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(54) **PRINTING APPARATUS AND METHOD OF HEATING MEDIUM**

(57) A printing apparatus includes a printing unit configured to execute printing on a medium, a heating unit configured to cause the medium on which printing has been executed to be heated, and a controller configured to control the heating unit. The controller employs, as a

heating mode in which the heating unit is caused to heat the medium, a steam-use heating mode in which heating is executed using steam and a steam-nonuse heating mode in which heating is executed without using steam.

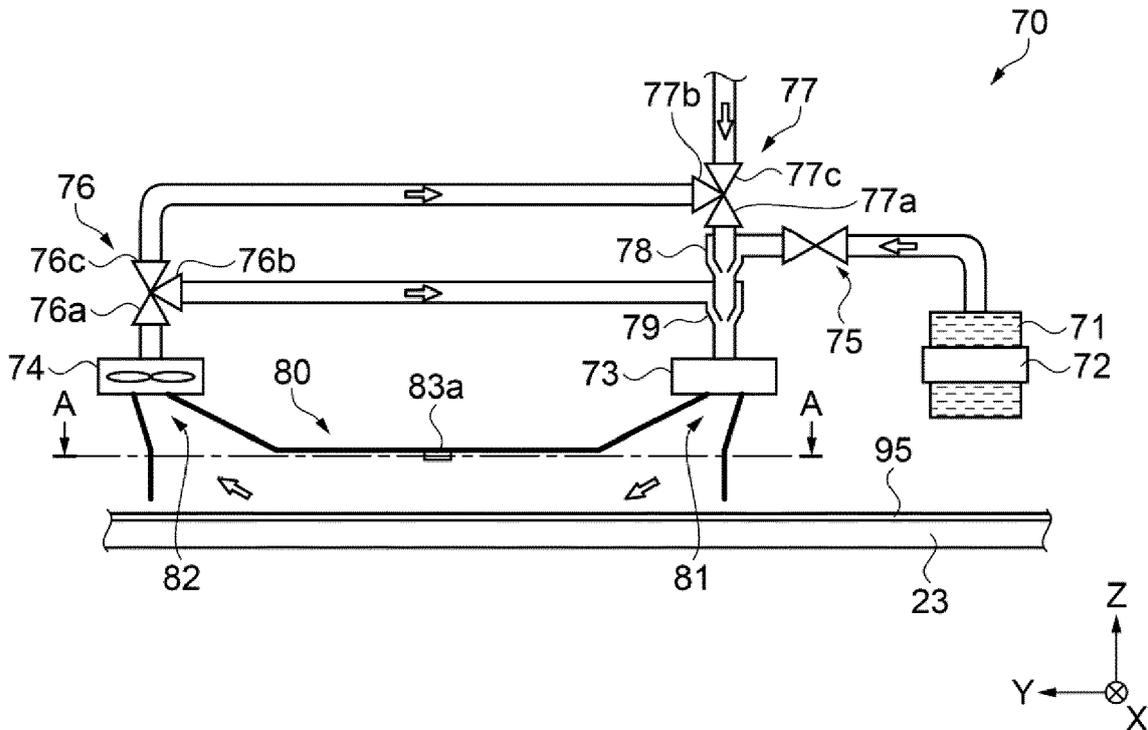


Fig. 2

DescriptionBACKGROUND

1. Technical Field

[0001] The invention relates to a printing apparatus and a method of heating a medium.

2. Related Art

[0002] There have been known printing apparatuses configured to execute printing of images or characters on a medium such as paper or cloth, along with causing a head configured to discharge an ink to be relatively moved with respect to the medium. Some of these printing apparatuses are equipped with a heating unit configured to cause the medium to be heated in order to dry the medium onto which ink has been discharged. For example, JP-A-2010-158861 discloses a recording apparatus (printing apparatus) equipped with a drying unit (heating unit) configured to discharge superheated steam onto a recording medium (medium) to promote drying of the recording medium.

[0003] These printing apparatuses execute printing using various types of inks and media. Since the easiness of drying of the printed image and the heat resistance of the medium differ depending on the types of inks or media to be used, the optimum heating method differs accordingly. Unfortunately, the printing apparatus described in JP-A-2010-158861 is merely configured to employ a single heating method (drying method) using superheated steam. This makes it difficult to properly dry the medium on which printing has been executed using various types of inks and media.

SUMMARY

[0004] The invention is made to address at least a part of the above-described issues, and can be realized as the following modes or application examples.

Application Example 1

[0005] A printing apparatus according to the application example includes a printing unit configured to execute printing on a medium, a heating unit configured to cause the medium on which printing has been executed to be heated, and a controller configured to control the heating unit. The controller is configured to employ, as a heating mode in which the heating unit is caused to heat the medium, a steam-use heating mode in which heating is executed using steam and a steam-nonuse heating mode in which heating is executed without using steam.

[0006] According to the application example described above, the printing apparatus includes a printing unit configured to execute printing on a medium, a heating unit configured to cause the medium to be heated in order to

dry the medium on which an image or the like is printed, and a controller configured to control the heating unit. The controller is configured to employ a steam-use heating mode in which the heating unit is caused to heat the medium using steam, and a steam-nonuse heating mode in which the heating unit is caused to heat the medium without using steam. That is, the printing apparatus of the application example is configured such that the heating unit is switchable between the steam-use heating mode and the steam-nonuse heating mode. This configuration allows the medium on which printing has been executed using various types of inks or media to be properly dried by causing the heating mode of the heating unit to be switched according to the type of the ink or the medium to be used for the printing.

Application Example 2

[0007] In the printing apparatus according to the application example described above, the heating unit may be configured to employ, as the steam-use heating mode, a steam heating mode in which the medium is caused to be heated using steam at a temperature lower than a boiling point of water and a superheated-steam heating mode in which the medium is caused to be heated using steam at a temperature not lower than the boiling point of water.

[0008] According to the application example described above, the controller is configured to employ, as the steam-use heating mode in which the medium is caused to be heated using steam, a steam heating mode in which heating is executed using steam at a temperature lower than a boiling point of water and a superheated-steam heating mode in which heating is executed using steam at a temperature not lower than the boiling point of water. That is, the printing apparatus of the application example described above is configured such that, in the steam-use heating mode, the heating unit is switchable between the steam heating mode and the superheated-steam heating mode. This configuration allows more types of inks or media to be properly dried.

Application Example 3

[0009] In the printing apparatus according to the application example described above, the heating unit may include a storing section configured to store water, a first heater configured to heat the water being stored in the storing section, an opening portion through which a fluid used for heating the medium is discharged, an opening/closing section provided between the storing section and the opening portion, the opening/closing section being configured to open and close a flow channel of the fluid, and a second heater provided between the opening/closing section and the opening portion, wherein the controller causes the opening/closing section to be in an open state and then activates the first heater and inactivates the second heater, to thus control the heating unit

as the steam heating mode, and causes the opening/closing section to be in an open state and then activates both the first heater and the second heater, to thus control the heating unit as the superheated-steam heating mode.

[0010] According to the application example described above, the heating unit includes a storing section configured to store water, a first heater configured to heat the water, an opening portion through which a fluid used for heating the medium is discharged, an opening/closing section provided between the storing section and the opening portion and configured to open and close a flow channel of the fluid, and a second heater provided between the opening/closing section and the opening portion. This configuration allows the controller to cause the opening/closing section to be in an open state and to then activate the first heater and inactivate the second heater, and to thus control the heating unit as the steam heating mode. The controller also causes the opening/closing section to be in an open state and then activates both the first heater and the second heater, to thus control the heating unit as the superheated-steam heating mode. This configuration allows suitable switching between the steam heating mode and the superheated-steam heating mode.

Application Example 4

[0011] In the printing apparatus according to the application example described above, the controller may employ, as the steam-nonuse heating mode, a hot-air heating mode in which the medium is caused to be heated using hot air.

[0012] According to the application example described above, the hot-air heating mode employs heating without using steam, non-contact heating with respect to the medium is accordingly executed, suppressing the thermal load on the medium or the ink.

Application Example 5

[0013] In the printing apparatus according to the application example described above, the controller switches the heating mode of the heating unit based on printing information at a time when printing is executed on the medium.

[0014] According to the application example described above, the controller configured to control the heating unit switches the heating mode of the heating unit based on printing information at the time when printing is executed on the medium. This configuration allows the printing apparatus to readily handle printing using various types of inks or media.

Application Example 6

[0015] In the printing apparatus according to the application example described above, the printing information

may include medium information about type of medium to be used for printing, and ink information about type of ink to be used for printing, and the controller switches the heating mode based on the medium information and the ink information.

