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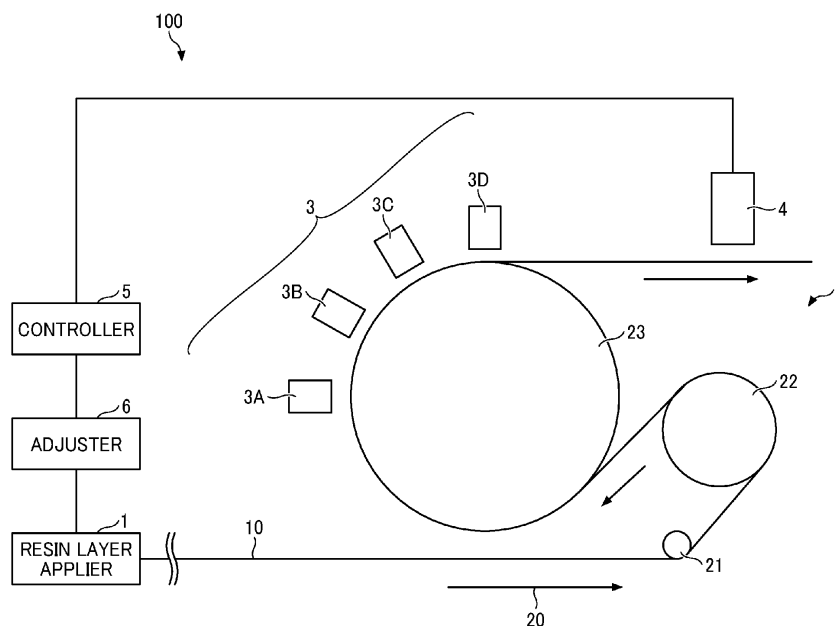
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(54) **LIQUID DISCHARGE APPARATUS, IMAGE FORMING APPARATUS, AND LIQUID DISCHARGE METHOD**

(57) A liquid discharge apparatus includes a conveyor (2) configured to convey a substrate (10) in a conveyance direction; a resin layer applicer (1) configured to apply a resin layer (30) containing a resin onto the substrate (10) conveyed by the conveyor (2), a liquid discharger (3) configured to discharge a liquid onto the resin layer (30) to apply a droplet (31) onto the resin layer (30), an

acquirer (4, 4a) configured to acquire a physical property of the resin layer (30), an adjuster (6) configured to adjust the physical property of the resin layer (30), and circuitry (5) configured to control the adjuster (6) to control the physical property of the resin layer (30) according to the physical property acquired by the acquirer (4, 4a).

FIG. 1



Description

BACKGROUND

Technical Field

[0001] An aspect of the present disclosure relates to a liquid discharge apparatus, an image forming apparatus, and a liquid discharge method.

Related Art

[0002] A liquid discharge apparatus applies (coats) a resin layer containing a polyvinyl chloride resin or the like containing a plasticizer on a substrate and discharges a liquid such as ink to apply droplets on the resin layer. Such liquid discharge apparatus includes an apparatus that forms an image on the substrate by a liquid discharge method to manufacture a sheet-like wallpaper.

[0003] Further, the liquid discharging apparatus controls an application amount of an aggregating agent applied onto the substrate such as a paper to adjust a diameter of droplets discharged onto the resin layer containing the aggregating agent or the like (see Japanese Unexamined Patent Application Publication No. 2010-184479, for example).

[0004] However, the resin layer applied onto the substrate changes its physical properties such as viscosity according to a surrounding environment such as temperature and humidity. Therefore, a state of spread of the droplet applied onto the resin layer is changed according to the physical properties of the resin layer. Thus, a state of the droplets on the resin layer is not stable. Thus, quality of an image or the like formed on the resin layer may not be stable.

SUMMARY

[0005] It is an object of the embodiments of the present disclosure to stabilize the state of the droplet applied on the resin layer.

[0006] In an aspect of this disclosure, a liquid discharge apparatus includes a conveyor configured to convey a substrate in a conveyance direction; a resin layer applier configured to apply a resin layer containing a resin onto the substrate conveyed by the conveyor, a liquid discharger configured to discharge a liquid onto the resin layer to apply a droplet onto the resin layer, an acquirer configured to acquire a physical property of the resin layer, an adjuster configured to adjust the physical property of the resin layer, and circuitry configured to control the adjuster to control the physical property of the resin layer according to the physical property acquired by the acquirer.

[0007] In another aspect of this disclosure, a liquid discharge method includes conveying a substrate in a conveyance direction, applying a resin layer containing a resin onto the substrate; discharging a liquid onto the resin

layer to apply a droplet onto the resin layer, acquiring a physical property of the resin layer; adjusting the physical property of the resin layer, and controlling the physical property of the resin layer according to the physical property acquired by the acquiring.

[0008] The liquid discharge apparatus according to the embodiments of the present disclosure can stabilize the state of the droplet applied on the resin layer.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] A more complete appreciation of the disclosure and many of the attendant advantages and features thereof can be readily obtained and understood from the following detailed description with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic side view of an overall configuration of an image forming apparatus according to a first embodiment of the present disclosure;

FIG. 2 is a schematic side view of an example of configuration of a resin layer applier and an adjuster according to the first embodiment of the present disclosure;

FIG. 3 is a block diagram illustrating an example of a hardware configuration of a controller;

FIG. 4 is a block diagram illustrating a functional configuration example of the controller according to the first embodiment of the present disclosure;

FIG. 5 is a side view of a droplet on a resin layer having a low viscosity;

FIG. 6 is a side view of a droplet on a resin layer having a high viscosity;

FIG. 7 is a schematic plan view of nozzle arrays in a nozzle surface of a head;

FIG. 8 is a schematic plan view of the resin layer on which an adjustment pattern including droplets applied onto the resin layer is formed;

FIG. 9 is a graph illustrating an example of the correspondence (correlation) between the diameter of the droplet applied on the resin layer and the viscosity of the resin layer;

FIG. 10 is a flowchart illustrating an example of an adjustment operation of the image forming apparatus according to the first embodiment;

FIG. 11 is a schematic cross-sectional side view of an example of the image forming apparatus according to a second embodiment of the present disclosure;

FIG. 12 is a block diagram illustrating a functional configuration example of the controller according to the second embodiment of the present disclosure; and

FIG. 13 is a flowchart illustrating an example of the adjustment operation of the image forming apparatus according to the second embodiment of the present disclosure.

[0010] The accompanying drawings are intended to depict embodiments of the present invention and should not be interpreted to limit the scope thereof. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted. Also, identical or similar reference numerals designate identical or similar components throughout the several views.

DETAILED DESCRIPTION

[0011] In describing embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that have a similar function, operate in a similar manner, and achieve a similar result.

[0012] Referring now to the drawings, embodiments of the present disclosure are described below. As used herein, the singular forms "a", "an", and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0013] Embodiments of the present disclosure are described in detail with reference to drawings. In the drawings, the same components are denoted by the same reference numerals, and redundant description is omitted as appropriate.

[0014] Further, the embodiments described below are some examples of a liquid discharge apparatus and an image forming apparatus for embodying the technical idea of the disclosure, and embodiments of the disclosure are not limited to the embodiments described below.

[0015] The dimensions, materials, shapes, relative configurations and the like of the components described below are intended to be illustrative and not limiting of the scope of the invention, unless otherwise specified. The size, positional relationship, and the like of members illustrated in the drawings may be magnified for clarity of description.

[0016] Hereinafter, an image forming apparatus serving as a liquid discharge apparatus according to a first embodiment of the present disclosure is described below. Note that image formation, recording, printing, and image printing in the terms of the embodiments are synonymous.

[0017] Further, "liquid" discharged from a head is not particularly limited as long as the liquid has a viscosity and surface tension of degrees dischargeable from the head. Preferably, the viscosity of the liquid is not greater than 30 mPa·s under ordinary temperature and ordinary pressure or by heating or cooling.

[0018] Examples of the liquid include a solution, a suspension, or an emulsion that contains, for example, a solvent, such as water or an organic solvent, a colorant, such as dye or pigment, a functional material, such as a polymerizable compound, a resin, or a surfactant, a biocompatible material, such as deoxyribonucleic acid

(DNA), amino acid, protein, or calcium, or an edible material, such as a natural colorant. The liquid can be used, for example, in applications such as ink jet inks.

[0019] The liquid discharger is a functional component that discharges and jets a liquid from a nozzle. Examples of an energy source for generating energy to discharge liquid include a piezoelectric actuator (a laminated piezoelectric element or a thin-film piezoelectric element), a thermal actuator that employs a thermoelectric conversion element, such as a thermal resistor, and an electrostatic actuator including a diaphragm and opposed electrodes.

[First Embodiment]

(Overall Configuration of Example of Image Forming Apparatus 100)

[0020] FIG. 1 is a schematic side view of an overall configuration of an image forming apparatus 100 according to a first embodiment of the present disclosure. As illustrated in FIG. 1, the image forming apparatus 100 includes a resin layer applier 1, a conveyor 2, a liquid discharger 3, a reader 4, a controller 5, and an adjuster 6.

[0021] The image forming apparatus 100 drives a resin layer applier 1 to apply a resin layer 30 (see FIG. 8) to a substrate 10. The image forming apparatus 100 further drives the liquid discharger 3 to discharges a liquid onto the resin layer 30 applied onto the substrate 10 to apply the liquid. The controller 5 of the image forming apparatus 100 controls the adjuster 6 to adjust physical properties of the resin layer 30 according to a reading result of the reader 4 that reads a pattern formed by the droplets applied on the resin layer 30.

[0022] For example, the image forming apparatus 100 applies droplets onto the resin layer 30 applied on the substrate 10 to form an image to manufacture the substrate 10 as a wallpaper. Material of the substrate 10 is not particularly limited as long as the material has suitable mechanical strength, heat resistance, and the like as a substrate of a wallpaper. A common substrate such as a paper and nonwoven fabric may be used as a wallpaper. More specifically, a natural paper, a plastic film, a synthetic paper, non-woven fabric, cloth, wood, metal thin-film and the like may be used as the substrate 10. Thus, the material of the substrate 10 is selected according to an application of the substrate 10.

[0023] The resin layer applier 1 applies (coats) a resin layer 30 containing resin to at least one surface of a smooth substrate 10 made of paper or non-woven fabric. Vinyl chloride resin, acrylic resin or the like can be used as the resin contained in the resin layer 30 to manufacture the wallpaper. The resin layer 30 may contain a plasticizer or may contain a plasticizer and a heating foaming agent. The resin layer 30 is applied (coated) on the substrate 10 in a state in which at least a vinyl chloride resin contains a plasticizer.

[0024] The conveyor 2 includes a conveyance roller

21, a preheat drum 22, and a heating drum 23. The conveyor 2 rotates each of the conveyance roller 21, the preheat drum 22, and the heating drum 23 to convey the substrate 10 stretched around the conveyance roller 21, the preheat drum 22, and the heating drum 23 along the predetermined conveyance direction 20. The conveyor 2 may further include other rollers or drums used for conveying the substrate 10.

[0025] The conveyor 2 includes a preheat drum 22 and a heating drum 23 on a downstream of the resin layer applicator 1 in the conveyance direction 20 as indicated by arrow in FIG. 1. Each of the preheat drum 22 and the heating drum 23 includes a heater inside the preheat drum 22 and the heating drum 23. Each of the preheat drum 22 and the heating drum 23 use the heater to heat the substrate 10 contacting an outer peripheral surface of the preheat drum 22 and the heating drum 23 while conveying the substrate 10.

