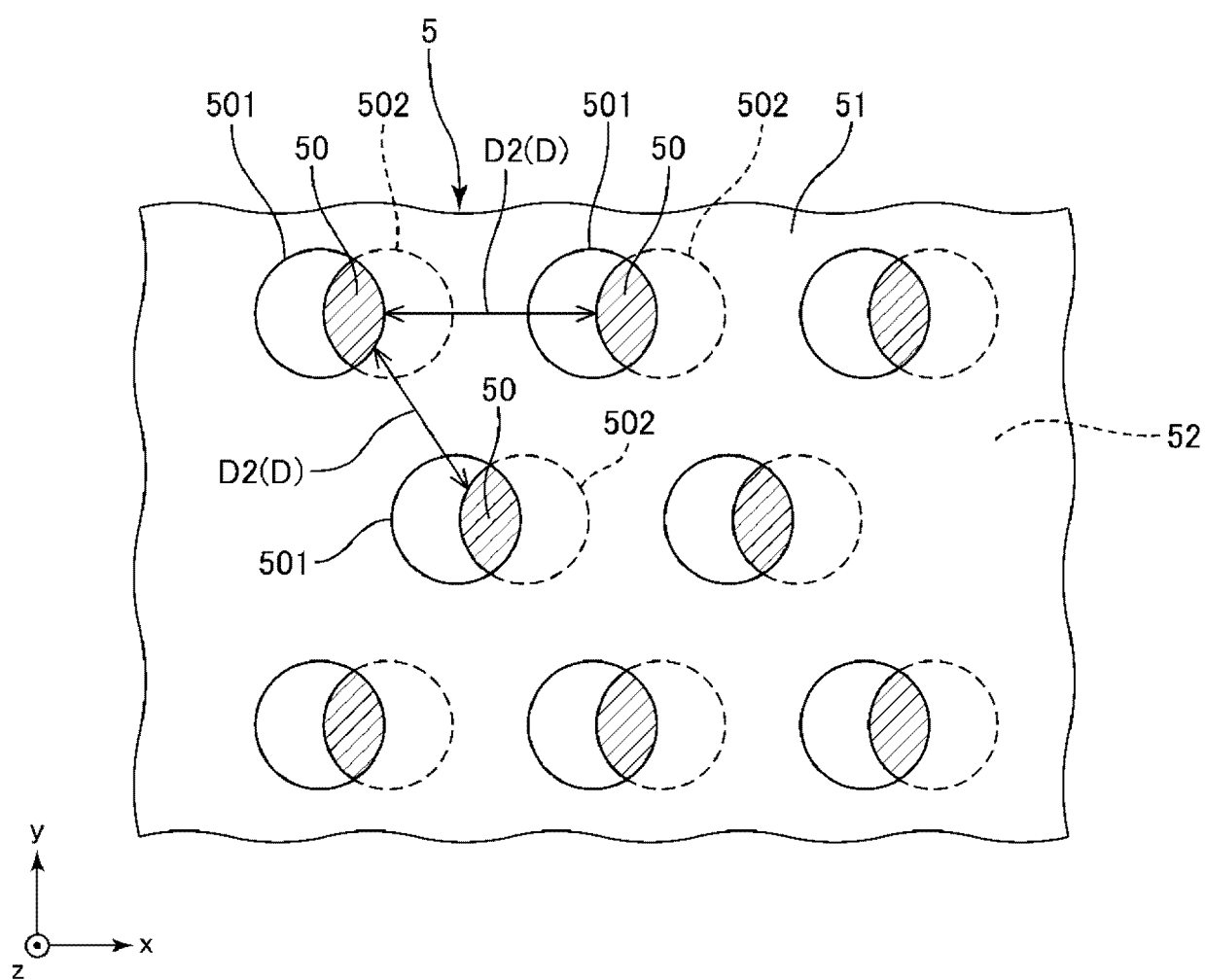


FIG. 7

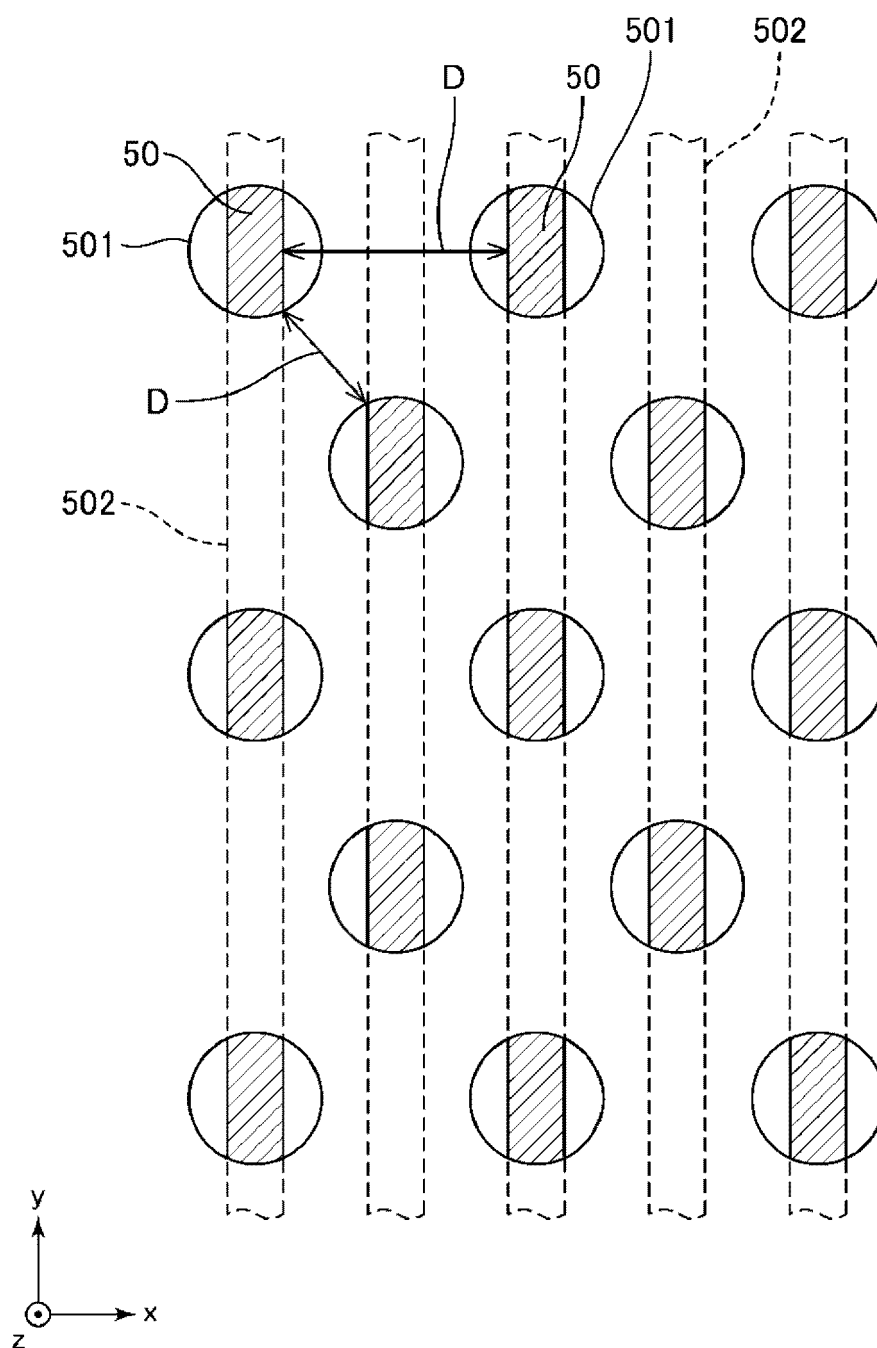


**FIG. 8**

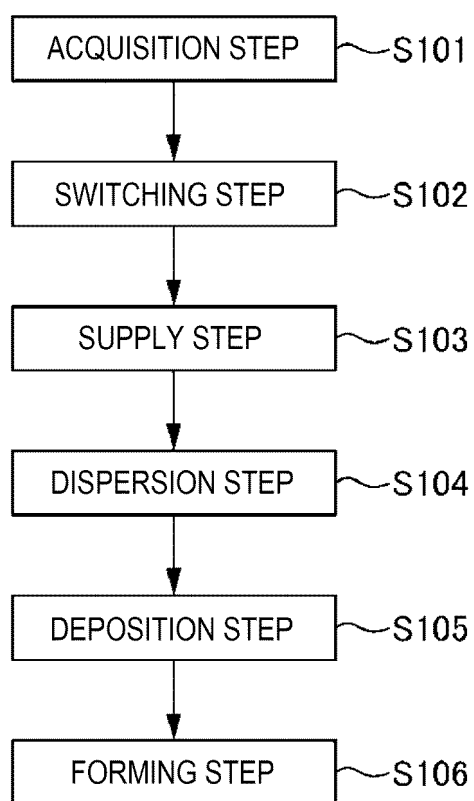


FIG. 9

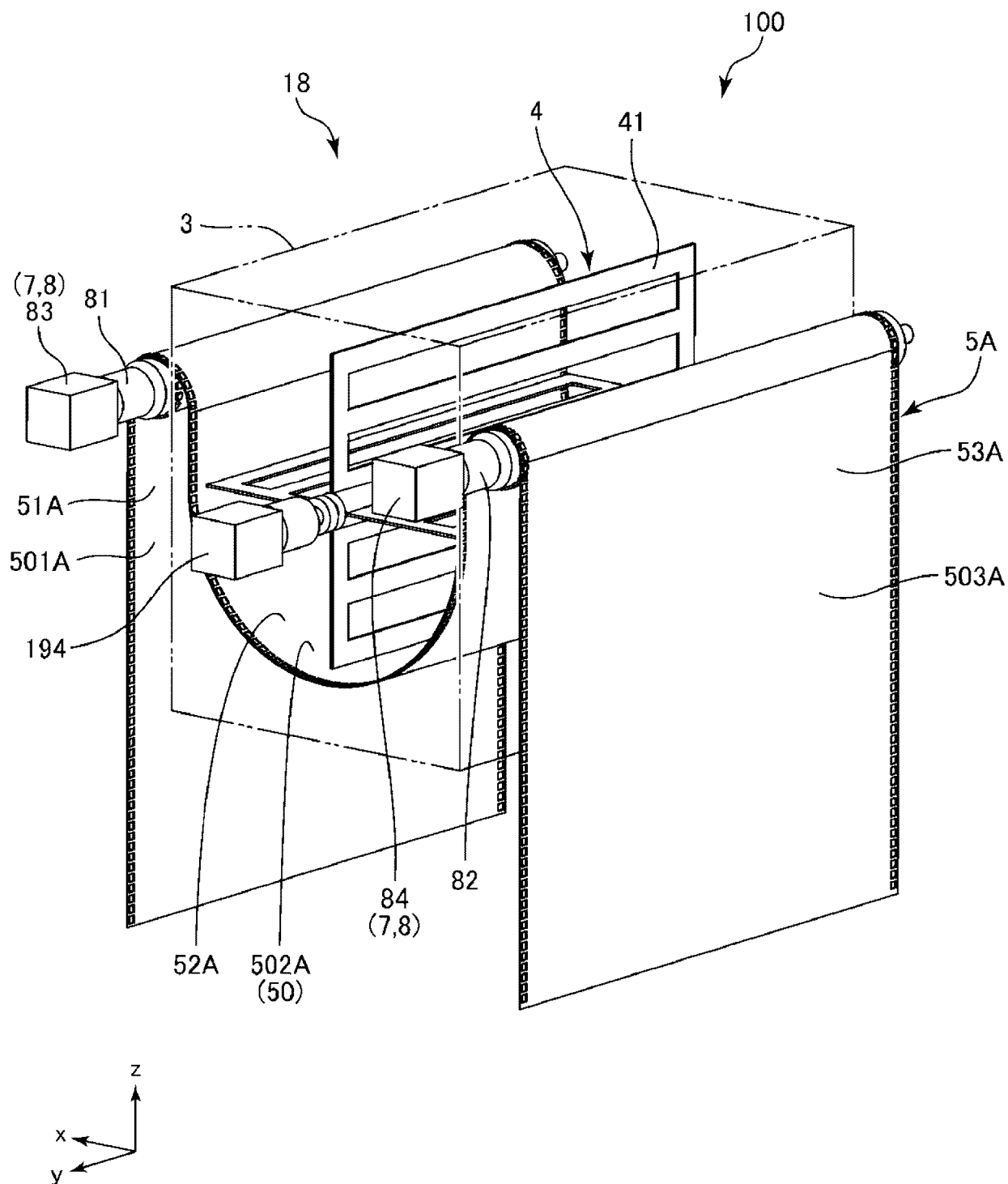


FIG. 10

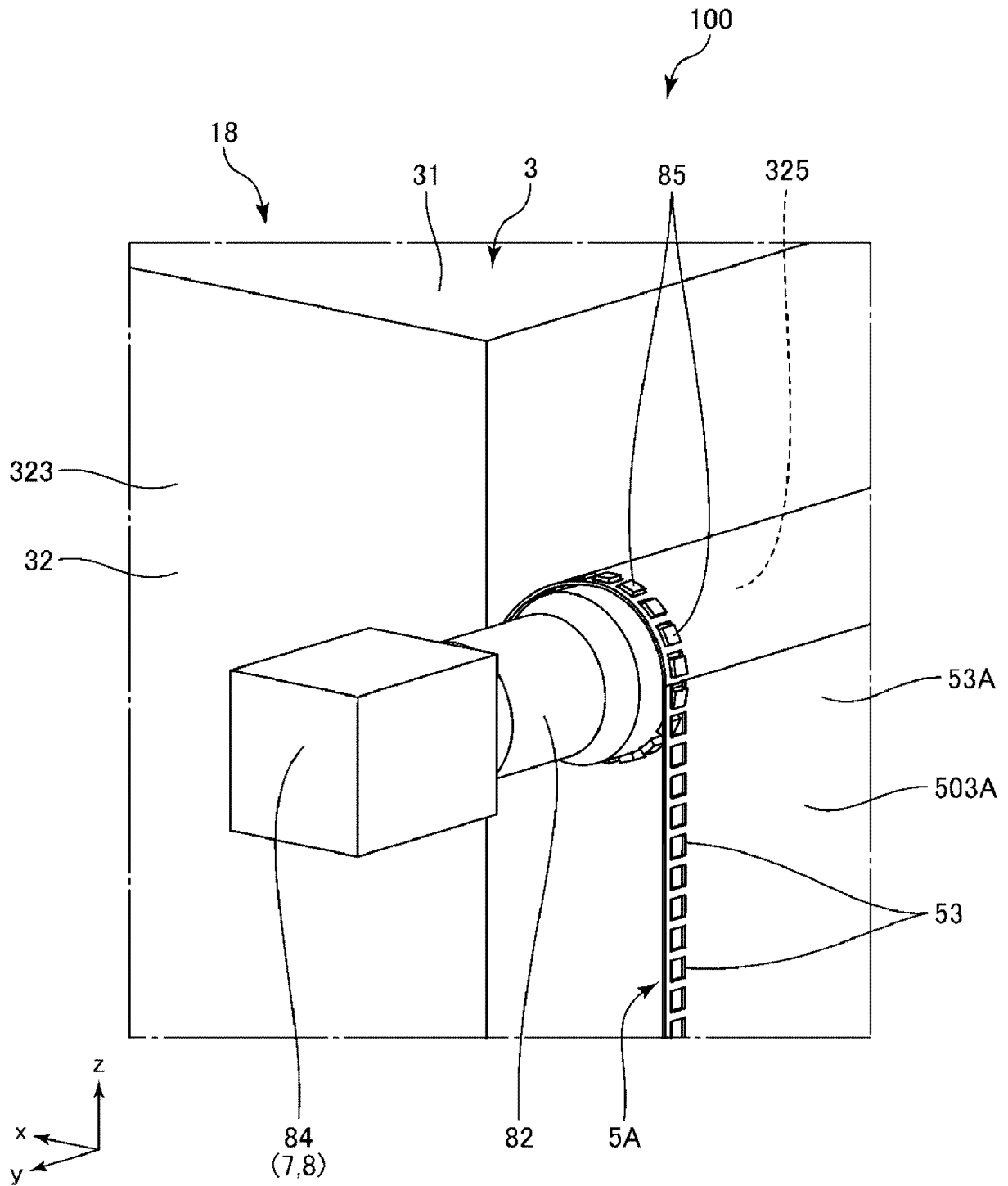


**FIG. 11**

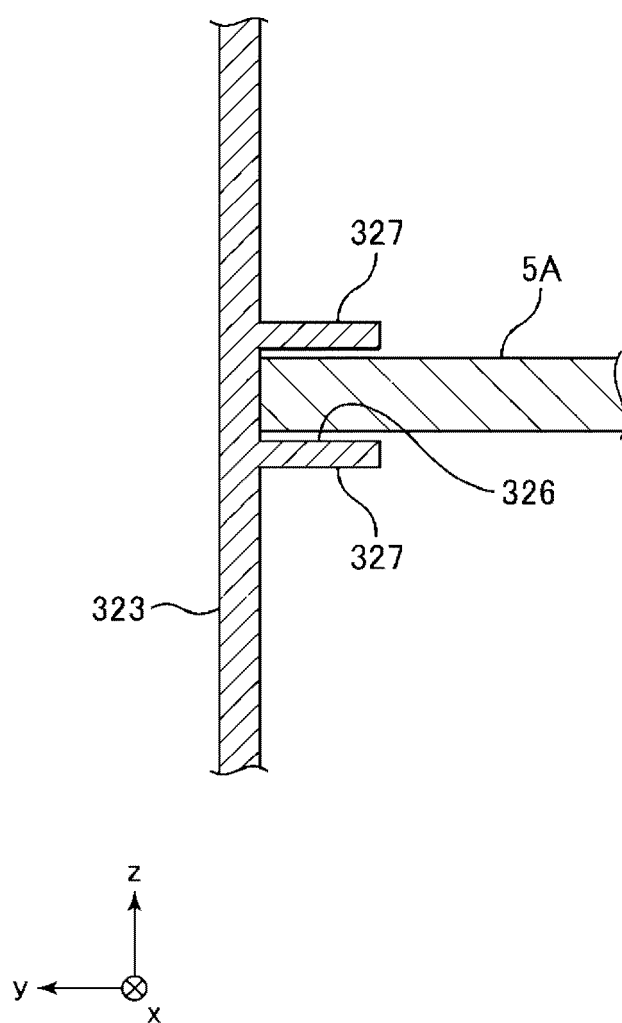


FIG. 12

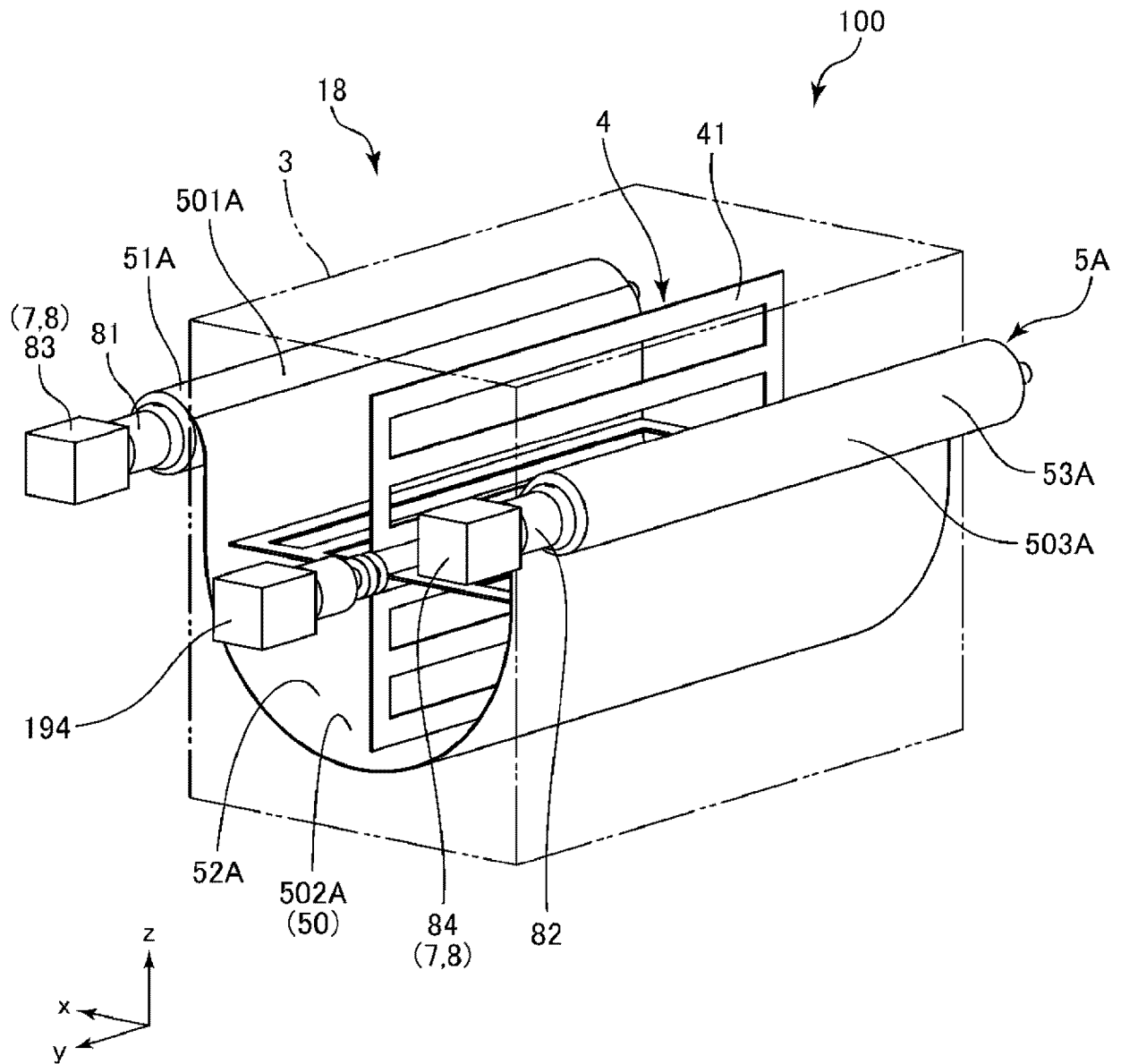


FIG. 13

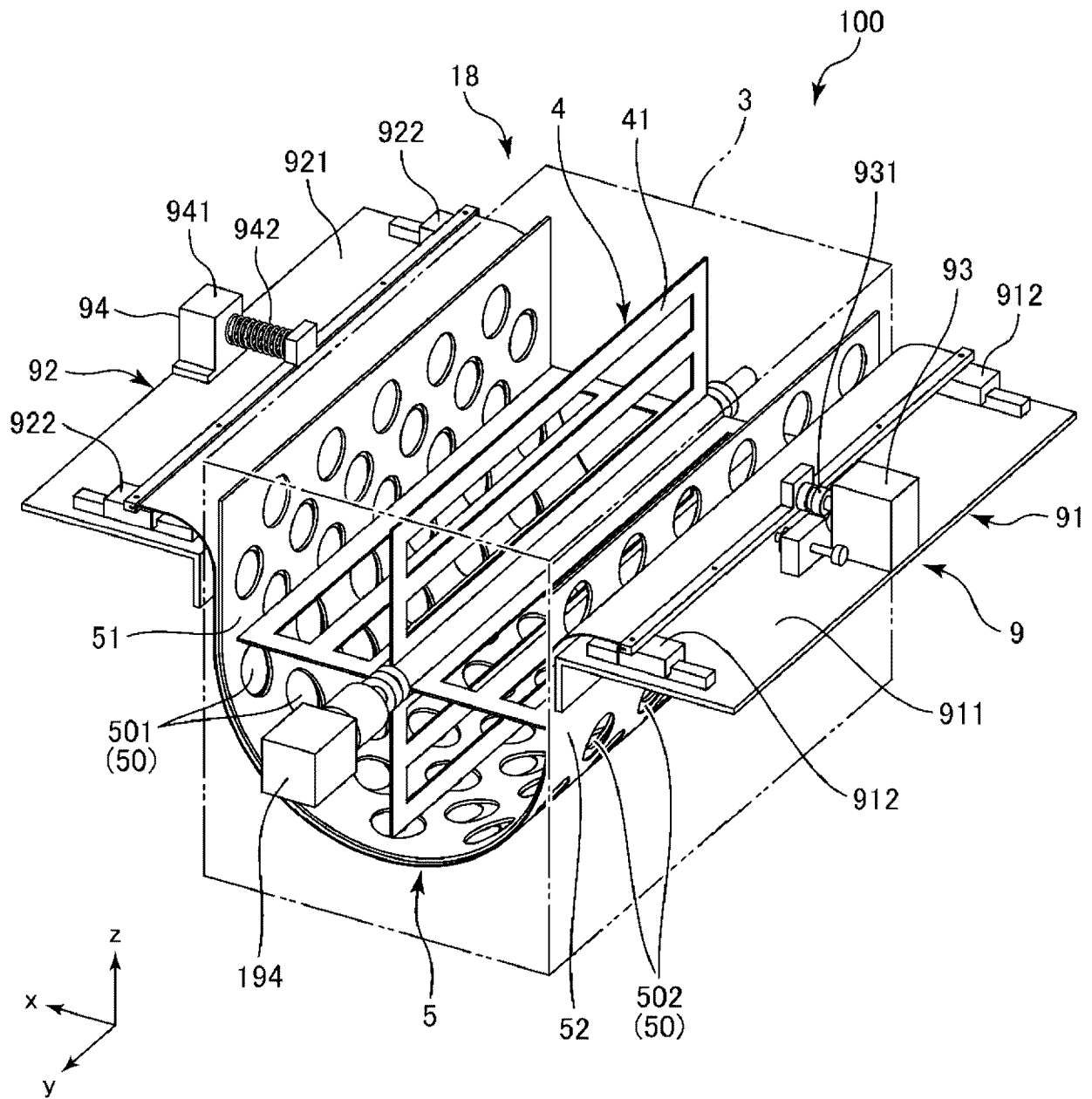


FIG. 14

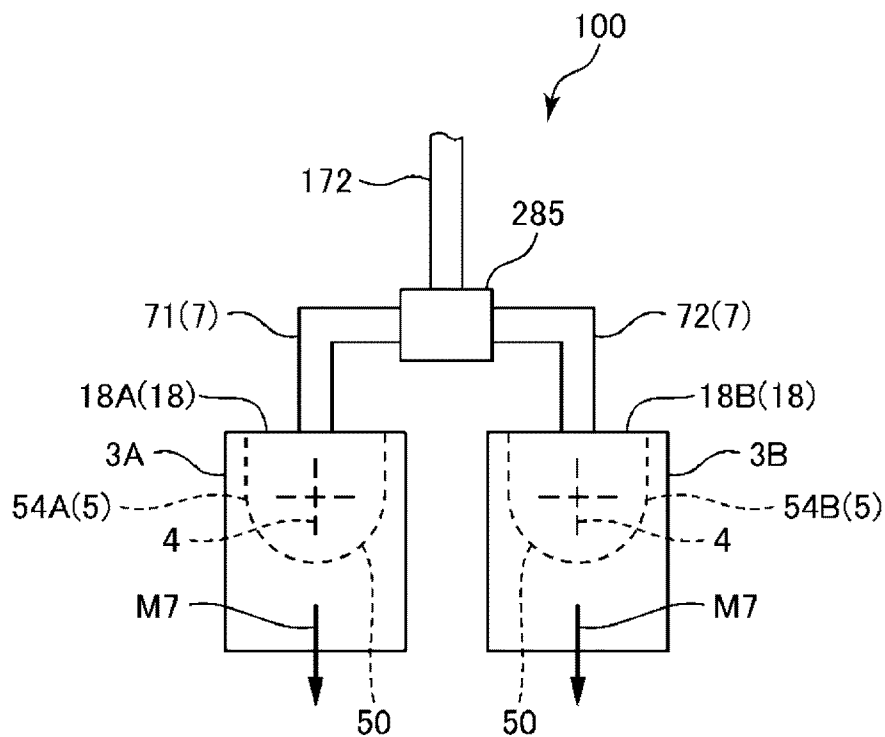
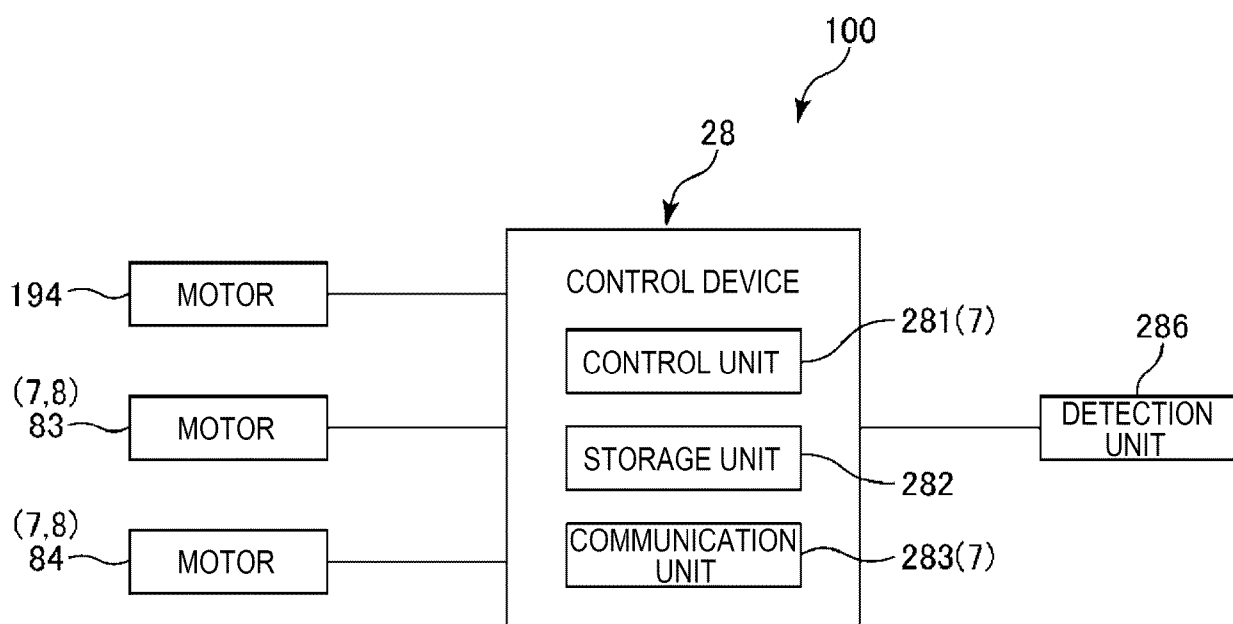


FIG. 15





## EUROPEAN SEARCH REPORT

Application Number

EP 26 16 8884

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category                                                                                                                                                                                                                                                                              | Citation of document with indication, where appropriate, of relevant passages              | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC)                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------|
| A                                                                                                                                                                                                                                                                                     | JP 2021 123066 A (SEIKO EPSON CORP)<br>30 August 2021 (2021-08-30)<br>* claim 1 *<br>----- | 1-11                             | INV.<br>D04H1/732<br>D04H1/58<br>D04H1/736<br>D21B1/10 |
|                                                                                                                                                                                                                                                                                       |                                                                                            |                                  | TECHNICAL FIELDS SEARCHED (IPC)                        |
|                                                                                                                                                                                                                                                                                       |                                                                                            |                                  | D04H<br>D21B                                           |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                            |                                                                                            |                                  |                                                        |
| Place of search                                                                                                                                                                                                                                                                       |                                                                                            | Date of completion of the search | Examiner                                               |
| Munich                                                                                                                                                                                                                                                                                |                                                                                            | 27 August 2026                   | Saunders, Thomas                                       |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                           |                                                                                            |                                  |                                                        |
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ON EUROPEAN PATENT APPLICATION NO.

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27-08-2026

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

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