[0016] According to the application example described above, the printing information includes medium information as information about type of medium to be used for printing, and ink information about type of ink to be used for printing. The controller switches the heating mode based on the medium information and the ink information. This configuration allows the printing apparatus to particularly readily handle printing using various types of inks or media.

Application Example 7

[0017] The printing apparatus according to the application example described above may include a transporting unit configured to transport the medium in a transport direction. A heating area where the heating unit causes the medium to be heated is separated into a plurality of areas in a width direction intersecting the transport direction, and the controller is configured to be capable of varying an output of the heating unit for each of the plurality of areas thus separated.

[0018] According to the application example described above, the heating area where the medium is caused to be heated is separated into a plurality of areas in the width direction, and the controller is configured to be capable of varying the output of the heating unit for each of the plurality of areas thus separated. This allows the medium on which the image or the like has been printed to be properly heated and dried.

Application Example 8

[0019] The printing apparatus according to the application example described above may include a transporting unit configured to transport the medium in a transport direction and a pressurizing unit provided on an upstream side of the heating unit in the transport direction, the pressurizing unit being configured to pressurize the medium.

[0020] According to the application example described above, the printing apparatus includes a pressurizing unit on the upstream side of the heating unit in the transport direction. The pressurizing unit pressurizes the medium to lay down fluff or the like on the medium, suppressing the fluid discharged from the heating unit from being blocked by the fluff or the like. This allows the medium on which an image or the like has been printed to be properly dried.

Application Example 9

[0021] A method of heating a medium performed in a printing apparatus according to the application example

described above, the printing apparatus including a printing unit configured to execute printing on a medium, and a heating unit configured to be capable of being switched between heating modes of a steam-use heating mode in which the medium is caused to be heated using steam and a steam-nonuse heating mode in which the medium is caused to be heated without using steam, and the method including accepting a selection of the heating mode to be employed, and causing the medium to be heated by the heating unit being in the heating mode that is selected.

[0022] According to the application example described above, switching the heating mode according to the type of the ink or the medium to be used for the printing enables the media on which printing has been executed using various types of inks or media to be properly dried.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings, wherein like numbers reference like elements.

Fig. 1 is a schematic view illustrating a schematic overall configuration of a printing apparatus according to an exemplary embodiment.

Fig. 2 is a side view illustrating a configuration of a heating unit.

Fig. 3 is a cross-sectional view taken along the line A-A in Fig. 2.

Fig. 4 is an electric block diagram illustrating an electrical configuration of a printing apparatus.

Fig. 5 is a view illustrating a cross section of a medium before being pressurized by a pressurizing unit.

Fig. 6 is a view illustrating a cross section of a medium after being pressurized by a pressurizing unit.

Fig. 7 is a flowchart illustrating a method of heating.

Fig. 8 is a heat application table illustrating a relationship between types of media/types of inks and heating modes according to the modified examples.

Fig. 9 is a flowchart illustrating a method of heating a medium.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0024] Exemplary embodiments of the invention will be described below with reference to the accompanying drawings. Note that, in each of the figures below, to illustrate each of layers or each of members at a recognizable size, a scale of each of the layers or each of the members is different from an actual scale.

[0025] Fig. 1 to Fig. 3 illustrate an X-axis, a Y-axis, and a Z-axis as three axes orthogonal to one another for convenience of explanation, where a leading end side of an arrow indicating an axial direction is defined as a "+ side" and a trailing end side is defined as a "- side". Herein, a direction parallel to the X-axis is referred to as an "X-axis

direction", a direction parallel to the Y-axis is referred to as a "Y-axis direction", and a direction parallel to the Z-axis is referred to as a "Z-axis direction".

5 Exemplary Embodiment

Schematic Configuration of Printing Apparatus

[0026] Fig. 1 is a schematic view illustrating a schematic overall configuration of a printing apparatus according to an exemplary embodiment. First, a schematic configuration of a printing apparatus 100 according to the exemplary embodiment will be described with reference to Fig. 1. Note that, in the exemplary embodiment, the printing apparatus 100 of a serial head type will be described as an example, which executes printing on a medium 95 by discharging an ink along with causing a head 42 to be moved with respect to the medium 95.

[0027] As illustrated in Fig. 1, the printing apparatus 100 includes a transporting unit 20, a pressurizing unit 60, a printing unit 40, a heating unit 70, a cleaning unit 50, and the like. Furthermore, the printing apparatus 100 includes a controller 1 configured to control each of these components. Each component of the printing apparatus 100 is attached to a frame portion 90.

[0028] The transporting unit 20 is configured to transport the medium 95 in the transport direction (toward the + side in the Y-axis direction in the printing unit 40). The transporting unit 20 includes a medium supplying unit 10, transporting rollers 21 and 22, a transporting belt 23, a belt-rotated roller 24, a belt-driving roller 25, transporting rollers 26 and 28, and a medium winding unit 30. First, the transport path of the medium 95 from the medium supplying unit 10 to the medium winding unit 30 will be described. Note that, in the exemplary embodiment, the gravity direction is defined as the Z-axis, the direction in which the medium 95 is transported in the printing unit 40 as the Y-axis, and the width direction of the medium 95 as the X-axis. Also note that the X-axis is a direction intersecting both the Z-axis and the Y-axis. Regarding the positional relationship along the transport direction of the medium 95 or the movement direction of the transporting belt 23, the side closer to the medium supplying unit 10 is also referred to as "upstream side" and the side closer to the medium winding unit 30 as "downstream side".

[0029] The medium supplying unit 10 is configured to supply the medium 95 onto which an image is to be formed to the printing unit 40 side. As the medium 95, for example, natural fiber, cotton, silk, hemp, mohair, wool, cashmere, regenerated fiber, synthetic fiber, nylon, polyurethane, polyester, and woven cloth or non-woven cloth made by mixed spinning of any of the materials can be used. To the woven cloth or the non-woven cloth, a pretreatment agent for promoting a color developing property and a fixing property may be applied. The medium supplying unit 10 includes a feeding shaft part 11 and a bearing part 12. The feeding shaft part 11 is formed

in a cylindrical shape or a columnar shape, and is provided rotatably in a circumferential direction. The medium 95 having a belt shape is wound around the feeding shaft part 11 to form a roll shape. The feeding shaft part 11 is detachably attached to the bearing part 12. This allows the medium 95 being wound beforehand onto the feeding shaft part 11 to be attached to the bearing part 12 together with the feeding shaft part 11.

[0030] The bearing part 12 rotatably supports both ends in an axis direction of the feeding shaft part 11. The medium supplying unit 10 includes a rotation driver (not illustrated) configured to rotate and drive the feeding shaft part 11. The rotation driver rotates the feeding shaft part 11 in a direction in which the medium 95 is supplied. An operation of the rotation driver is controlled by the controller 1. The transporting rollers 21 and 22 relay the medium 95 from the medium supplying unit 10 to the transporting belt 23.

[0031] The transporting belt 23, which is held between at least two rollers for rotating the transporting belt 23, transports the medium 95 toward the + side in the Y-axis direction (in the transport direction) with the rotation of the transporting belt 23. More specifically, the transporting belt 23, which is endlessly formed with both of the end portions of a band-shaped belt being coupled to each other, is hung between two rollers of the belt-rotated roller 24 and the belt-driving roller 25. The transporting belt 23 is retained with a predefined tension acting such that the portion between the belt-rotated roller 24 and the belt-driving roller 25 is held horizontal. A surface (support face) 23a of the transporting belt 23 is provided with an adhesive layer 29 onto which the medium 95 adheres. The transporting belt 23 is supplied from the transporting roller 22, supporting (retaining) the medium 95 fitted onto the adhesive layer 29 by the pressurizing unit 60 that will be described below. This allows stretchable fibers and the like to be handled as the medium 95.

[0032] The belt-rotated roller 24 and the belt-driving roller 25 support an inner circumferential surface 23b of the transporting belt 23. Note that a configuration may be employed in which between the belt-rotated roller 24 and the belt-driving roller 25 is provided a support portion such as a roller for supporting the transporting belt 23.

[0033] The belt-driving roller 25 rotates the transporting belt 23 to transport the medium 95 toward the + side in the Y-axis direction. The belt-driving roller 25 includes a rotation driver (not illustrated) for rotationally driving the belt-driving roller 25. The belt-driving roller 25 is provided on the downstream side of the printing unit 40 in the transport direction, while the belt-rotated roller 24 is provided on the upstream side of the printing unit 40 in the transport direction. The belt-driving roller 25 being rotationally driven causes the transporting belt 23 to be rotated in accordance with the rotation of the belt-driving roller 25, and then the rotational movement of the transporting belt 23 causes the belt-rotated roller 24 to be rotated. The rotation of the transporting belt 23 causes the medium 95 supported on the transporting belt 23 to be

transported toward the + side in the Y-axis direction in the printing unit 40, and then an image or the like is formed on the medium 95 in the printing unit 40 described below.