[0026] The preheat drum 22 preheats the substrate 10 applied (coated) with the resin layer 30. The heating drum 23 conveys a region of the substrate 10 applied (coated) with the resin layer 30 to a position facing the liquid discharger 3 while heating the substrate 10 to a substantially constant temperature. The resin heated by the preheat drum 22 and the heating drum 23 gels so that the resin layer 30 is fixed on the substrate 10.

[0027] Although the preheat drum 22 and the heating drum 23 are not essential components of the conveyor 2, the image forming apparatus 100 preferably includes the heating drum 23 and the like to heat the resin layer 30 after applying (coating) the resin layer 30 on the substrate 10 from a viewpoint of stably fixing the resin layer 30 on the substrate 10.

[0028] The image forming apparatus 100 includes the liquid discharger 3 in a downstream of the resin layer applicator 1 in the conveyance direction 20. The liquid discharger 3 discharge droplets onto the resin layer 30 of the substrate 10 conveyed by the heating drum 23 to apply droplets on the resin layer 30 after the resin layer applicator 1 applies the resin layer 30 on the substrate 10.

[0029] The liquid discharger 3 includes liquid discharge heads 3A, 3B, 3C and 3D. Hereinafter, the "liquid discharge head" is simply referred to as a "head". The heads 3A, 3B, 3C and 3D are arrayed in parallel along the conveyance direction 20 to sequentially discharge a liquid toward the conveyed substrate 10.

[0030] Each of the heads 3A, 3B, 3C and 3D may discharge liquid of the same color or liquid of different color. For example, the heads 3A, 3B, 3C and 3D discharges liquid of cyan, magenta, yellow, and black to form a full-color image on the resin layer 30.

[0031] The liquid discharged from the liquid discharger 3 is, for example, an oil-based ink having no curing reactivity as a liquid. The oil-based ink contains at least an oil-based component and a coloring agent, and may contain a binder resin if necessary. The oil-based ink preferably contains 80% by mass or more of an oil-based component having a boiling point of 200°C or higher. The

oil-based component of the oil-based ink preferably contains ester oil as a main component.

[0032] The oil-based ink discharged from the liquid discharger 3 contains an oil-based component and a coloring agent. From the viewpoint of maintaining good ink fixing properties after image formation, a content of the ester oil is preferably 30% by mass or more, more preferably 50% by mass or more and 90% by mass or less. The oil-based ink may contain 5% by mass or less of water.

[0033] The reader 4 is an example of an acquirer to acquire physical property information of the resin layer 30. For example, the reader 4 is an in-line sensor that includes pixels such as a charge coupled device (CCD) and a complementary metal oxide semiconductor (CMOS) in a line shape.

[0034] The reader 4 is disposed such that pixels are arrayed in a direction substantially orthogonal to the conveyance direction 20. The reader 4 reads the pattern formed on the resin layer 30 on the substrate 10 conveyed along the conveyance direction 20 to shoot a two-dimensional pattern. However, the reader 4 is not limited to the in-line sensor, and may include a two-dimensional imaging element in which pixels such as the CCD and the CMOS are two dimensionally arrayed.

[0035] When the reader 4 reads the physical properties of the resin layer 30, the image forming apparatus 100 first drives the liquid discharger 3 to form a predetermined adjustment pattern (predetermined pattern) on the resin layer 30 to acquire the physical property information of the resin layer 30. Then, the reader 4 reads the adjustment pattern formed on the resin layer 30. The reader 4 is disposed downstream of the liquid discharger 3 in the conveyance direction 20.

[0036] The adjustment pattern is, for example, a dot pattern formed by droplets. The physical property of the resin layer 30 to be acquired is viscosity, for example. The droplets applied on the resin layer 30 spread differently according to the viscosity of the resin layer 30. Thus, the reader 4 reads an image of a dot pattern formed by the droplets and outputs a read image to the controller 5. In the following description, the viscosity of the resin layer 30 is an example of the physical properties of the resin layer 30.

[0037] The controller 5 controls a liquid discharge operation by the liquid discharger 3, a conveyance operation of the substrate 10 by the conveyor 2, and an adjustment operation of the adjuster 6 based on viscosity information of the resin layer 30.

[First Embodiment]

[Example of Configuration of Resin Layer Applicator 1 And Adjuster 6]

[0038] FIG. 2 is a schematic side view of an example of configuration of the resin layer applicator 1 and the adjuster 6 according to the first embodiment of the present

disclosure.

[0039] The resin layer applier 1 includes a mixed liquid storage 11, a stirrer 12, an application roller 13, and a blade 14. A resin layer applier 1 coats the substrate 10 with the resin layer 30 formed from a mixed liquid 15 of a resin and a diluent that dilutes the mixed liquid to change a rate of the resin contained in the resin layer 30. Examples of the diluent include water, thinner, and organic solvent.

[0040] The mixed liquid storage 11 is a container to store the mixed liquid 15. A vertically upper part of the mixed liquid storage 11 is open to the atmosphere.

[0041] The stirrer 12 includes blades rotatably disposed inside the mixed liquid storage 11. The stirrer 12 rotates and stirs the mixed liquid 15 stored in the mixed liquid storage 11. Thus, the stirrer 12 stirs the mixed liquid 15 so that the ratio of the resin to the diluent is substantially constant over the entire mixed liquid 15.

[0042] The substrate 10 is stretched around an outer peripheral surface of the application roller 13. The application roller 13 is immersible a part of the substrate 10 in the mixed liquid 15 through a vertically upper part of the mixed liquid storage 11 opening to the atmosphere. The substrate 10 is stretched around the application roller 13 as described above. The mixed liquid 15 is adhered to an immersed region of the substrate 10 immersed in the mixed liquid 15.

[0043] The blade 14 is disposed on a downstream of the immersed region of the substrate 10 in the conveyance direction 20. A leading edge of the blade 14 is brought into contact with the surface of the substrate 10 conveyed along the conveyance direction 20. Thus, the blade 14 regulates a thickness of the mixed liquid 15 adhered onto the surface of the substrate 10 so that the thickness of the mixed liquid 15 becomes substantially constant. As a result, the mixed liquid 15 is applied onto the surface of the substrate 10 at a substantially constant thickness. Thus, the resin layer 30 made of the mixed liquid 15 is applied (coated) on the substrate 10.

[0044] Examples of methods of applying the resin layer 30 onto the substrate 10 by the resin layer applier 1 includes, but not limited to, a nozzle coating method, a die coating method, a lip coating method, a comma coating method, a gravure coating method, a rotary screen coating method, a reverse roll coating method, and the like in addition to the methods described above.

[0045] The adjuster 6 includes a diluent tank 61, a diluent switch valve 62, a diluent supply nozzle 63, a resin tank 64, a resin switch valve 65, and a resin supply nozzle 66. The adjuster 6 supplies at least one of a resin or a diluent to the mixed liquid storage 11 to adjust the physical properties of the resin layer 30 applied to the substrate 10. Any liquid may be used as the diluent as long as the liquid is dilutable viscosity and other physical properties of the mixed liquid 15.

[0046] The diluent tank 61 is a container to store a diluent. One end of the diluent supply nozzle 63 is connected to the diluent tank 61 via the diluent switch valve 62. The

diluent switch valve 62 is an electromagnetic valve switchable in response to a control signal from the controller 5. Another end of the diluent supply nozzle 63 is coupled (connected) to the mixed liquid storage 11. The diluent tank 61 and the mixed liquid storage 11 communicate with each other through a diluent supply nozzle 63.

[0047] The diluent tank 61 is disposed such that a liquid level of the diluent stored in the diluent tank 61 is higher than a liquid level of the mixed liquid 15 in the mixed liquid storage 11 in a vertical direction. Therefore, the diluent in the diluent tank 61 flows toward the mixed liquid storage 11 by the water head pressure and is supplied to the mixed liquid storage 11 in response to an opening of the diluent switch valve 62. Supply of the diluent to the mixed liquid storage 11 is stopped in response to a closing of the diluent switch valve 62.

[0048] The resin tank 64 is a container to store a liquid resin. One end of the resin supply nozzle 66 is coupled (connected) to the resin tank 64 via the resin switch valve 65. The resin switch valve 65 is an electromagnetic valve switchable in response to a control signal from the controller 5. Another end of the resin supply nozzle 66 is coupled (connected) to the mixed liquid storage 11. The resin tank 64 and the mixed liquid storage 11 communicate with each other through a resin supply nozzle 66.

[0049] The resin tank 64 is disposed such that a liquid level of the diluent stored in the diluent tank 61 is higher than a liquid level of the mixed liquid 15 in the mixed liquid storage 11 in a vertical direction. Therefore, the resin in the resin tank 64 flows toward the mixed liquid storage 11 by the water head pressure and is supplied to the mixed liquid storage 11 in response to an opening of the resin switch valve 65. When the resin switch valve 65 is closed, the supply of the resin to the mixed liquid storage 11 is stopped.

[0050] The supply of the diluent to the mixed liquid storage 11 increase a rate of the diluent in the mixed liquid 15 in the mixed liquid storage 11. Thus, the viscosity of the mixed liquid decreases, and the viscosity of the resin layer 30 formed by the mixed liquid 15 decreases. The supply of the resin to the mixed liquid storage 11 increase a rate of the resin in the mixed liquid 15 in the mixed liquid storage 11. Thus, the viscosity of the mixed liquid 15 increases, and the viscosity of the resin layer 30 by the mixed liquid 15 increases. Therefore, the adjuster 6 supplies at least one of the diluent and the resin to the mixed liquid storage 11 or stops the supply of at least one of the diluent and the resin to the mixed liquid storage 11 in response to a control signal from the controller 5. Thus, the adjuster 6 is adjustable the viscosity of the resin layer 30.

[0051] The image forming apparatus 100 according to the first embodiment as described above illustrates a configuration in which a head pressure is used to supply the diluent and the resin to the substrate 10. However, the image forming apparatus 100 according to the first embodiment is not limited to the embodiment as described above, and the image forming apparatus 100

may use a pump or the like to supply the diluent and the resin to the substrate 10.

[0052] A configuration of the adjuster 6 and a method to adjust the physical properties of the liquid by the adjuster 6 are not limited to the configuration and the method as described with reference to FIG. 2. Any adjustment method may be used as long as the physical properties of the liquid are adjustable.

[Configuration of Controller 5]

[0053] FIG. 3 is a block diagram illustrating an example of a hardware configuration of the controller 5.

[0054] The controller 5 includes a central processing unit (CPU 101), a read only memory (ROM 102), a random-access memory (RAM 103), a hard disk drive (HDD) / solid state drive (SSD) 104, and an interface (I/F 105). The hard disk drive (HDD) / solid state drive (SSD) 104 is simply referred to as a "HDD/SSD 104". The above-described elements are electrically connected (coupled) via a system bus B. The resin layer applier 1, the conveyor 2, the liquid discharger 3, the reader 4, the adjuster 6, and the like are coupled (connected) to the system bus B.

[0055] The CPU 101 is a processor that uses the RAM 103 as a work area and executes programs stored in the ROM 102. The HDD/SSD 104 is used as storage and stores preset setting values. The CPU 101 may read information stored in the HDD/SSD 104 and use the information to execute a program. The I/F 105 is an interface to communicatively connecting the controller 5 and an external device 7 such as a client personal computer (PC).

[0056] FIG. 4 is a block diagram illustrating a functional configuration example of the controller 5 according to the first embodiment of the present disclosure.