[0034] In the exemplary embodiment, on the side where the front surface 23a of the transporting belt 23 faces the printing unit 40 (on the + side in the Z-axis direction), the medium 95 is supported on the transporting belt 23, where the medium 95 is transported together with the transporting belt 23 from the belt-rotated roller 24 side to the belt-driving roller 25 side. While on the side where the surface 23a of the transporting belt 23 faces the cleaning unit 50 (on the - side in the Z-axis direction), the transporting belt 23 alone is moved from the belt-driving roller 25 side to the belt-rotated roller 24 side. This is because the transporting roller 26 described below causes the medium 95 to be removed from the transporting belt 23. Note that description is made above on the transporting belt 23 including the adhesive layer 29 onto which the medium 95 is fitted, but the transporting belt 23 is not limited to this. For example, the transporting belt may be of an electrostatic attraction type belt for absorbing the medium with static electricity onto the belt.

[0035] The transporting roller 26 is configured to remove the medium 95 on which an image is formed from the adhesive layer 29 of the transporting belt 23. The transporting rollers 26 and 28 relay the medium 95 from the transporting belt 23 up to the medium winding unit 30.

[0036] The medium winding unit 30 winds the medium 95 having been transported by the transporting unit 20. The medium winding unit 30 includes a winding shaft part 31 and a bearing part 32. The winding shaft part 31 is formed in a cylindrical shape or a columnar shape, and is provided rotatably in a circumferential direction. Around the winding shaft part 31, the medium 95 in a band-like shape is wound in a roll-like shape. The winding shaft part 31 is detachably attached to the bearing part 32. This allows the medium 95 in a roll-like shape having been wound around the winding shaft part 31 to be detached together with the winding shaft part 31.

[0037] The bearing part 32 rotatably supports both ends in an axis line direction of the winding shaft part 31. The medium winding unit 30 includes a rotation driver (not illustrated) for rotationally driving the winding shaft part 31. The rotation driver rotates the winding shaft part 31 in a direction in which the medium 95 is wound. An operation of the rotation driver is controlled by the controller 1.

[0038] Next, each component of the pressurizing unit 60, the printing unit 40, the cleaning unit 50, and the heating unit 70 provided around the transporting unit 20 will be described.

[0039] The pressurizing unit 60 is configured to pressurize the medium 95 to cause the medium 95 to be fitted onto the transporting belt 23. The pressurizing unit 60 is provided on the upstream side of the printing unit 40 and the heating unit 70 in the transport direction (on the - side in the Y-axis direction). The pressurizing unit 60 includes a pressurizing roller 61 and a supporting roller 63 for sup-

porting the pressurizing roller 61. The pressurizing roller 61 and the supporting roller 63, which are each formed in a cylindrical shape or a columnar shape, are provided rotatably in a circumferential direction. The pressurizing roller 61 and the supporting roller 63 are disposed such that their axis line directions intersect the transport direction to cause the rollers to rotate in the direction along the transport direction. The supporting roller 63 is provided on the side of the inner circumferential surface 23b of the transporting belt 23, where the inner circumferential surface 23b is on the opposite side to the pressurizing roller 61 with the transporting belt 23 in between. The pressurizing roller 61 is provided with a heater. Accordingly, the pressurizing roller 61 is configured to be capable of pressurizing the medium 95 while the medium 95 is being heated.

[0040] The medium 95 overlaid on the transporting belt 23 is pressed against the transporting belt 23 between the pressurizing roller 61 and the supporting roller 63. Thus, the medium 95 can securely adhere onto the adhesive layer 29 provided on the surface 23a of the transporting belt 23, and separation of the medium 95 from the transporting belt 23 can be prevented.

[0041] The printing unit 40 is disposed at a position above (+ Z-axis side) a disposition position of the transporting belt 23, and is configured to execute printing on the medium 95 placed on the surface 23a of the transporting belt 23. The printing unit 40 includes the head 42, a carriage 43 on which the head 42 is installed, a carriage moving unit 45 configured to move the carriage 43 in the width direction (the X-axis direction) intersecting the transport direction (the Y-axis direction) of the medium 95, and the like. For example, the head 42 is configured such that an ink such as a cyan (C), a magenta (M), a yellow (Y), or a black (K) ink is supplied to the head 42, where the ink is discharged onto the medium 95 through nozzles (not illustrated) each corresponding to one of these colors.

[0042] The type of the ink used in the printing apparatus 100 is changed according to the type of the medium 95. Examples of the color material used for the ink include an acidic dye, a reactive dye, and a pigment, and an ink containing corresponding color material is used, such as an acidic ink, a reaction ink, or a pigment ink.

[0043] The carriage moving unit 45 is provided above (on the + Z-axis side of) the transporting belt 23. The carriage moving unit 45 includes a pair of guide rails 45a and 45b extending along the X-axis direction. The head 42 is supported by the guide rails 45a and 45b in a state capable of reciprocating together with the carriage 43 along the X-axis direction.

[0044] The carriage moving unit 45 includes a moving mechanism and a power source (not illustrated) for causing the carriage 43 to be moved along the guide rails 45a and 45b. As the moving mechanism, a mechanism including a combination of a ball screw and a ball nut, a linear guide mechanism, or the like may be employed. As the power source, a variety of motors such as a step-

ping motor, a servomotor, and a linear motor may be employed. The motor is driven under the control of the controller 1, causing the moving mechanism to move the head 42 together with the carriage 43 along the X-axis direction.

[0045] The cleaning unit 50 is disposed between the belt-rotated roller 24 and the belt-driving roller 25 in the Y-axis direction. The cleaning unit 50 includes a cleaning section 51, a pressing section 52, and a moving section 53. The moving section 53 causes the cleaning unit 50 to be integrally moved in parallel with a floor surface 99 and then to be fixed at a predefined position.

[0046] The pressing section 52, which serves as, for example, a lifting and lowering device constituted by an air cylinder 56 and a ball bush 57, is configured to cause the cleaning section 51 provided on the pressing section 52 to be abutted against the surface 23a of the transporting belt 23. The cleaning section 51 causes a surface (support face) 23a of the transporting belt 23 being hung between the belt-rotated roller 24 and the belt-driving roller 25 in a state where a predefined tension is being applied and being moved from the belt-driving roller 25 toward the belt-rotated roller 24 to be cleaned from a position lower than the surface (from the - Z-axis direction).

[0047] The cleaning section 51 includes a cleaning tank 54, a cleaning roller 58, and a blade 55. The cleaning tank 54 is a tank configured to store a cleaning liquid used to clean ink and foreign materials adhering onto the surface 23a of the transporting belt 23. The cleaning roller 58 and the blade 55 are provided inside the cleaning tank 54. As the cleaning liquid, for example, water or a water-soluble solvent (alcoholic aqueous solution or the like) may be used, and to which a surfactant agent and an antifoaming agent may be added as necessary.

[0048] As the cleaning roller 58 is rotated, the cleaning liquid is supplied onto the surface 23a of the transporting belt 23 and the cleaning roller 58 and the transporting belt 23 slide against each other. This allows the ink adhering to the transporting belt 23, the fibers of the cloth serving as the medium 95, and the like to be removed by the cleaning roller 58.

[0049] The blade 55 may be formed of a flexible material such as silicon rubber. The blade 55 is provided on the downstream side of the cleaning roller 58 in the transport direction. The transporting belt 23 and the blade 55 slide against each other and thus, the cleaning liquid remaining on the surface 23a of the transporting belt 23 is removed.

[0050] Next, a configuration of the heating unit 70 will be described with reference to Fig. 2 and Fig. 3. Fig. 2 is a side view illustrating the configuration of the heating unit. Fig. 3 is a cross-sectional view taken along the line A-A in Fig. 2. Note that, in Fig. 2 and Fig. 3, the movement direction of the fluid is indicated by outlined arrows. In the descriptions below, regarding the positional relationship along the movement direction of the fluid (fluid movement direction), the side closer to the fluid inflow side is also referred to as "upstream side" and the side closer

to the fluid outflow side as "downstream side".

[0051] The heating unit 70 provided on the downstream side of the printing unit 40 in the transport direction causes the medium 95 on which printing has been executed by the printing unit 40 to be heated and dried. The heating unit 70 includes a storing section 71, a first heater 72, a second heater 73, a chamber 80, a fan 74, a first opening/closing section 75, a second opening/closing section 76, a third opening/closing section 77, a first fluid mixing section 78, and a second fluid mixing section 79. Further, each component of the heating unit 70 is connected by piping.

[0052] The storing section 71 is a receptacle for storing water. The first heater 72 is configured to heat the water being stored in the storing section 71. The first heater 72 formed of an electric heating wire made of nichrome (80% nickel and 20% chromium) or the like is wound around the outer circumference of the storing section 71. The water in the storing section 71 is heated by the first heater 72 to generate steam from the storing section 71. Note that the first heater 72 may alternatively be provided at the inner side of the storing section 71. Also note that the storing section 71 may also be configured to store a fluid other than water as long as the storing section 71 can generate steam (vapour). Specifically, a fluid containing water may be stored. The storing section 71 is substantially storing water when it is storing the fluid containing water. Accordingly, the phrase "the storing section 71 stores water" also represents "the storing section 71 stores a fluid containing water".

[0053] The chamber 80 is formed in a bottomless box shape, the longitudinal direction of which coincides with the transport direction (the Y-axis direction). The chamber 80 includes a supply port 81 as an opening portion through which a fluid used for heating the medium is discharged, where the supply port 81 is provided at a portion on the upstream side in the transport direction. At this point, the supply port 81 is provided at the central portion in the width direction (the X-axis direction) of the chamber 80. The chamber 80 also includes a recovery port 82 through which a fluid discharged from the supply port 81 is recovered, where the recovery port 82 is provided at a portion on the downstream side in the transport direction. At this point, the recovery port 82 is provided at the center portion in the width direction (the X-axis direction) of the chamber 80. Note that the recovery port 82 may occasionally be used to recover materials other than the fluid discharged from the supply port 81 (for example, volatile materials from the medium 95). The chamber 80 covers the medium 95 transported on the transporting belt 23, causing the medium 95 to be dried with the fluid being supplied from the supply port 81 and being moved toward the recovery port 82.

[0054] The first opening/closing section 75 as an opening/closing section serves as a two-way valve provided between the storing section 71 and the supply port 81, allowing a flow channel of the steam (fluid) generated in the storing section 71 to be opened and closed. The sec-

ond heater 73 is provided between the first opening/closing section 75 and the supply port 81, and heats the fluid passing through the second heater 73. In the exemplary embodiment, the first opening/closing section 75 is coupled to the second heater 73 via both the first fluid mixing section 78 and the second fluid mixing section 79. Note that the first and second fluid mixing sections 78 and 79 serve as two so-called fluid valves for mixing or selecting fluids flowing in from two directions, where the first opening/closing section 75 is coupled to the upstream side (inflow side) of the first fluid mixing section 78 in the fluid movement direction, while the second heater 73 is coupled to the downstream side (discharge side) of the second fluid mixing section 79 in the fluid movement direction.

[0055] The chamber 80 includes the fan 74 provided on the downstream side of the recovery port 82 in the fluid movement direction. The fan 74 recovers the fluid in the chamber 80 and compresses the fluid thus recovered, and then delivers the fluid toward the downstream side in the fluid movement direction.

[0056] The second opening/closing section 76 serves as a three-way valve including a first port 76a, a second port 76b, and a third port 76c. The third opening/closing section 77 serves as a three-way valve including a first port 77a, a second port 77b, and a third port 77c. The downstream side in the fluid movement direction of the fan 74 is coupled to the first port 76a of the second opening/closing section 76. The third port 76c of the second opening/closing section 76 is coupled to the second port 77b of the third opening/closing section 77. The first port 77a of the third opening/closing section 77 is coupled to the upstream side (inflow side) of the first fluid mixing section 78 in the fluid movement direction. The third port 77c of the third opening/closing section 77 functions as an air-intake port for taking in external air. That is, the first fluid mixing section 78 is configured to be capable of discharging to the second fluid mixing section 79, a fluid obtained by mixing at least one of the fluid recovered from the chamber 80 and external air with the steam generated in the storing section 71.

[0057] The second port 76b of the second opening/closing section 76 is coupled to the upstream side (inflow side) of the second fluid mixing section 79 in the fluid movement direction. The second fluid mixing section 79 is configured to be capable of discharging to the second heater 73, a fluid obtained by mixing the fluid recovered from the chamber 80 with the fluid discharged from the first fluid mixing section 78. In addition, as described above, the third port 76c of the second opening/closing section 76 is coupled to the second port 77b of the third opening/closing section 77. Thereby, a configuration is provided such that the fluid recovered from the chamber 80 and the steam generated in the storing section 71 can be mixed with each other in the first fluid mixing section 78.

[0058] The controller 1 of the printing apparatus 100 is configured to employ, as a heating mode in which the

heating unit 70 is caused to heat the medium 95, a steam-use heating mode and a steam-nonuse heating mode (hot-air heating mode in the exemplary embodiment). The steam-use heating mode is a heating mode in which heating of the medium 95 is executed using steam. The steam-nonuse heating mode is a heating mode in which heating of the medium 95 is executed without using steam. The steam-use heating mode has a higher capability of drying the medium 95 than the steam-nonuse heating mode. Meanwhile, the thermal load on the medium 95 is also higher in the steam-use heating mode than in the steam-nonuse heating mode.

[0059] The controller 1 is also configured to employ a steam heating mode and a superheated-steam heating mode as the steam-use heating mode. The steam heating mode is a heating mode in which heating of the medium 95 is executed using steam at a temperature lower than a boiling point of water. The superheated-steam heating mode is a heating mode in which heating of the medium 95 is executed using superheated steam (steam at a temperature not lower than the boiling point of water). The boiling point of water, which is 100°C under the condition of 1 atm, varies with the change of atmospheric pressure. For example, in a state where the atmospheric pressure is higher than 1 atm, the boiling point of water becomes higher than 100°C, while in a state where the atmospheric pressure is lower than 1 atm, the boiling point of water becomes lower than 100°C. Accordingly, the boiling point of water can vary depending on the environment in which the printing apparatus 100 is used.

[0060] The superheated-steam heating mode has a higher capability of drying the medium 95 than the steam heating mode. Meanwhile, the thermal load on the medium 95 is also higher in the superheated-steam heating mode than in the steam heating mode. As such, the high capability of drying the medium 95 is in inverse proportion to the thermal load on the medium 95, and the heating modes need to be separately used depending on the applications. The controller 1 controls the first and second heaters 72 and 73, the first to third opening/closing sections 75, 76, and 77 and the fan 74 that constitute the heating unit 70. The controller 1 switches each of the heating modes by controlling each component of the heating unit 70.

[0061] Specifically, the controller 1 causes the first opening/closing section 75 to be in the open state and then activates the first heater 72, to thus control the heating unit 70 as the steam-use heating mode. The water being stored in the storing section 71 is heated by the first heater 72 and is converted into steam to be supplied into the chamber 80 through the supply port 81.

[0062] Furthermore, the controller 1 activates the second heater 73 and then controls the heating unit 70 as the superheated-steam heating mode. The steam generated by the first heater 72 is further heated by the second heater 73 to be converted into steam (superheated steam) at a temperature not lower than the boiling point of water and is then supplied into the chamber 80 through

the supply port 81 to cause the medium 95 to be heated. The superheated steam having a large heat capacity per unit volume and thus being excellent in heat transferability enables the medium 95 to be more promptly dried in the superheated-steam heating mode than in other heating modes.

[0063] In a case where the controller 1 inactivates the second heater 73, the heating unit 70 is controlled as the steam heating mode. The steam generated by the first heater 72 is (or is converted into) steam at a temperature lower than the boiling point of water and is then supplied into the chamber 80 through the supply port 81 to cause the medium 95 to be heated. In the steam heating mode, the medium 95 can be more promptly dried than in the steam-nonuse heating mode (hot-air heating mode).

[0064] The controller 1 causes the first opening/closing section 75 to be in the closed state and then activates the second heater 73, to thus control the heating unit 70 as the steam-nonuse heating mode. The steam-nonuse heating mode in the exemplary embodiment is a hot-air heating mode in which heating of the medium 95 is executed using hot air. The external air taken in from the third opening/closing section 77 or the fluid recovered from the recovery port 82 is heated by the second heater 73 to be converted into hot air containing no steam (that is, substantially no steam or only steam from ambient water vapour in the air) and is then supplied into the chamber 80 through the supply port 81 to cause the medium 95 to be heated. In the hot-air heating mode in which heating is executed without using steam, the heat capacity per unit volume is less than in the steam-use heating mode (superheated-steam heating mode and steam heating mode) in which heating is executed using steam, and by which the thermal load on the medium 95 or the ink can be suppressed. Note that heating modes other than the hot-air heating mode may be employed as the steam-nonuse heating mode. For example, an infrared heating mode in which heating of the medium 95 is executed with the infrared heater or a pressing heating mode in which the heater is pressed against the medium 95 may be employed.