[0057] The controller 5 includes a resin layer application controller 51, a conveyance controller 52, a discharge controller 53, a physical property information acquisition unit 54, an adjustment controller 55, and an input-output unit 56. The CPU 101 illustrated in FIG. 3 executes a predetermined program or the like to realize the above-described functions. The controller 5 may include functions other than the functions as described above.

[0058] The resin layer application controller 51 controls an operation of the resin layer applier 1. The conveyance controller 52 controls an operation of the conveyor 2. The discharge controller 53 controls an operation of the liquid discharger 3. The adjustment controller 55 controls an operation of the adjuster 6.

[0059] The physical property information acquisition unit 54 performs image processing on a read image input from the reader 4. The physical property information acquisition unit 54 detects a diameter of the droplet included in the adjustment pattern in the read image. Then, the physical property information acquisition unit 54 refers to a predetermined correspondence (correlation) between the diameter of the droplet and the viscosity of the resin layer 30 to acquire the viscosity information of the

resin layer 30 based on the detected diameter of the droplet. The physical property information acquisition unit 54 outputs the physical property information to the adjustment controller 55. The reader 4 may include functions of the physical property information acquisition unit 54.

[0060] The adjustment controller 55 outputs a control signal to control opening and closing of the diluent switch valve 62 and the resin switch valve 65 in accordance with the property information of the resin layer input from the physical property information acquisition unit 54. The adjustment controller 55 controls the adjuster 6 to control the supply of each of the diluent and the resin to the mixed liquid storage 11 to adjust a viscosity of the resin layer 30.

[An Example of a Droplet on The Resin Layer 30]

[0061] FIG. 5 is a side view of a droplet 31 on a resin layer 30a applied (coated) on the substrate 10. The resin layer 30a has a low viscosity. In FIG. 5, the droplet 31 is applied on the resin layer 30a applied (coated) on the substrate 10.

[0062] FIG. 6 is a side view of a droplet 31 on a resin layer 30b applied (coated) on the substrate 10. The resin layer 30b has a viscosity higher than the viscosity of the resin layer 30a. In FIG. 6, the droplet 31 is applied on the resin layer 30b applied (coated) on the substrate 10.

[0063] Since the viscosity of the resin layer 30a is higher than the viscosity of the resin layer 30b so that a wettability (hydrophilicity) of the resin layer 30a is higher than a wettability (hydrophilicity) of the resin layer 30b. Thus, a wet-spreadability of the droplets 31 on the resin layer 30a is larger than the wet-spreadability of the droplets 31 on the resin layer 30b. As a result, a diameter D_a of the droplet 31 on the resin layer 30a is larger than a diameter D_b of the droplet 31 on the resin layer 30b.

[Example of Adjustment Pattern]

[0064] FIGS. 7 and 8 illustrate an example of the adjustment pattern.

[0065] FIG. 7 is a schematic plan view of nozzle arrays 3Aa to 3Ad in a nozzle surface of the head 3A.

[0066] FIG. 7 illustrates the nozzle arrays 3Aa to 3Ad formed in the nozzle surface of the head 3A. Each of the nozzle arrays 3Aa to 3Ad includes multiple nozzles.

[0067] FIG. 8 is a schematic plan view of the resin layer 30 on which an adjustment pattern is formed. The head 3A discharges (applies) droplets 31 from the nozzles on the resin layer 30 to form the adjustment pattern on the resin layer 30.

[0068] FIG. 8 is a plan view of the resin layer 30 viewed from an application surface of the droplets 31 of the resin layer 30 onto which the droplets 31 are applied. The resin layer 30 is applied onto the substrate 10 as described above.

[0069] As illustrated in FIG. 7, the head 3A includes nozzle arrays 3Aa to 3Ad. Each of the nozzle arrays 3Aa to 3Ad includes the multiple nozzles from which the drop-

lets 31 are discharged. The multiple nozzles are arrayed in each of the nozzle arrays 3Aa to 3Ad in a direction orthogonal to the conveyance direction 20. Although the head 3A is illustrated as an example here, the heads 3A to 3D in the liquid discharger 3 have the same configuration. Thus, the head 3A in FIG. 7 may be any one of the heads 3A to 3D.

[0070] As illustrated in FIG. 8, the adjustment pattern 32 includes a pattern 32a, a pattern 32b, a pattern 32c, and a pattern 32d. The pattern 32a is formed by droplets 31 discharged from the nozzle array 3Aa. The pattern 32b is formed by droplets 31 discharged from the nozzle array 3Ab. The pattern 32c is formed by droplets 31 discharged from the nozzle array 3Ac. The pattern 32d is formed by droplets 31 discharged from the nozzle array 3Ad.

[0071] The adjustment pattern 32 is a dot pattern applied on the resin layer 30 at intervals such that the droplets 31 discharged from the nozzles included in each of the nozzle arrays 3Aa to 3Ad do not coincide and unite with each other.

[0072] The reader 4 reads the adjustment pattern 32 and outputs the read image to the controller 5. The physical property information acquisition unit 54 of the controller 5 performs image processing on the read image of the adjustment pattern 32 and detects the diameter of the droplet 31 corresponding to one dot in the read image.

[0073] The physical property information acquisition unit 54 may detect diameter information of a predetermined droplet 31 among the multiples droplets 31 included in the adjustment pattern 32. The physical property information acquisition unit 54 may also detect an average value or the like of the diameter information of the multiple droplets 31 as the diameter information of the droplets 31. Thus, the physical property information acquisition unit 54 detects a diameter of at least one of the multiple droplets 31 in the adjustment pattern 32.

[Example of Correspondence (Correlation) Between Diameter of Droplet 31 and Viscosity of Resin Layer 30]

[0074] FIG. 9 is a graph illustrating an example of the correspondence (correlation) between the diameter of the droplet 31 applied on the resin layer 30 and the viscosity of the resin layer 30. In FIG. 9, a horizontal axis represents the viscosity of the resin layer 30, and a vertical axis represents the diameter of the droplet 31.

[0075] As the viscosity of the resin layer 30 increases, the wettability of the resin layer 30 decreases, so that the wet-spreadability of the droplets 31 applied on the resin layer 30 decreases, and the diameter of the droplets 31 decreases.

[0076] The correspondence (correlation) illustrated in FIG. 9 is stored in advance in the HDD/SSD 104 or the like as a correspondence table. The physical property information acquisition unit 54 refers to the correspondence table stored in the HDD/SSD 104 based on the diameter information of the detected droplet 31 to acquire

the viscosity information of the resin layer 30.

[Operation Example of Image Forming Apparatus 100]

[0077] FIG. 10 is a flowchart illustrating an example of a viscosity adjustment operation of the resin layer 30 by the image forming apparatus 100.

[0078] FIG. 10 illustrates an adjustment operation triggered by starting the viscosity adjustment operation of the resin layer 30 by the image forming apparatus 100. A trigger of the viscosity adjustment operation may be automatically triggered at a predetermined timing. A trigger of the viscosity adjustment operation may also be triggered in response to an operation input signal from the user of the image forming apparatus 100 to the image forming apparatus 100.

[0079] The image forming apparatus 100 can appropriately perform the operation illustrated in FIG. 10 according to a usage, a usage environment, or the like of the image forming apparatus 100. For example, the image forming apparatus 100 may perform the operation illustrated in FIG. 10 each time the image forming apparatus 100 performs image formation. Alternatively, the image forming apparatus 100 may also perform the operation illustrated in FIG. 10 once in a predetermined timing such as a start-up time of the image forming apparatus 100.

[0080] First, the image forming apparatus 100 applies (coats) the resin layer 30 on the substrate 10 by the resin layer applier 1 in step S101.

[0081] Subsequently, the liquid discharger 3 of the image forming apparatus 100 discharges the droplets 31 while the substrate 10 is conveyed by the conveyor 2 in step S102. The image forming apparatus 100 applies the droplets 31 onto the resin layer 30 applied (coated) onto the substrate 10 to form a predetermined adjustment pattern 32 on the resin layer 30. The adjustment pattern 32 is, for example, a dot pattern.

[0082] In step S103, the reader 4 of the image forming apparatus 100 reads the adjustment pattern 32 formed on the resin layer 30.

[0083] Subsequently, the controller 5 of the image forming apparatus 100 performs image processing on the read image of the adjustment pattern 32 by the reader 4 in step S104. The image forming apparatus 100 detects the diameter of the droplet 31 included in the adjustment pattern 32.

[0084] Subsequently, the image forming apparatus 100 determines whether the diameter of the detected droplet 31 is within a target diameter range in step S105. The target diameter range is an example of a predetermined diameter range.

[0085] If the image forming apparatus 100 determines that the diameter of the droplet 31 is within the target diameter range in step S105 (step S105, YES), the image forming apparatus 100 ends the operation. On the other hand, if the image forming apparatus 100 determines that the diameter of the droplet 31 is not within the target

diameter range (step S105, NO), the image forming apparatus 100 determines whether the diameter of the droplet 31 is below the target diameter range in step S106.

[0086] If the image forming apparatus 100 determines that the diameter of the droplet 31 is below the target diameter range in step S106 (step S106, YES), the image forming apparatus 100 supplies the diluent to the mixed liquid storage 11 by the adjuster 6 to reduce the viscosity of the mixed liquid 15 and reduce the viscosity of the resin layer 30 in step S107.

[0087] If the image forming apparatus 100 determines that the diameter of the droplet 31 is not below (above) the target diameter range in step S106 (step S106, NO), the image forming apparatus 100 supplies the resin to the mixed liquid storage 11 by the adjuster 6 to increase the viscosity of the mixed liquid 15 and increase the viscosity of the resin layer 30 in step S108.

[0088] In the above way, the image forming apparatus 100 can adjust the viscosity of the resin layer 30.

[Operational Effect of Image Forming Apparatus 100]

[0089] Next, an operational effect of the image forming apparatus 100 is described below.

[0090] A sheet-like wallpaper with excellent design is used for the inner walls and ceilings of buildings.

[0091] To produce the wallpaper, a resin layer made of a polyvinyl chloride resin containing a plasticizer is applied (coated) on a noncombustible substrate such as a base paper or a non-woven fabric. Then an image forming apparatus forms an image on the resin layer by a liquid discharge method.

[0092] However, a wettability of the resin layer 30 changes due to an influence of temperature and humidity around an image forming apparatus. In a conventional image forming apparatus. When the wettability of the resin layer is high, the droplets on the resin layer are easy to spread. When the wettability of the resin layer is low, the droplets on the resin layer are not easily spread. As a result, a coverage of the droplets on the substrate differs according to temperature and humidity. In some cases, quality of a formed image varies and becomes unstable.

[0093] To solve the above-described problem, an operator may perform an operation such as adding a diluent to the resin layer while visually confirming quality of image formed on the substrate. However, the above operation increases work man-hours and may cause problems such as variance in the image quality depending on the operator who performs the work.

[0094] An image forming apparatus 100 according to the first embodiment includes the conveyor 2 to convey the substrate 10 in the conveyance direction 20, a resin layer applier 1 to apply the resin layer 30 containing a resin to the substrate 10, and a liquid discharger 3 to discharge a liquid to apply droplets 31 on the resin layer 30. The image forming apparatus 100 includes the reader

4 (er), the adjuster 6, and the controller 5. The reader 4 (acquirer) acquires the physical property information of the resin layer 30. The adjuster 6 adjusts the viscosity (physical property) of the resin layer 30. The controller 5 controls an adjustment operation of the adjuster 6.