[0065] In the printing apparatus 100 according to the exemplary embodiment including the heating unit 70 thus configured, the steam-use heating mode and the steam-nonuse heating mode (hot-air heating mode) can be readily switched to each other. In the steam-use heating mode, the superheated-steam heating mode and the steam heating mode can be readily switched to each other.

[0066] The heating unit 70, as described above, constitutes a heat circulation cycle in which the heated fluid (superheated steam, steam, and hot air) is recovered through the recovery port 82 to be reused. This allows the energy loss, and the energy consumption while heating is executed in the printing apparatus 100 to be suppressed.

[0067] Next, an internal configuration of the chamber 80 will be described with reference to Fig. 3.

[0068] The chamber 80 includes, in a plan view from the Z-axis direction, a side wall 80a extending in a V shape to cover the entire width of the medium 95 from the supply port 81 located at the central portion in the width direction toward the downstream side in the transport direction. The chamber 80 also includes, in a plan view from the Z-axis direction, a side wall 80b extending in a V shape to cover the entire width of the medium 95 from the recovery port 82 located at the central portion in the width direction toward the upstream side in the transport direction. In other words, the side wall 80b is narrowed in a V shape from the upstream side toward the recovery port 82 in the transport direction. An area surrounded by the side walls 80a and the side walls 80b opposing each other in V shapes serves as a heating area where the heating unit 70 causes the medium 95 to be heated.

[0069] The heating area is separated into a plurality of areas in the width direction. Inside the side walls 80a and 80b in V shapes are provided separation walls 87a and 87b for separating the heating area into three areas in the width direction. Between the side walls 80a and 80b in V shapes and the side walls 80a and 80b in V shapes are provided rectifying plates 86 for guiding the moving direction of the fluid extending in V shapes to be in the transport direction. This allows the heating area to be separated into three heating areas 88a, 88b, and 88c in the width direction.

[0070] In the vicinity of the supply port 81 are provided supply amount adjustment sections 84a, 84b, and 84c for adjusting the amount of fluid supplied to the heating areas 88a, 88b, and 88c, respectively. In the vicinity of the recovery port 82 are provided recovery amount adjustment sections 85a, 85b, and 85c for adjusting the amount of fluid recovered from the heating areas 88a, 88b, and 88c, respectively. The supply amount adjustment sections 84a, 84b, and 84c and the recovery amount adjustment sections 85a, 85b, and 85c may be configured by so-called butterfly valves or the like for controlling the flow rate of the fluid by, for example, rotating a valve body attached to a valve rod about the valve rod as an axis. The heating areas 88a, 88b, and 88c include sensor units 83a, 83b, and 83c, respectively. The sensor units 83a, 83b, and 83c each provided with a temperature sensor and a flow rate sensor and are configured to be capable of detecting the heating temperature and the flow rate of the fluid in the heating areas 88a, 88b, and 88c, respectively.

[0071] The controller 1 is configured to be capable of varying the output of the heating unit 70 for each of the separated areas (the heating areas 88a, 88b, and 88c). Specifically, the controller 1 is configured to be capable of controlling the supply amount adjustment sections 84a, 84b, and 84c and the recovery amount adjustment sections 85a, 85b, and 85c in the chamber 80. The controller 1 controls, based on the data on the temperature and the flow rate that are output from the sensor units 83a, 83b, and 83c, the first and second heaters 72 and

73, the supply amount adjustment sections 84a, 84b, and 84c, and the recovery amount adjustment sections 85a, 85b, and 85c. This allows the output of the heating unit 70 to be adjusted for each of the separated heating areas 88a, 88b, and 88c, suppressing the temperature of the medium 95 to be heated from becoming uneven. For example, the temperature is liable to be lowered at both of the end portions in the width direction of the medium 95 relative to the central portion in the width direction of the medium 95. At this point, the output of the heating areas 88a and 88c is made higher than the output of the heating area 88b, suppressing insufficient drying that occurs at both of the end portions in the width direction of the medium 95. This allows the medium 95 on which an image or the like has been printed to be properly heated and dried.

[0072] Although the exemplary embodiment exemplifies a configuration in which the heating areas 88a, 88b, and 88c are each provided with one sensor unit, a configuration may be employed, in which each heating area is provided with a plurality of sensor units. Further, although the chamber 80 separated into the three heating areas 88a, 88b, and 88c is exemplified, the chamber may be a chamber separated into two or not less than four areas.

Electrical Configuration

[0073] Fig. 4 is an electric block diagram illustrating an electrical configuration of a printing apparatus. Next, an electrical configuration of the printing apparatus 100 will be described with reference to Fig. 4.

[0074] The printing apparatus 100 includes an input device 6 to which printing information or the like is input, the controller 1 configured to control each component of the printing apparatus 100 to cause the medium 95 to be printed with an image, and the like. As the input device 6, a desktop-type or laptop-type Personal Computer (PC), a tablet-type device, a portable-type device, or the like may be used. The input device 6 may be provided independently from the printing apparatus 100.

[0075] The controller 1 is configured to include an Interface unit (I/F) 2, a Central Processing Unit (CPU) 3, a storage unit 4, a control circuit 5, and the like. The interface unit 2 is configured to transmit/receive data between the input device 6 configured to handle input signals or images and the controller 1. The CPU 3 is an arithmetic processing unit configured to process input signals from a detector group 7 including sensor units 83a, 83b, and 83c and to control the printing operation of the printing apparatus 100.

[0076] The storage unit 4 serving as a storage medium configured to secure an area for storing the program, a work area, or the like of the CPU 3 includes a storage device such as a Random-Access Memory (RAM), an Electrically Erasable Programmable Read Only Memory (EEPROM), and the like.

[0077] The controller 1 controls driving of the head 42

in accordance with the control signals output from the control circuit 5 to cause inks to be discharged onto the medium 95. The controller 1 controls driving of a motor provided in the carriage moving unit 45 in accordance with the control signals output from the control circuit 5 to cause the carriage 43 on which the head 42 is installed to reciprocate in the width direction of the medium 95 (in the X-axis direction). The controller 1 controls the rotation driver provided in each component of the transporting unit 20 in accordance with the control signals output from the control circuit 5 to cause the medium 95 placed on the transporting belt 23 to be moved in the transport direction (toward the + side in the Y-axis direction).

[0078] Images and the like are formed on the medium 95 by execution of the printing operation in which a main scanning (pass), where the controller 1 controls the carriage moving unit 45 and the head 42 to cause the carriage 43 (the head 42) to be moved in the width direction while causing the head 42 to discharge inks, and a sub-scanning, where the controller 1 controls the transporting unit 20 to cause the medium 95 to be transported in the transport direction, are alternately repeated.

[0079] The controller 1 controls, in accordance with the control signals output from the control circuit 5, the first and second heaters 72 and 73, the first to third opening/closing sections 75, 76, and 77, the fan 74, the supply amount adjustment sections 84a, 84b, and 84c, and the recovery amount adjustment sections 85a, 85b, and 85c that are included in the heating unit 70. This allows the heating mode, or the temperature and the flow rate of the fluid in the heating unit 70 to be changed. The controller 1 further controls the non-illustrated devices.

[0080] Fig. 5 is a view illustrating a cross section of a medium before being pressurized by a pressurizing unit. Fig. 6 is a view illustrating a cross section of a medium after being pressurized by a pressurizing unit. The printing apparatus 100 of the exemplary embodiment includes the pressurizing unit 60 described above. As illustrated in Fig. 5, in the medium 95 before being pressurized, the surface is partially bulged out and/or fibers 95a are irregularly fluffed up. In the medium 95, when pressurized by the pressurizing unit 60, the bulging of the medium 95 and the fluffing of the fibers 95a are suppressed as illustrated in Fig. 6. The pressurizing unit 60 including a heater pressurizes the medium 95 while heating the medium 95, thus maintaining the shape of the medium 95 in a stable manner. This makes it possible to suppress a color mixture, contamination, and uneven dyeing occurring on the surface of the medium 95 due to the contact between the head 42 and the medium 95 (the fiber 95a). The medium 95 pressurized as above is dried at a high speed in a state where the fluid moving in the chamber 80 of the heating unit 70 is rectified, thus enhancing the robustness and vividness of the dyed image printed on the medium 95. This suppresses the fluid supplied (discharged) through the supply port 81 of the heating unit 70 from being blocked by the fiber 95a, enabling the medium 95 on which an image or the like has been printed

to be properly dried.

Method of Heating Medium

[0081] Next, a method of heating the medium performed in the printing apparatus 100 will be described with reference to Fig. 7. Fig. 7 is a flowchart illustrating a method of heating.