[0095] For example, the resin layer applier 1 applies the mixed liquid 15 onto the substrate 10 to apply the resin layer 30 onto the substrate 10. The mixed liquid 15 is a mixture of a resin and a diluent. The diluent dilutes the mixed liquid to change a rate of the resin contained in the resin layer 30. The mixed liquid 15 is stored in the mixed liquid storage 11. The adjuster 6 supplies at least one of a resin and a diluent to a mixed liquid storage 11 to adjust the viscosity of the resin layer 30.

[0096] The liquid discharger 3 applies the droplets 31 onto the resin layer 30 to form the adjustment pattern 32 (predetermined pattern). The reader 4 acquires the viscosity information of the resin layer 30 based on the adjustment pattern 32 formed on the resin layer 30.

[0097] With the above-described configuration, the image forming apparatus 100 uses the adjuster 6 to adjust the viscosity of the resin layer 30 based on the viscosity information of the resin layer 30 acquired from the reading result of the adjustment pattern 32 read by the reader 4 even when the viscosity of the resin layer 30 changes due to changes in temperature and humidity around the image forming apparatus 100. As a result, the image forming apparatus 100 (liquid discharge apparatus) can reduce a change in the viscosity of the resin layer 30 and stabilize a state of the droplets 31 applied on the resin layer 30.

[0098] The reader 4 in the image forming apparatus 100 according to the first embodiment acquires the viscosity information of the resin layer 30 based on the diameter of the droplet 31 included in the adjustment pattern 32 formed on the resin layer 30. The reader 4 is disposed in a downstream of the liquid discharger 3 in the conveyance direction 20 so that the reader 4 acquires the viscosity information in a downstream of the liquid discharger 3 in the conveyance direction 20.

[0099] For example, the adjuster 6 supplies a resin to the mixed liquid storage 11 to adjust the viscosity of the resin layer 30 when the diameter of the droplet 31 is above the target diameter range (predetermined diameter range). Further, the adjuster 6 supplies a diluent to the mixed liquid storage 11 to adjust the viscosity of the resin layer 30 when the diameter of the droplet 31 is below the target diameter range (predetermined diameter range).

[0100] The reader 4 acquires the viscosity information of the resin layer 30 from the diameter of the droplet 31 applied (coated) on the resin layer 30 by the liquid discharger 3. Thus, the image forming apparatus 100 can further accurately acquire a change in the viscosity of the resin layer 30 that affects a state of the droplets 31. As a result, the image forming apparatus 100 (liquid discharge apparatus) can reduce a change in the viscosity of the resin layer 30 and stabilize a state of the droplets

31 applied on the resin layer 30.

[0101] In the image forming apparatus 100 according to the first embodiment, the resin layer 30 contains polyvinyl chloride. As a result, the image forming apparatus 100 can easily apply (coats) the resin layer 30 onto the substrate 10 so that the resin layer 30 is obtainable good weather resistance, water resistance, or strength.

[0102] The liquid discharged from the liquid discharger 3 is an oil-based ink in the first embodiment of the present disclosure. Thus, the image forming apparatus 100 applies the oil-based ink to the resin layer 30 in a heated state to form an image. Therefore, the image forming apparatus 100 can apply a liquid that produces good image quality without forming a special receiving layer on the substrate 10.

[0103] In the image forming apparatus 100 according to the first embodiment, the viscosity of the resin layer 30 is used as an example of the physical property of the resin layer 30. However, the physical property of the resin layer 30 is not limited the viscosity and may be any other physical properties. The image forming apparatus 100 acquires information of the resin layer 30 such as the surface tension and the wettability of the resin layer 30. The adjuster 6 of the image forming apparatus 100 may also adjust the surface tension and the wettability of the resin layer 30 based on the acquired result (information) on the surface tension and the wettability of the resin layer 30. In the above case as well, the image forming apparatus 100 can reduce changes in surface tension and wettability of the resin layer 30 and stabilize the state of droplets 31 applied on the resin layer 30.

[0104] A dot pattern is illustrated as an example of the adjustment pattern 32, and a method that acquires the viscosity information of the liquid from the diameter of a dot (droplet 31) is illustrated as an example of the physical property information in the image forming apparatus 100 according to the first embodiment. However, the adjustment pattern 32 and the physical property information are not limited to the examples as described above.

[0105] The image forming apparatus 100 may appropriately changes the adjustment pattern 32 or information detected from the adjustment pattern 32 according to usage or usage information of the image forming apparatus 100 as long as the reader 4 and the physical property information acquisition unit 54 can acquire the physical property information of the liquid.

[0106] When the image forming apparatus 100 can monitor characteristics of the mixed liquid 15 with some characteristic values, the image forming apparatus 100 may only control the characteristic values without detecting the diameter of the droplet 31 to stabilize the image quality after adjusting the physical properties based on the diameter of the initial droplet 31. Examples of the characteristic values include a load applied to the stirrer 12 and the physical properties of the mixed liquid 15. Here, the higher the viscosity is, the larger the load applied to the stirrer 12 becomes. When the physical property of the mixed liquid 15 is used as a characteristic

value, the image forming apparatus 100 may include a sensor to detect the physical property of the mixed liquid 15.

5 [Second Embodiment]

[0107] Next, an image forming apparatus 100a according to a second embodiment of the present disclosure is described below. The same components as those of the first embodiment are denoted by the same reference numerals, and redundant description thereof will be appropriately omitted.

[0108] FIG. 11 is a schematic cross-sectional side view of an example of the image forming apparatus 100a according to the second embodiment of the present disclosure. As illustrated in FIG. 11, the image forming apparatus 100a includes a viscometer 4a and a controller 5a.

[0109] The viscometer 4a is an example of an acquirer to acquire the viscosity information of the mixed liquid 15 stored in the mixed liquid storage 11. The method of measuring the viscosity by the viscometer 4a is not particularly limited. Various measurement methods such as a capillary viscometer, a falling ball viscometer or a rotational viscometer may be used to measure the viscosity of the mixed liquid 15 in the mixed liquid storage 11.

[0110] A lower portion of the viscometer 4a is in a state of being immersed in the mixed liquid 15 stored in the mixed liquid storage 11. The viscometer 4a outputs a measurement result of the viscosity to the controller 5a.

[0111] FIG. 12 is a block diagram illustrating an example of the functional configuration of the controller 5a. As illustrated in FIG. 12, the controller 5a includes a physical property information acquisition unit 54a. The physical property information acquisition unit 54a inputs the measurement result of the viscosity from the viscometer 4a to acquire the viscosity information of the resin layer 30. The viscometer 4a measures the viscosity of the mixed liquid 15 as described above.

[0112] The elements illustrated in FIG. 12 such as the controller 5a, the physical property information acquisition unit 54a, the resin layer applicator 1, the conveyor 2, the liquid discharger 3, and the adjuster 6 have a similar function, operate in a similar manner, and achieve a similar result with the controller 5, the physical property information acquisition unit 54, the resin layer applicator 1, the conveyor 2, the liquid discharger 3, and the adjuster 6 as illustrated in FIG. 4, respectively.

[0113] FIG. 13 is a flowchart illustrating an example of the adjustment operation of the image forming apparatus 100a.

[0114] FIG. 13 is a flowchart illustrating an example of a viscosity adjustment operation of the resin layer 30 by the image forming apparatus 100a as above-illustrated FIG. 10

[0115] FIG. 13 illustrates an adjustment operation triggered by starting the viscosity adjustment operation of the resin layer 30 by the image forming apparatus 100a. Here, a description of portions overlapping with FIG. 10

is omitted. Conversely, a description of portions different from FIG. 10 is mainly described below.

[0116] First, the image forming apparatus 100a measures the viscosity of the mixed liquid 15 stored in the mixed liquid storage 11 by the viscometer 4a, and outputs the measurement result to the controller 5a in step S131.

[0117] Next, the image forming apparatus 100a determines whether the measured viscosity of the mixed liquid 15 is within the target viscosity range in step S132. The targeted viscosity range is an example of a predetermined diameter range.

[0118] If the image forming apparatus 100a determines that the viscosity is within the target viscosity range in step S132 (step S132, YES), the image forming apparatus 100a ends the viscosity adjustment operation. On the other hand, if the image forming apparatus 100a determines that the viscosity is not within the target viscosity range (step S132, NO), the image forming apparatus 100a determines whether the viscosity is above the target viscosity range in step S133.

[0119] If the image forming apparatus 100 determines that the viscosity of the mixed liquid 15 is above the target viscosity range in step S106 (step S133, YES), the image forming apparatus 100 supplies the diluent to the mixed liquid storage 11 by the adjuster 6 to reduce the viscosity of the mixed liquid 15 and reduce the viscosity of the resin layer 30 in step S134.

[0120] If the image forming apparatus 100 determines that the viscosity of the mixed liquid 15 is not above (below) the target viscosity range in step S133 (step S133, NO), the image forming apparatus 100 supplies the resin to the mixed liquid storage 11 by the adjuster 6 to increase the viscosity of the mixed liquid 15 and increase the viscosity of the resin layer 30 in step S135.

[0121] In the above way, the image forming apparatus 100a can adjust the viscosity of the resin layer 30.

[Operational Effect of Image Forming Apparatus 100a]

[0122] As described above, the viscometer 4a (er) acquires viscosity (physical property) information of the mixed liquid 15 stored in the mixed liquid storage 11 in the image forming apparatus 100 according to the embodiments of the present disclosure. The above-described configuration can obtain effects same as described in the first embodiment.

[0123] Although some embodiments have been described above, embodiments of the present disclosure are not limited to the above-described embodiments specifically disclosed. Various modifications and changes are possible without departing from the scope of the claims.

[0124] In the above-described embodiment, the image forming apparatuses 100 and 100a have been described as an example of the liquid discharge apparatus. The liquid discharge apparatus according to the present embodiment is not limited to an image forming apparatus. The above embodiments are applicable to any apparatus

as long as the apparatus forms a pattern such as an image on the resin layer 30 applied (coated) onto the substrate 10 by a liquid discharge method.

[0125] The numbers such as ordinal number and quantity used in the description of the above embodiments are all illustrative for the purpose of describing the technology of the embodiments of the present disclosure, and the embodiments of the present disclosure are not limited to the illustrative numbers. Further, a connection relation between the components is exemplified for the purpose of describing the technology of the embodiments of the present disclosure, and the connection relation to enable the functions of the present disclosure is not limited to the connection relation as described above.

[0126] Further, the above-described embodiments include a liquid discharge method. For example, the liquid discharge method includes a liquid discharge method using the image forming apparatus 100 (liquid discharge apparatus). The image forming apparatus 100 (liquid discharge apparatus) conveys the substrate 10 in a predetermined conveyance direction by the conveyor 2. The image forming apparatus 100 drives the resin layer applicator 1 to apply the resin layer 30 to the substrate 10. The liquid discharger discharges the droplets 31 to apply the droplets 31 onto the resin layer 30. The physical property information acquisition unit 54 acquires the physical property information of the resin layer 30. The adjuster 6 adjusts the physical properties of the resin layer 30 based on the acquired result (information) acquired by the physical property information acquisition unit 54. The controller controls the adjustment controller 55 to control the adjuster 6 to control the adjustment operation. Such a liquid discharge method can provide operational effects equivalent to the operational effects of the above-described image forming apparatuses 100.