[0082] Step S1 is a heating mode receiving step of receiving information about the heating mode that is selected by the user according to the type of the ink or the medium 95 to be used. The controller 1 receives, from the input device 6, information about the heating mode at the time of drying the medium 95 on which an image or the like has been printed by the printing unit 40, and then stores the information in the storage unit 4.

[0083] Step S2 is a step of determining whether the heating mode as indicated by the information received in Step S1 is the steam-use heating mode. When the heating mode as indicated by the information thus received is determined as the steam-use heating mode (Step S2: YES), the process proceeds to Step S3. When the heating mode as indicated by the received information is determined as the steam-nonuse heating mode (Step S2: NO), the process proceeds to Step S6.

[0084] Step S3 is a step of determining whether the steam-use heating mode as determined in Step S2 is the superheated-steam heating mode. When the steam-use heating mode as determined in Step S2 is the superheated-steam heating mode (Step S3: YES), the process proceeds to Step S4. When the steam-use heating mode as determined in Step S2 is not the superheated-steam heating mode, in other words, when the heating mode as indicated by the information received as above is the steam heating mode (Step S3: NO), the process proceeds to Step S5. Note that Step S2 to Step S3 are heating mode determining steps of determining the heating mode of the heating unit 70.

[0085] Step S4 to Step S6 are mode switching steps of causing the heating unit 70 to be switched to the heating mode as determined.

[0086] In the heating step (superheated-steam heating mode) of Step S4, the controller 1 switches the heating mode to the superheated-steam heating mode of the steam-use heating mode. The controller 1 causes the first opening/closing section 75 to be in the open state and then activates the first and second heaters 72 and 73, to thus control the heating unit 70 as the superheated-steam heating mode.

[0087] In the heating step (steam heating mode) of Step S5, the controller 1 switches the heating mode to the steam heating mode of the steam-use heating mode. The controller 1 causes the first opening/closing section 75 to be in the open state and then activates the first heater 72, to thus control the heating unit 70 as the steam heating mode. Note that, at this point, the second heater 73 is inactivated.

[0088] In the heating step (hot air heating mode) of

Step S6, the controller 1 switches the heating mode to the hot air heating mode which is of the steam-nonuse heating mode. The controller 1 causes the first opening/closing section 75 to be in the closed state and then activates the second heater 73, to thus control the heating unit 70 as the hot-air heating mode. Note that, at this point, the first heater 72 is inactivated.

[0089] Step S7 is a printing execution step of executing printing. The controller 1 controls the printing unit 40 and the transporting unit 20 based on print data, to thereby execute printing. The medium 95 on which an image or the like has been printed by the printing unit 40, when passing through the heating area of the heating unit 70, is heated and dried in accordance with the heating mode switched in any one of steps S4 to S6. Then, after completing the printing, the controller 1 terminates the operation of the printing apparatus 100.

[0090] According to the printing apparatus 100 and the method of heating the medium 95 of the exemplary embodiment, the controller 1 switches the heating mode of the heating unit 70 to the heating mode that is selected according to the type of the ink or the medium 95 to be used for the printing. This allows various types of inks or media 95 to be properly dried.

[0091] As described above, according to the printing apparatus 100 and the method of heating the medium 95 of the exemplary embodiment, the following effects can be obtained.

[0092] The printing apparatus 100 includes the printing unit 40 configured to execute printing on the medium 95 and the heating unit 70 configured to cause the medium 95 on which printing has been executed to be heated. The controller 1 is configured to employ, as a heating mode in which the heating unit 70 is caused to heat the medium 95, a steam-use heating mode in which heating of the medium 95 is executed using steam and a steam-nonuse heating mode in which heating of the medium 95 is executed without using steam. Switching the heating mode of the heating unit 70 according to the type of the ink or the medium 95 to be used for the printing enables various types of inks or media 95 to be properly dried.

[0093] The heating unit 70 of the printing apparatus 100 includes the storing section 71 configured to store water, the first heater 72 configured to heat water, the supply port 81 through which a fluid used for heating the medium 95 is discharged, a first opening/closing section 75 provided between the storing section 71 and the supply port 81 and configured to open and close a fluid flow channel, and the second heater 73 provided between the first opening/closing section 75 and the supply port 81. The controller 1 causes the first opening/closing section 75 to be in the open state and then activates the first heater 72, to thus control the heating unit 70 as the steam-use heating mode. The controller 1 also causes the first opening/closing section 75 to be in the closed state and then activates the second heater 73, to thus control the heating unit 70 as the steam-nonuse heating mode. This configuration allows suitable switching between the

steam-use heating mode and the steam-nonuse heating mode.

[0094] The controller 1 is further configured to employ, as a steam-use heating mode, a steam heating mode in which heating is executed using steam at a temperature lower than the boiling point of water and a superheated-steam heating mode in which heating is executed using steam at a temperature not lower than the boiling point of water. The controller 1 causes the first opening/closing section 75 to be in the open state and then activates the first heater 72 and inactivates the second heater 73, to thus control the heating unit 70 as the steam heating mode of the steam-use heating mode. The controller 1 causes the first opening/closing section 75 to be in the open state and then activates both the first heater 72 and the second heater 73, to thus control the heating unit 70 as the superheated-steam heating mode of the steam-use heating mode. This configuration allows suitable switching between the steam heating mode and the superheated-steam heating mode.

[0095] The controller 1 is also configured to employ, as the steam-nonuse heating mode, a hot-air heating mode in which heating of the medium 95 is executed using hot air. The hot-air heating mode employing heating executed without using steam causes non-contact heating with respect to the medium 95 to be executed, suppressing the thermal load on the medium 95 or the ink.

[0096] The heating area where the heating unit 70 causes the medium 95 to be heated is separated into a plurality of areas in the width direction of the medium 95. The controller 1 is configured to be capable of varying the output of the heating unit 70 for each of the areas thus separated (the heating areas 88a, 88b, and 88c). This allows the medium 95 on which an image or the like has been printed to be properly heated and dried.

[0097] The printing apparatus 100 includes the pressurizing unit 60 configured to pressurize the medium 95, where the pressurizing unit 60 is provided on the upstream side of the heating unit 70 in the transport direction. The medium 95 is pressurized by the pressurizing unit 60, suppressing the fluffing of the fibers 95a of the medium 95. This suppresses the fluid supplied (discharged) through the supply port 81 of the heating unit 70 from being blocked by the fiber 95a, enabling the medium 95 on which an image or the like has been printed to be properly dried.

[0098] The method of heating the medium 95 performed in the printing apparatus 100 includes accepting the selection of the heating mode to be employed and causing the medium 95 to be heated by the heating unit 70 being in the heating mode that is selected. Switching the heating mode according to the type of the ink or the medium 95 to be used for the printing enables various types of inks or media 95 to be properly dried.

[0099] Note that the invention is not limited to the exemplary embodiments described above, and the exemplary embodiments described above can be variously changed and modified. Modified examples are described

below.

Modified Example

[0100] Fig. 8 is a heat application table illustrating a relationship between types of media/types of inks and heating modes according to the modified examples. Fig. 9 is a flowchart illustrating a method of heating a medium. A method of heating a medium according to modified examples will be described with reference to Fig. 8 and Fig. 9. Note that the configurations as in the exemplary embodiment are referenced using like numbers, and no detailed descriptions for such configurations are provided below.

[0101] Step S11 is a print information receiving step of receiving the print information. The controller 1 receives, from the input device 6, print information such as information about print data to be printed on the medium 95, information about the type of medium to be used for the printing (medium information), or information about the type of ink to be used for the printing (ink information), and then stores the print information in the storage unit 4. As an example of the types of inks, pigment ink ("Pigment" in Fig. 8), reactive dye ink ("Reaction" in Fig. 8), and acidic dye ink ("Acidic" in Fig. 8) are prepared. As an example of the types of the media 95, cotton, polyester, nylon, and silk are prepared. Note that, when the type of the medium 95 is silk, the information about the drying method (baking or steaming) is additionally included in the print information. Baking represents a drying method in which an ink applied to the medium 95 is heated and then a resin contained in the ink is fixed to the medium 95. Steaming represents a drying method in which the medium 95 to which an ink has been applied is steamed with saturated vapor (steam) and then a dye contained in the ink is fixed to the medium 95.

[0102] Step S12 is a heating mode determining step of determining the heating mode based on the printing information received in Step S11. The heat application table illustrated in Fig. 8 is stored in advance in the storage unit 4. The controller 1 refers to the heat application table and then determines the heating mode and the heating temperature based on the information about the type of the medium 95 and the type of the ink received in Step S11.