[0127] Each function of the embodiments described above such as the controller 5 can be implemented by one processing circuit or a plurality of processing circuits. Here, the term "processing circuit or circuitry" in the present specification includes a programmed processor to execute each function by software, such as a processor implemented by an electronic circuit, and devices, such as an application specific integrated circuit (ASIC), a digital signal processor (DSP), a field programmable gate array (FPGA), and conventional circuit components arranged to perform the recited functions.

[0128] Any one of the above-described operations may be performed in various other ways, for example, in an order different from the one described above.

[0129] The present invention can be implemented in any convenient form, for example using dedicated hardware, or a mixture of dedicated hardware and software. The present invention may be implemented as computer software implemented by one or more networked processing apparatuses. The processing apparatuses include any suitably programmed apparatuses such as a general purpose computer, a personal digital assistant, a Wireless Application Protocol (WAP) or third-genera-

tion (3G)-compliant mobile telephone, and so on.

[0130] Since the present invention can be implemented as software, each and every aspect of the present invention thus encompasses computer software implementable on a programmable device. The computer software can be provided to the programmable device using any conventional carrier medium (carrier means). The carrier medium includes a transient carrier medium such as an electrical, optical, microwave, acoustic or radio frequency signal carrying the computer code.

[0131] An example of such a transient medium is a Transmission Control Protocol/Internet Protocol (TCP/IP) signal carrying computer code over an IP network, such as the Internet. The carrier medium may also include a storage medium for storing processor readable code such as a floppy disk, a hard disk, a compact disc read-only memory (CD-ROM), a magnetic tape device, or a solid state memory device.

Claims

1. A liquid discharge apparatus comprising:

a conveyor (2) configured to convey a substrate (10) in a conveyance direction;
a resin layer applier (1) configured to apply a resin layer (30) containing a resin onto the substrate (10) conveyed by the conveyor (2);
a liquid discharger (3) configured to discharge a liquid onto the resin layer (30) to apply a droplet (31) onto the resin layer (30);
an acquirer (4, 4a) configured to acquire a physical property of the resin layer (30);
an adjuster (6) configured to adjust the physical property of the resin layer (30); and
circuitry (5) configured to control the adjuster (6) to control the physical property of the resin layer (30) according to the physical property acquired by the acquirer (4, 4a).

2. The liquid discharge apparatus according to claim 1,

wherein the liquid discharger (3) applies the droplet (31) onto the resin layer (30) to form a pattern on the resin layer (30), and
the acquirer (4, 4a) acquires the physical property of the resin layer (30), and the physical property of the resin layer (30) is based on the pattern formed on the resin layer (30).

3. The liquid discharge apparatus according to claim 2,

wherein the acquirer (4, 4a) comprises a reader (4) configured to read an image of the pattern, and
the circuitry (5) is further configured to detect a diameter of the droplet in the image of the pattern

on the resin layer (30) to acquire the physical property.

4. The liquid discharge apparatus according to claim 3,

wherein the resin layer applier (1) comprises a mixed liquid storage (11) configured to store a mixed liquid containing the resin and a diluent that dilutes the mixed liquid to change a rate of the resin in the resin layer (30),
the resin layer applier (1) applies the mixed liquid (15) onto the substrate (10) to apply the resin layer (30) onto the substrate (10), and
the adjuster (6) supplies at least one of the resin and the diluent to the mixed liquid storage (11) to adjust the physical property of the resin layer (30).

5. The liquid discharge apparatus according to claim 4,

wherein the adjuster (6) supplies the resin to the mixed liquid storage (11) if the diameter of the droplet is above a target diameter range; and
the adjuster (6) supplies the diluent to the mixed liquid storage (11) if the diameter of the droplet is below the target diameter range.

6. The liquid discharge apparatus according to claim 1,

wherein the resin layer applier (1) comprises a mixed liquid storage (11) configured to store a mixed liquid containing the resin and a diluent that dilutes the mixed liquid to change a rate of the resin in the resin layer (30),
the resin layer applier (1) applies the mixed liquid (15) onto the substrate (10) to apply the resin layer (30) onto the substrate (10), and
the acquirer (4, 4a) comprises a viscometer (4a) configured to measure a viscosity of the mixed liquid in the mixed liquid storage (11) to acquire the viscosity of the mixed liquid (15) as the physical property.

7. The liquid discharge apparatus according to claim 6,

wherein the adjuster (6) supplies the resin to the mixed liquid storage (11) if the viscosity of the mixed liquid (15) is below a target viscosity range; and
the adjuster (6) supplies the diluent to the mixed liquid storage (11) if the viscosity of the mixed liquid (15) is above the target viscosity range.

8. The liquid discharge apparatus according to any one of claims 1 to 7,

wherein the resin of the resin layer (30) contains a polyvinyl chloride resin.

9. The liquid discharge apparatus according to any one of claims 1 to 8, wherein the liquid is an oil-based ink.
10. The liquid discharge apparatus according to any one of claims 1 to 9, wherein the physical property of the resin layer (30) includes viscosity of the resin layer (30). 5
11. The liquid discharge apparatus according to any one of claims 1 to 10, wherein the physical property of the resin layer (30) includes a surface tension of the resin layer (30). 10
12. The liquid discharge apparatus according to any one of claims 1 to 11, wherein the physical property of the resin layer (30) includes a wettability of the resin layer (30). 15
13. An image forming apparatus comprising the liquid discharge apparatus according to any one of claims 1 to 12. 20
14. A liquid discharge method comprising: 25
- conveying a substrate (10) in a conveyance direction;
 - applying a resin layer (30) containing a resin onto the substrate (10);
 - discharging a liquid onto the resin layer (30) to apply a droplet (31) onto the resin layer (30); 30
 - acquiring a physical property of the resin layer (30);
 - adjusting the physical property of the resin layer (30); and 35
 - controlling the physical property of the resin layer (30) according to the physical property acquired by the acquiring.