[0103] For example, in a case where the type of the medium 95 is cotton and the type of the ink is pigment, the controller 1 determines the heating mode as the superheated-steam heating mode of the steam-use heating mode, and then sets the temperature of the superheated steam at 170°C. Further, for example, in a case where the type of the medium 95 is silk, the type of the ink is acidic, and the drying method is baking, the controller 1 determines the heating mode as the hot-air heating mode of the steam-nonuse heating mode, and then sets the temperature of the hot air at 150°C. Note that Step S12 is a heating mode determining step of determining the heating mode.

[0104] Step S13 is a mode switching step of switching the heating mode performed by the controller 1 to the heating mode as determined in Step S12. The controller 1 switches the heating mode to any one of the superheated-steam heating mode, the steam heating mode, and the hot-air heating mode, based on the printing information at the time when printing is executed on the medium 95. This makes it easy to handle printing using various types of inks or media 95. For example, in a case where the type of the medium 95 is cotton and the type of the ink is pigment, the controller 1 controls each component of the heating unit 70 to cause the heating mode to be switched to the superheated-steam heating mode of the steam-use heating mode, and then controls the temperature of the superheated steam supplied into the chamber 80 to be set at 170°C. Further, for example, in a case where the type of the medium 95 is silk, the type of the ink is acidic, and the drying method is baking, the controller 1 controls each component of the heating unit 70 to cause the heating mode to be switched to the hot-air heating mode of the steam-nonuse heating mode, and then controls the temperature of the hot air supplied into the chamber 80 to be set at 150°C. Note that in Step S13, since the medium 95 is additionally heated in accordance with the heating mode being switched, Step S13 can also be referred to as a heating step.

[0105] Step S14 is a printing execution step of executing printing. The controller 1 controls the printing unit 40 and the transporting unit 20 based on the print data, to thus execute printing. The medium 95 on which an image or the like has been printed by the printing unit 40, when passing through the heating unit 70, is heated and dried in accordance with the heating mode being switched in Step S13. Then, after completing the printing, the controller 1 terminates the operation of the printing apparatus 100.

[0106] According to the method of heating of the modified examples, the controller 1 switches the heating mode to be employed to the heating mode that is determined based on the printing information including information such as the type of the medium 95 and the type of the ink, and the heat application table stored in the storage unit 4. This allows various types of inks or media 95 to be properly dried.

[0107] To summarize the modified examples, the controller 1 is configured, in the printing apparatus 100, to switch the heating mode based on the printing information at the time when printing is executed on the medium 95. This configuration allows the printing apparatus 100 to readily handle printing using various types of inks or media 95.

[0108] At this point, the print information includes medium information about the type of the medium 95 to be used for the printing, and ink information about the type of the ink to be used for the printing. Then, the controller 1 switches the heating mode based on the medium information and the ink information. This configuration allows the printing apparatus 100 to particularly readily

handle printing using various types of inks or media 95.

[0109] Note that the specific contents of the switching control of the heating mode performed in the controller 1 are summarized below.

[0110] In a case where the type of the ink is pigment ink and the type of the medium 95 is cotton or polyester, the controller 1 employs the superheated-steam heating mode. Further, in a case where the type of the ink is pigment ink and the type of the medium 95 is nylon, the controller 1 employs the hot-air heating mode.

[0111] In a case where the type of the ink is reactive dye ink and the type of the medium 95 is cotton or silk (the drying method is steaming), the controller 1 employs the steam heating mode. Further, in a case where the type of the ink is reactive dye ink and the type of the medium 95 is silk (the drying method is baking), the controller 1 employs the hot-air heating mode.

[0112] Furthermore, in a case where the type of the ink is acidic dye ink and the type of the medium 95 is silk (the drying method is baking), the controller 1 employs the hot-air heating mode.

[0113] The control as described above enables the printing apparatus 100 to particularly readily handle printing using various types of inks or media 95.

Claims

1. A printing apparatus (100) comprising:

- a printing unit (40) configured to execute printing on a medium (95);
- a heating unit (70) configured to cause the medium on which printing has been executed to be heated; and
- a controller (1) configured to control the heating unit, wherein
 - the controller is configured to employ, as a heating mode in which the heating unit is caused to heat the medium,
 - a steam-use heating mode in which heating is executed using steam and
 - a steam-nonuse heating mode in which heating is executed without using steam.

2. The printing apparatus according to claim 1, wherein the heating unit is configured to employ, as the steam heating mode, a steam heating mode in which the medium is caused to be heated using steam at a temperature lower than a boiling point of water and a superheated-steam heating mode in which the medium is caused to be heated using steam at a temperature not lower than the boiling point of water.

3. The printing apparatus according to claim 2, wherein the heating unit (70) includes:

- a storing section (71) configured to store water;
- a first heater (72) configured to heat the water being stored in the storing section;
- an opening portion (81) through which a fluid used for heating the medium is discharged;
- an opening/closing section (75) provided between the storing section and the opening portion, the opening/closing section being configured to open and close a flow channel of the fluid; and
- a second heater (73) provided between the opening/closing section and the opening portion, wherein
 - the controller is configured to cause the opening/closing section to be in an open state and activate the first heater and inactivate the second heater, to thus control the heating unit as the steam heating mode, and
 - to cause the opening/closing section to be in an open state and then activate both the first heater and the second heater, to thus control the heating unit as the superheated-steam heating mode.

4. The printing apparatus according to any one of the preceding claims, wherein the controller is configured to employ, as the steam-nonuse heating mode, a hot-air heating mode in which the medium is caused to be heated using hot air.

5. The printing apparatus according to any one of the preceding claims, wherein the controller is configured to switch the heating mode of the heating unit based on printing information at a time when printing is executed on the medium.

6. The printing apparatus according to claim 5, wherein the printing information includes medium information about type of medium to be used for printing, and ink information about type of ink to be used for printing, and the controller is configured to switch the heating mode based on the medium information and the ink information.

7. The printing apparatus according to any one of the preceding claims, comprising a transporting unit (20) configured to transport the medium in a transport direction (Y), wherein a heating area where the heating unit causes the medium to be heated is separated into a plurality of areas (88a, 88b, 88c) in a width direction (X) intersecting the transport direction, and the controller is configured to be capable of varying an output of the heating unit for each of the plurality of areas thus separated.

8. The printing apparatus according to any one of the preceding claims, comprising:

a transporting unit (20) configured to transport the medium in a transport direction; and
a pressurizing unit (60) provided on an upstream side of the heating unit in the transport direction, the pressurizing unit being configured to pressurize the medium.

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9. A method of heating a medium performed in a printing apparatus (100), the printing apparatus including a printing unit (40) configured to execute printing on a medium, and

a heating unit (70) configured to be capable of being switched between heating modes of a steam-use heating mode in which the medium is caused to be heated using steam and a steam-nonuse heating mode in which the medium is caused to be heated without using steam, the method comprising:

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accepting a selection of the heating mode to be employed; and
causing the medium to be heated by the heating unit being in the heating mode that is selected.

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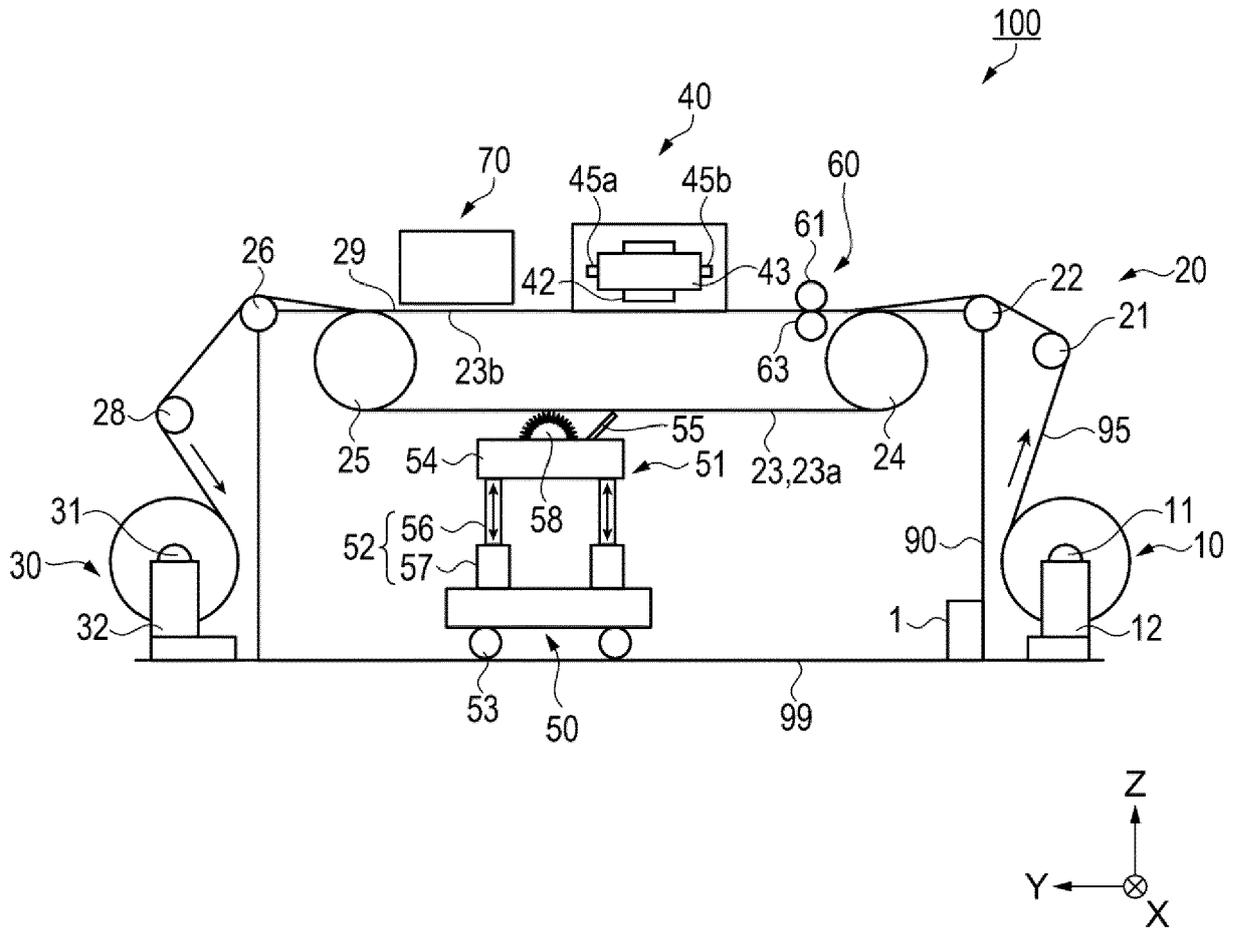