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FIG. 1

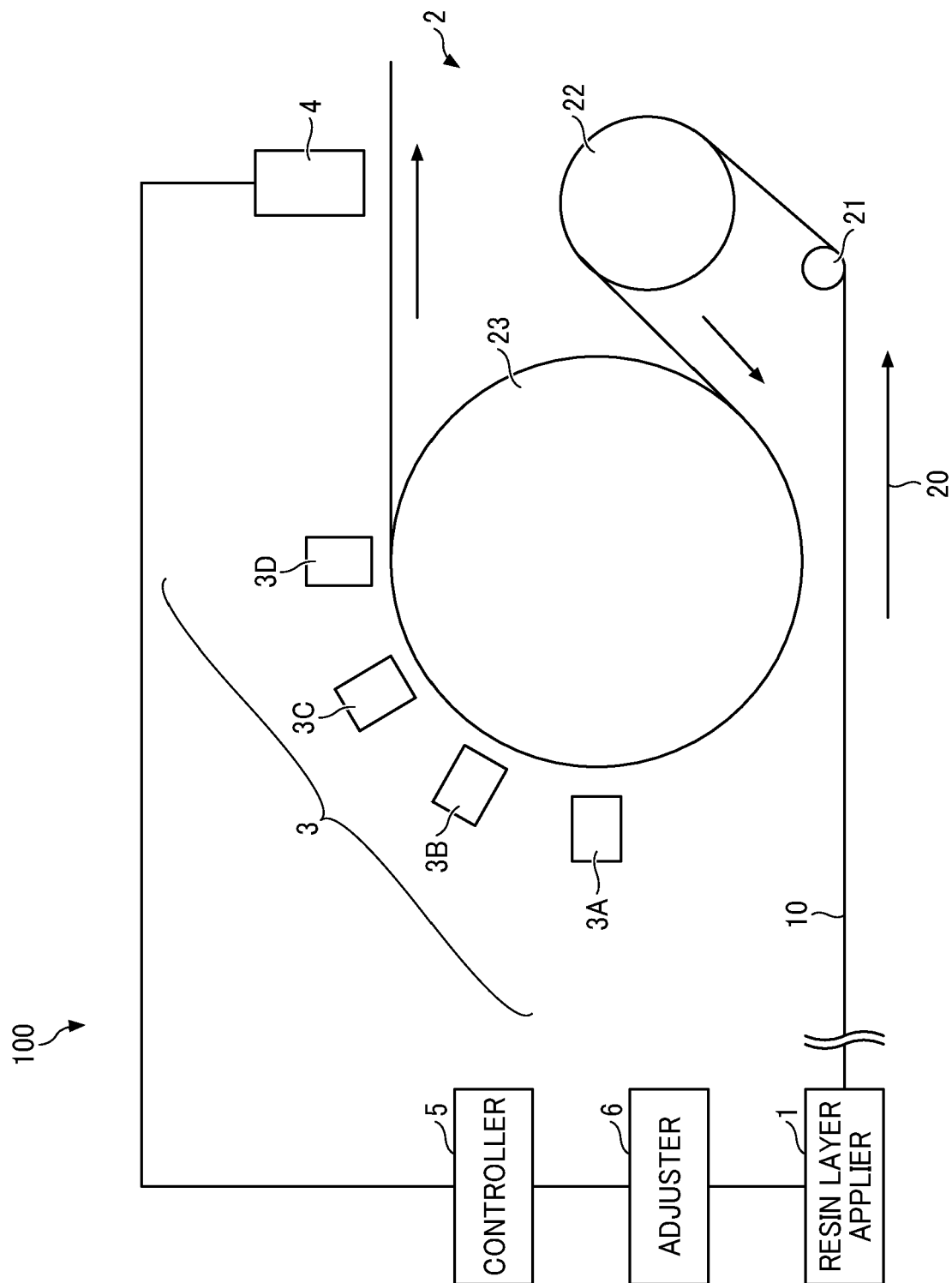


FIG. 2

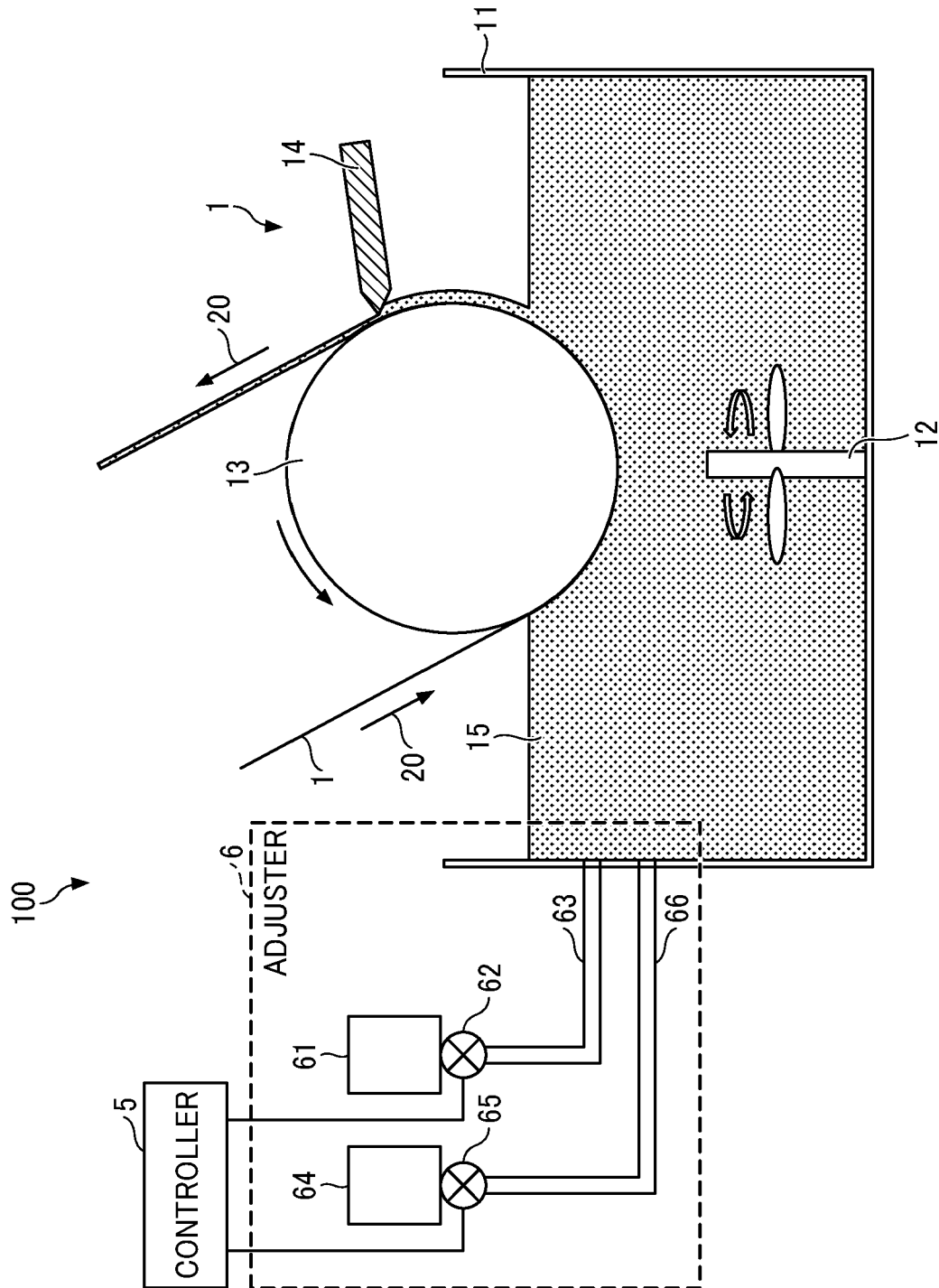


FIG. 3

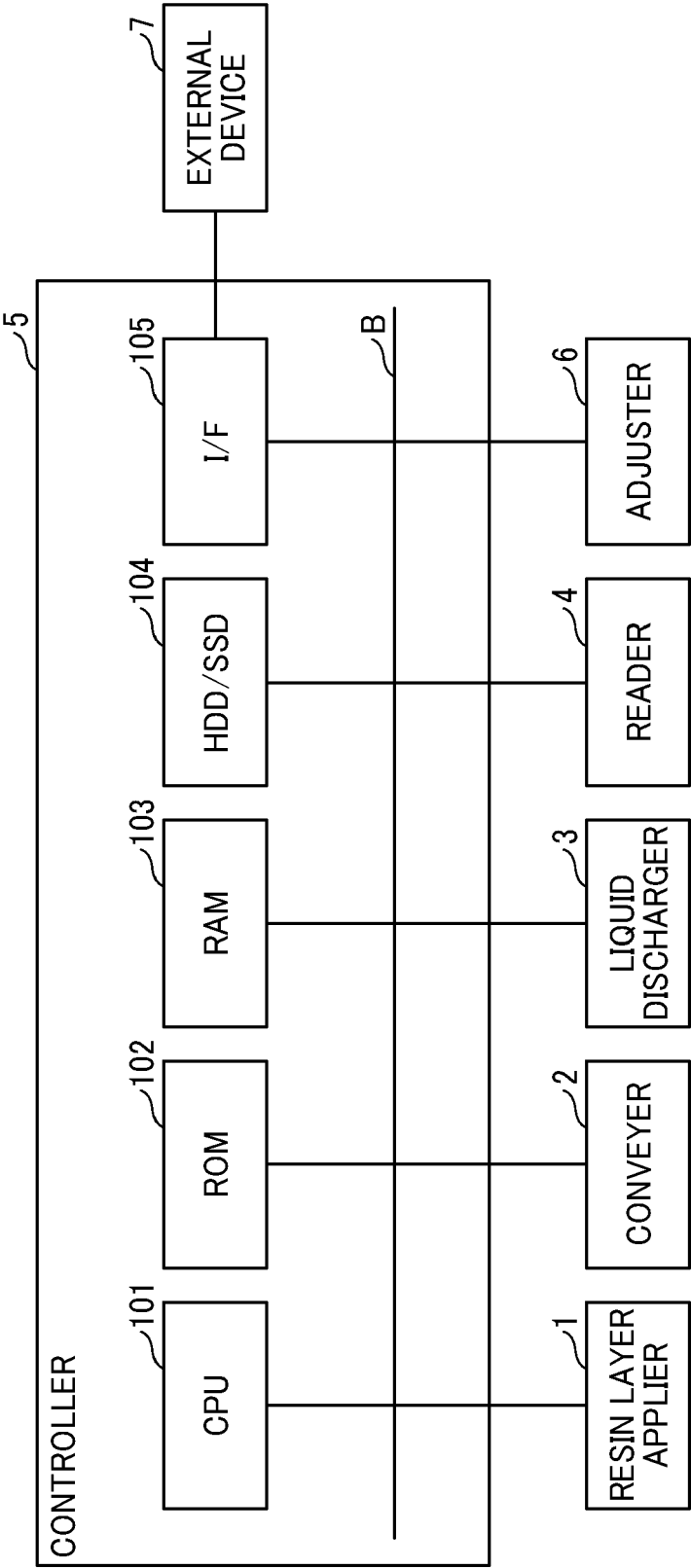


FIG. 4

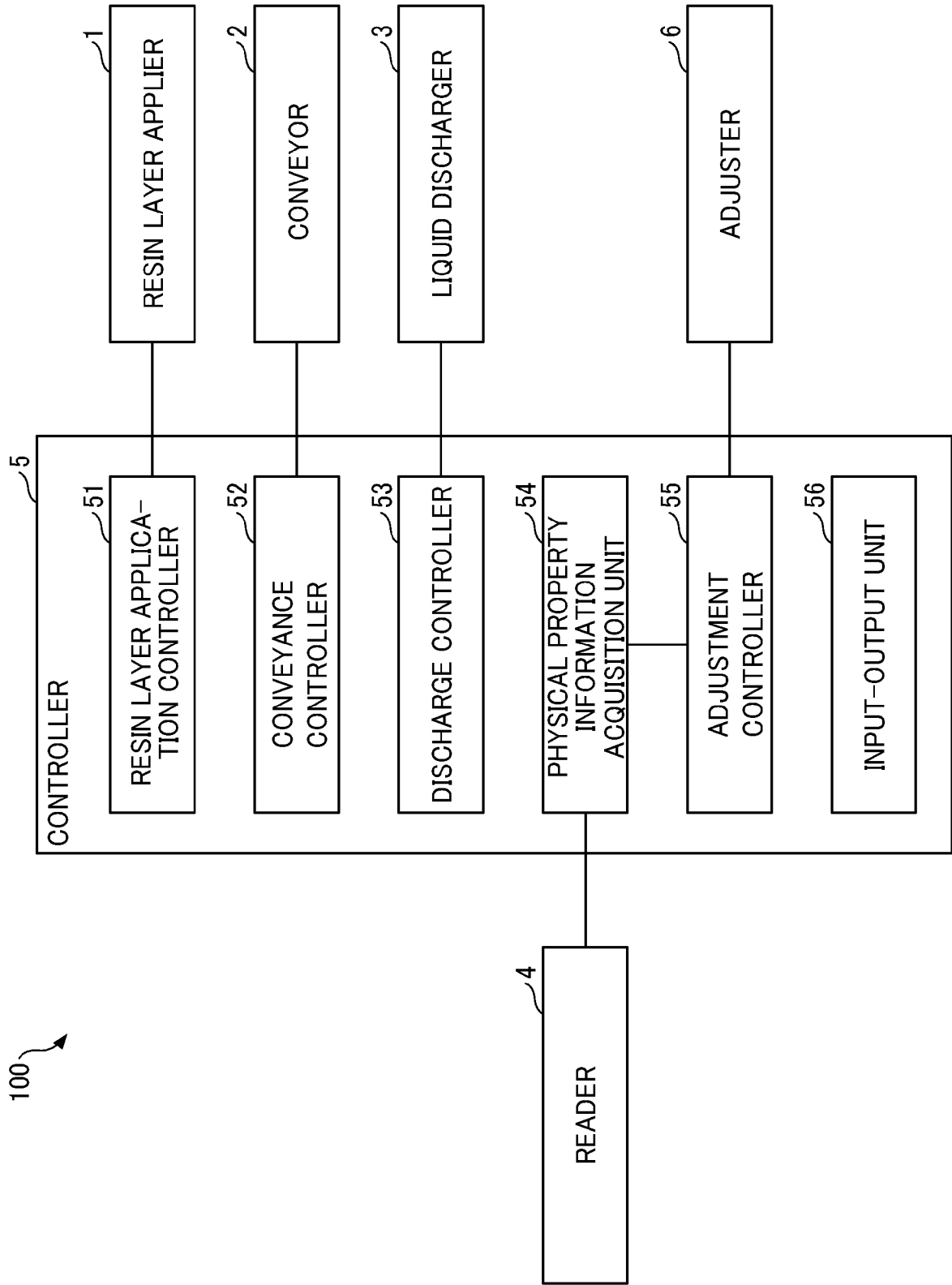


FIG. 5

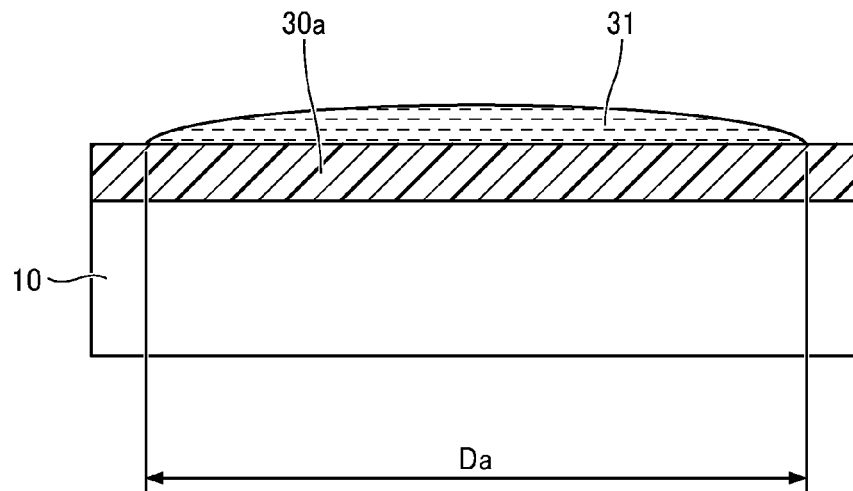


FIG. 6

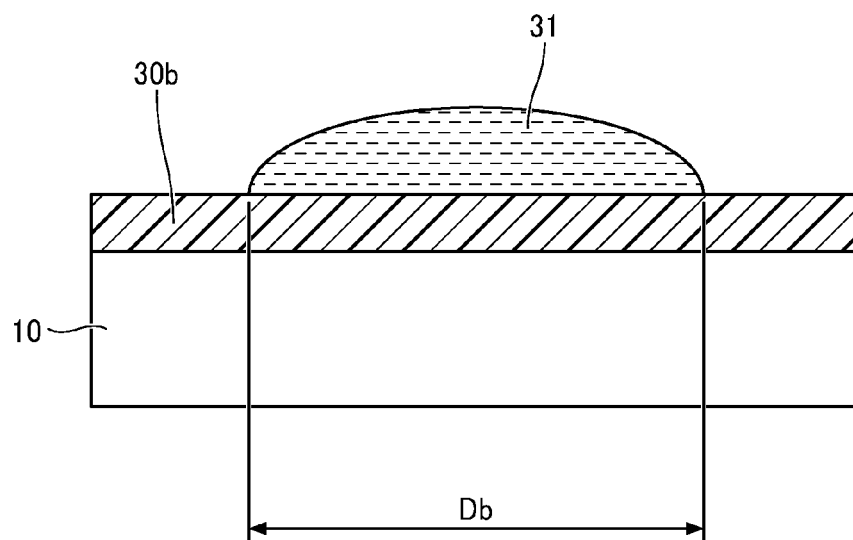


FIG. 7

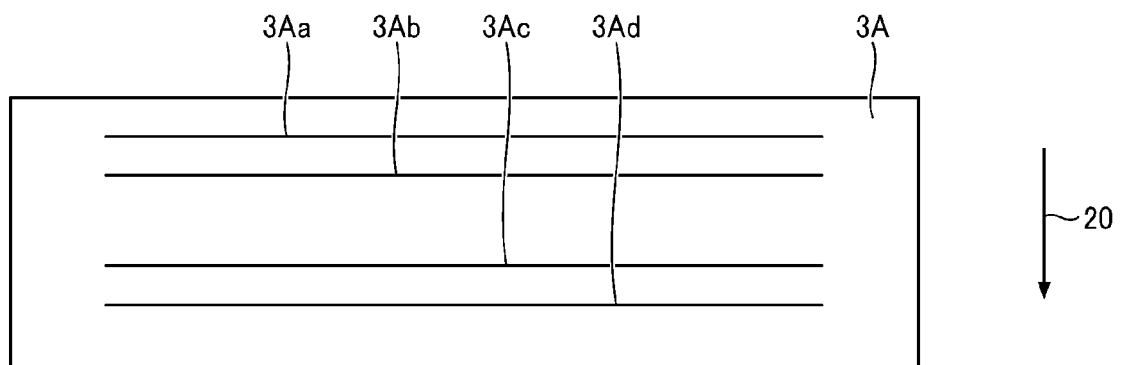


FIG. 8

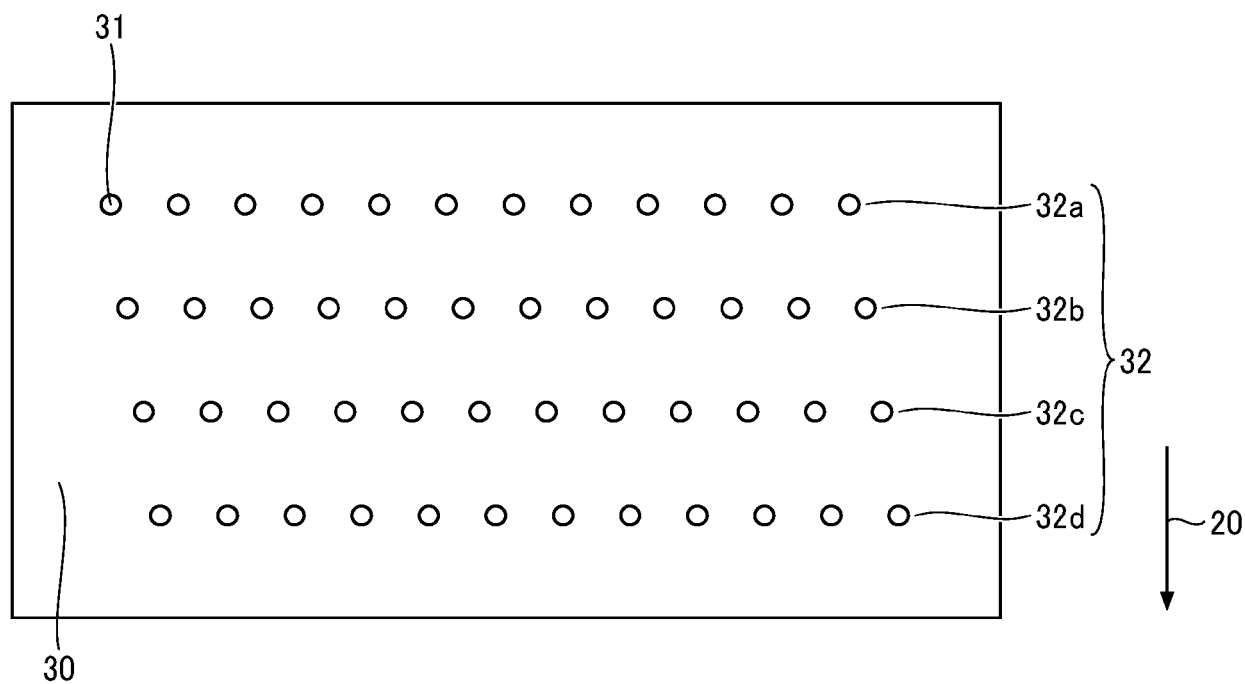


FIG. 9

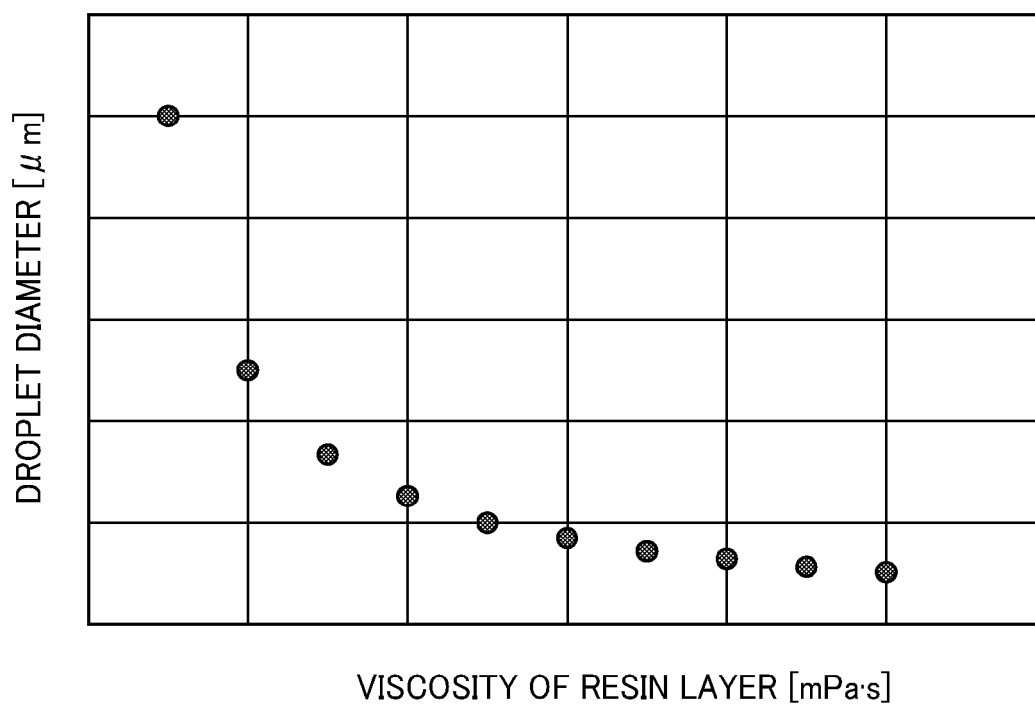


FIG. 10

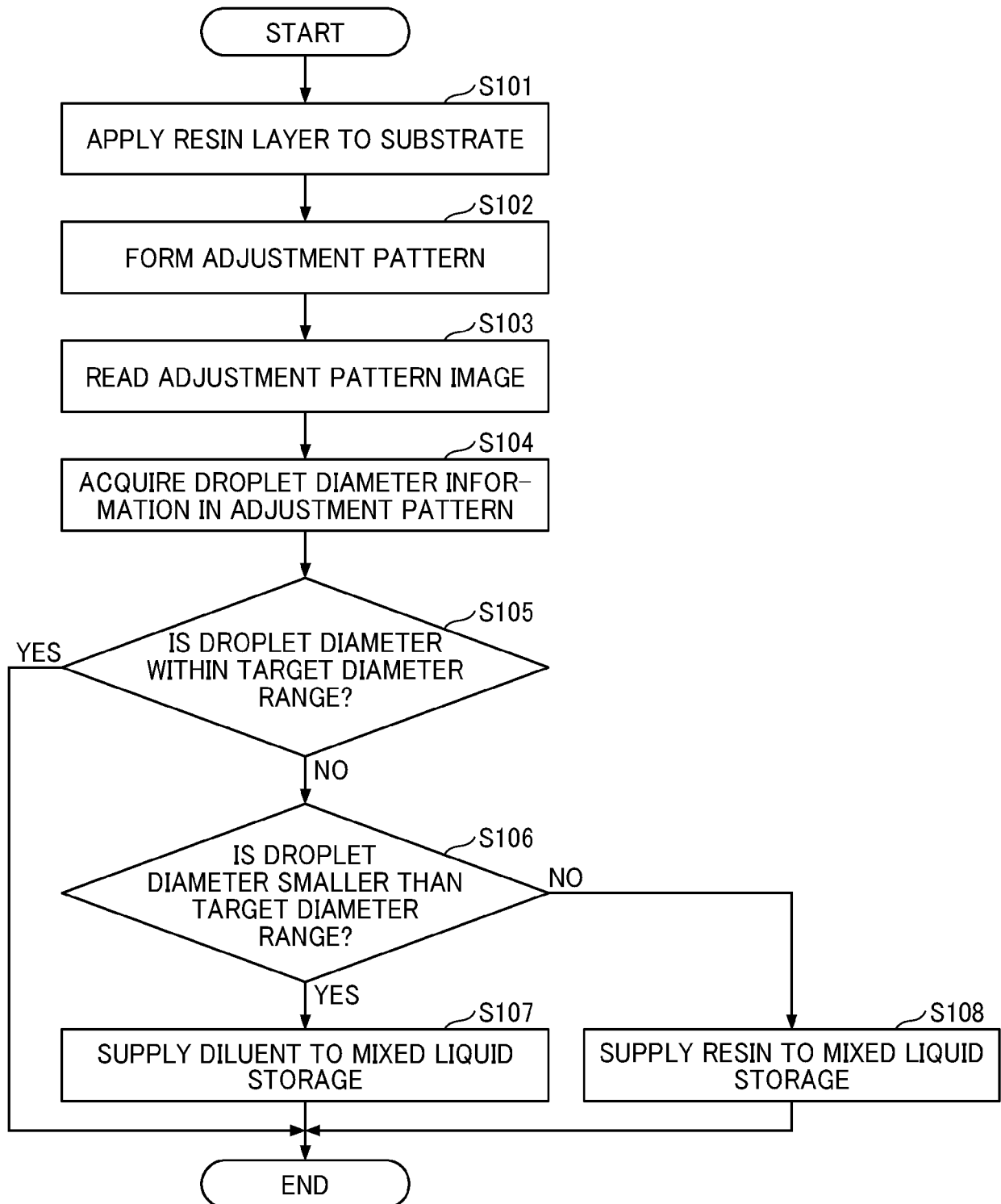


FIG. 11

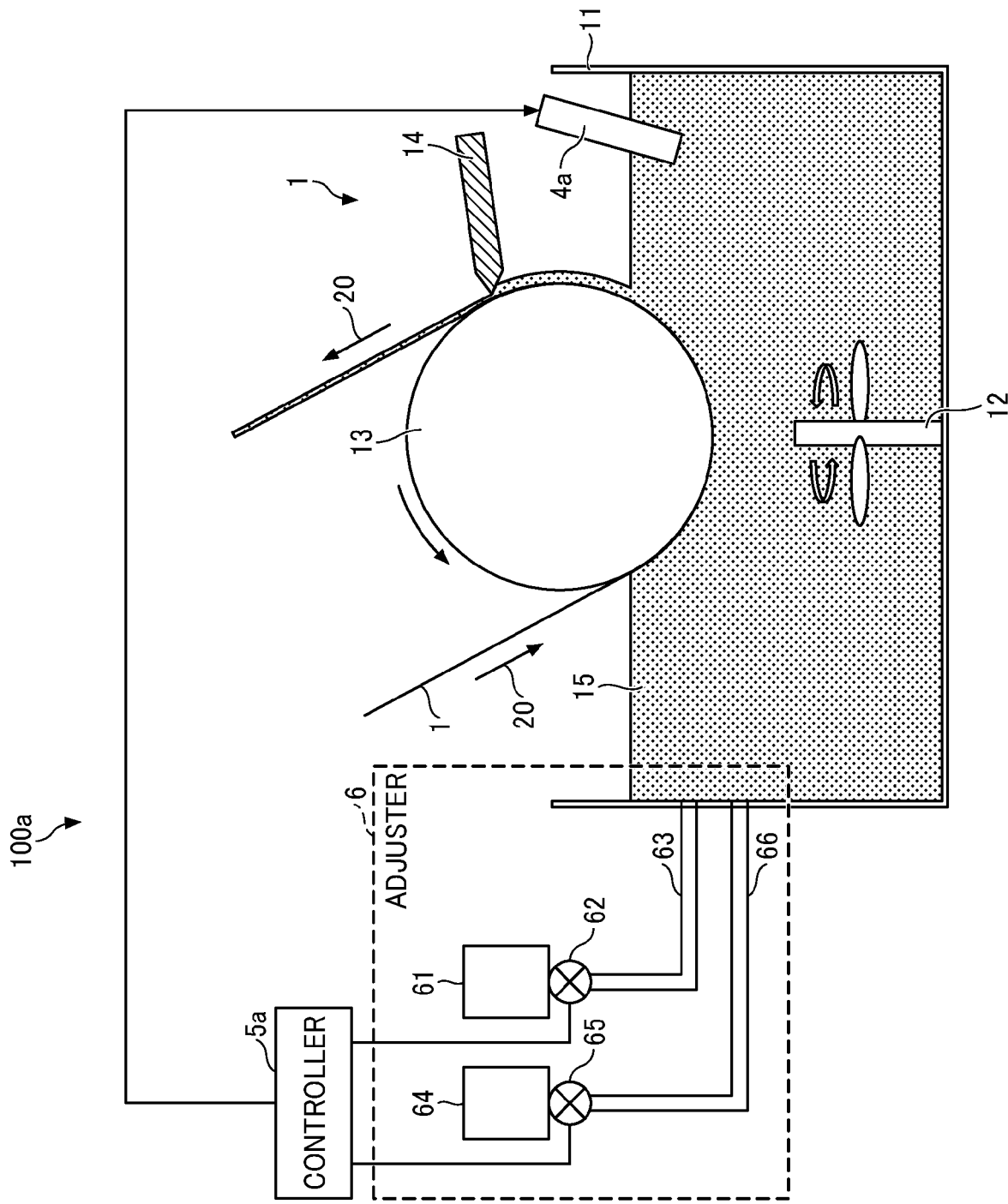


FIG. 12

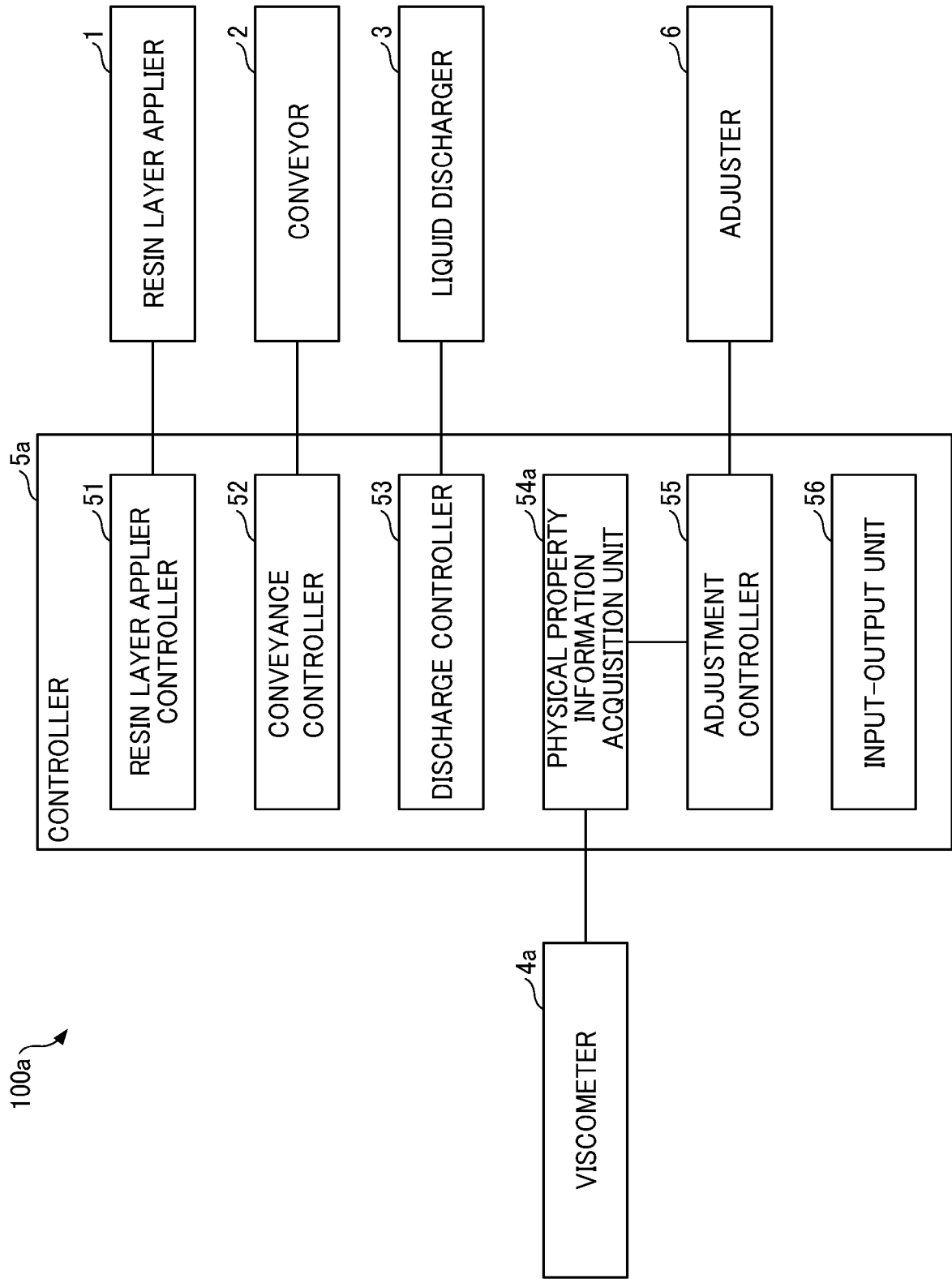
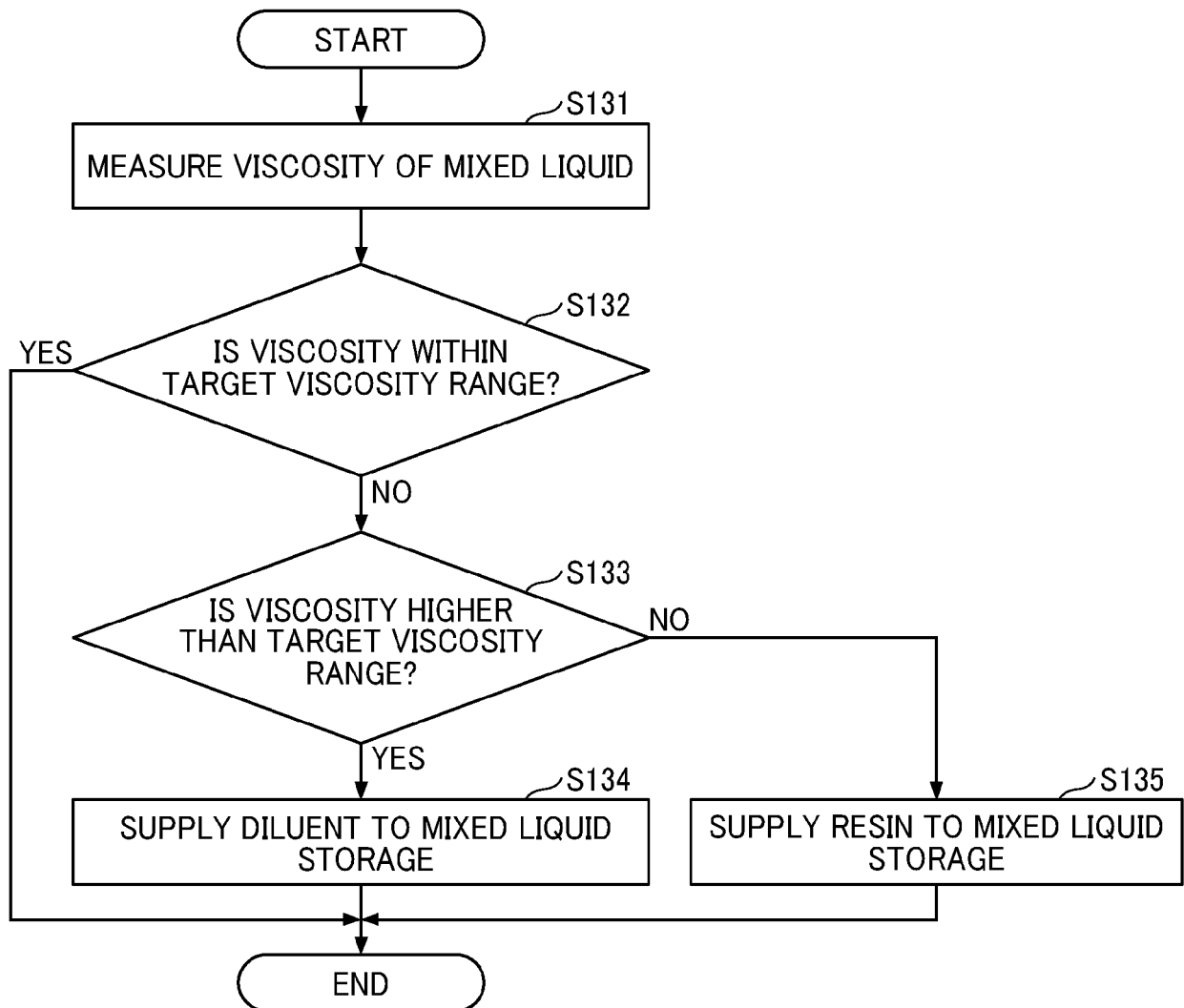


FIG. 13





EUROPEAN SEARCH REPORT

Application Number

EP 22 16 7149

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			B41J
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		9 August 2022	Cavia Del Olmo, D
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