Fig. 1

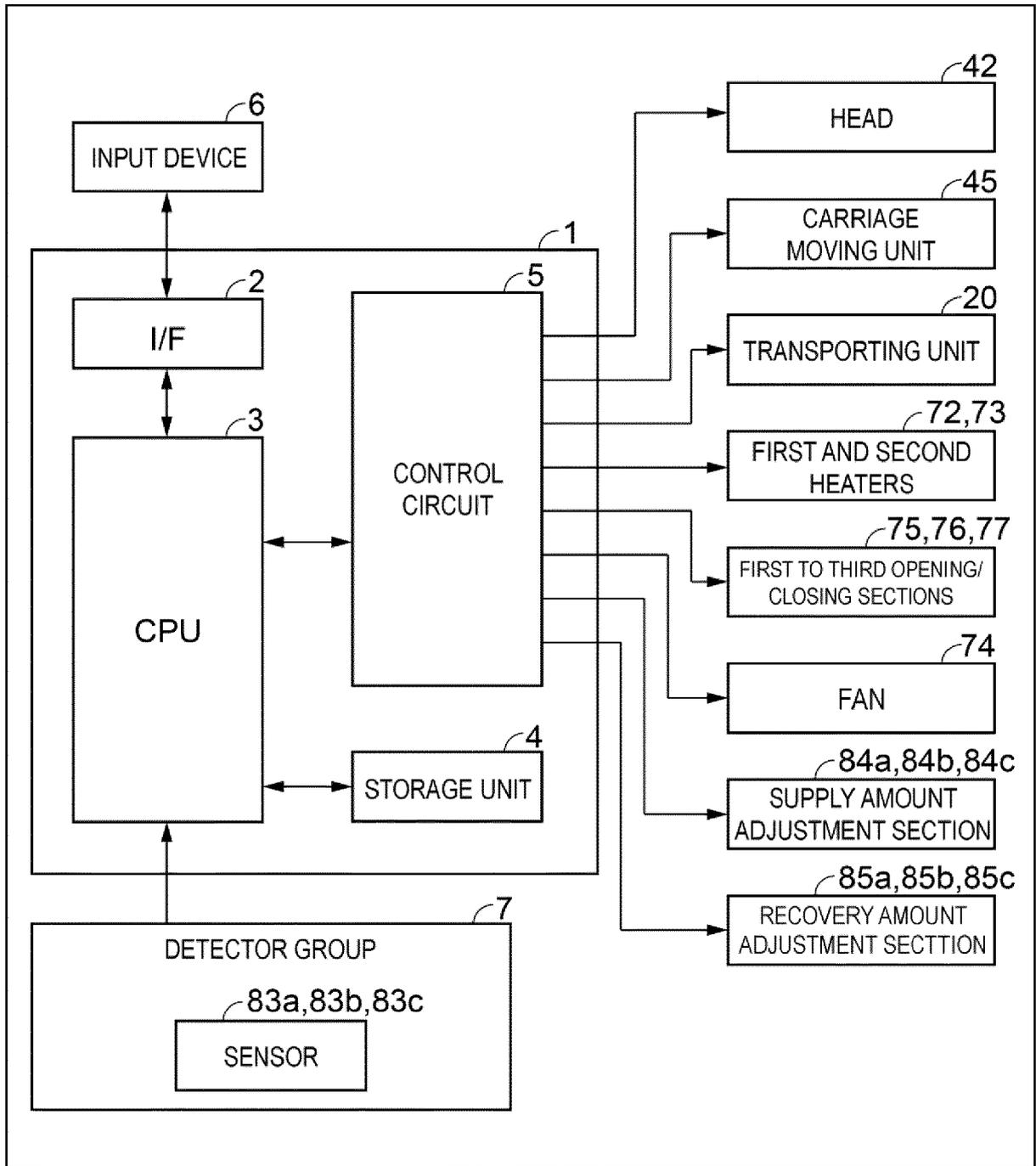


Fig. 4

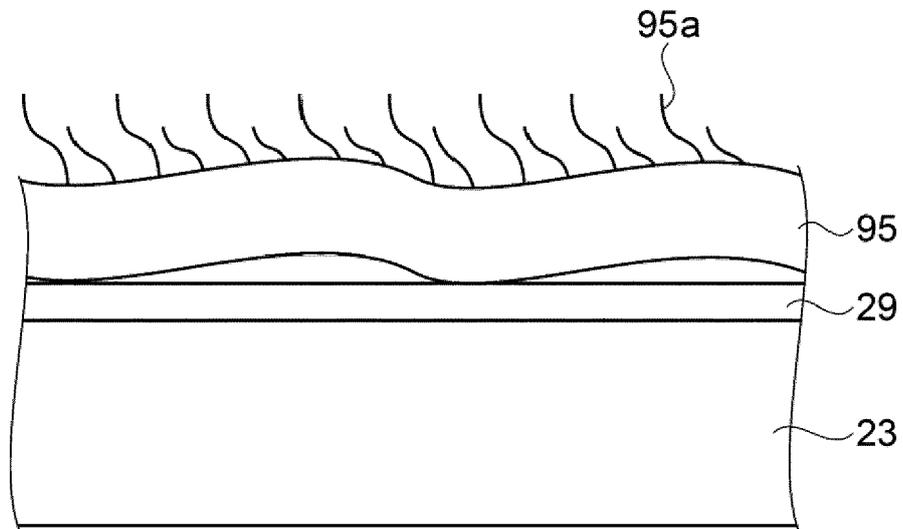


Fig. 5

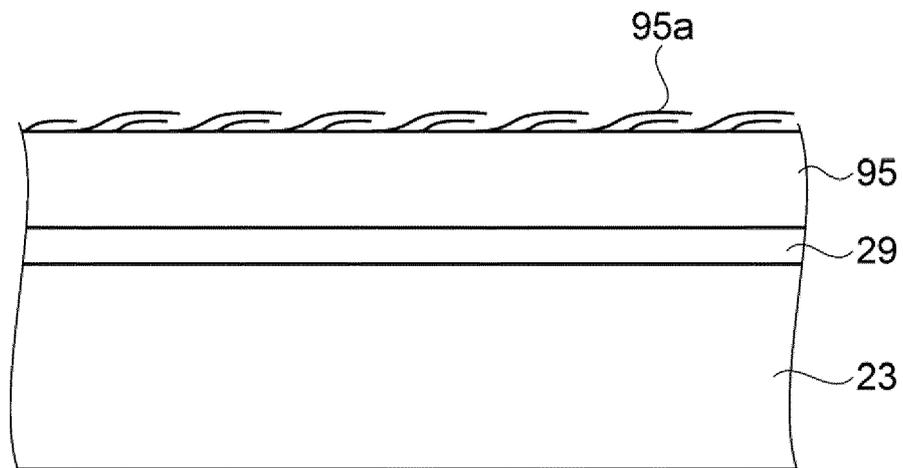


Fig. 6

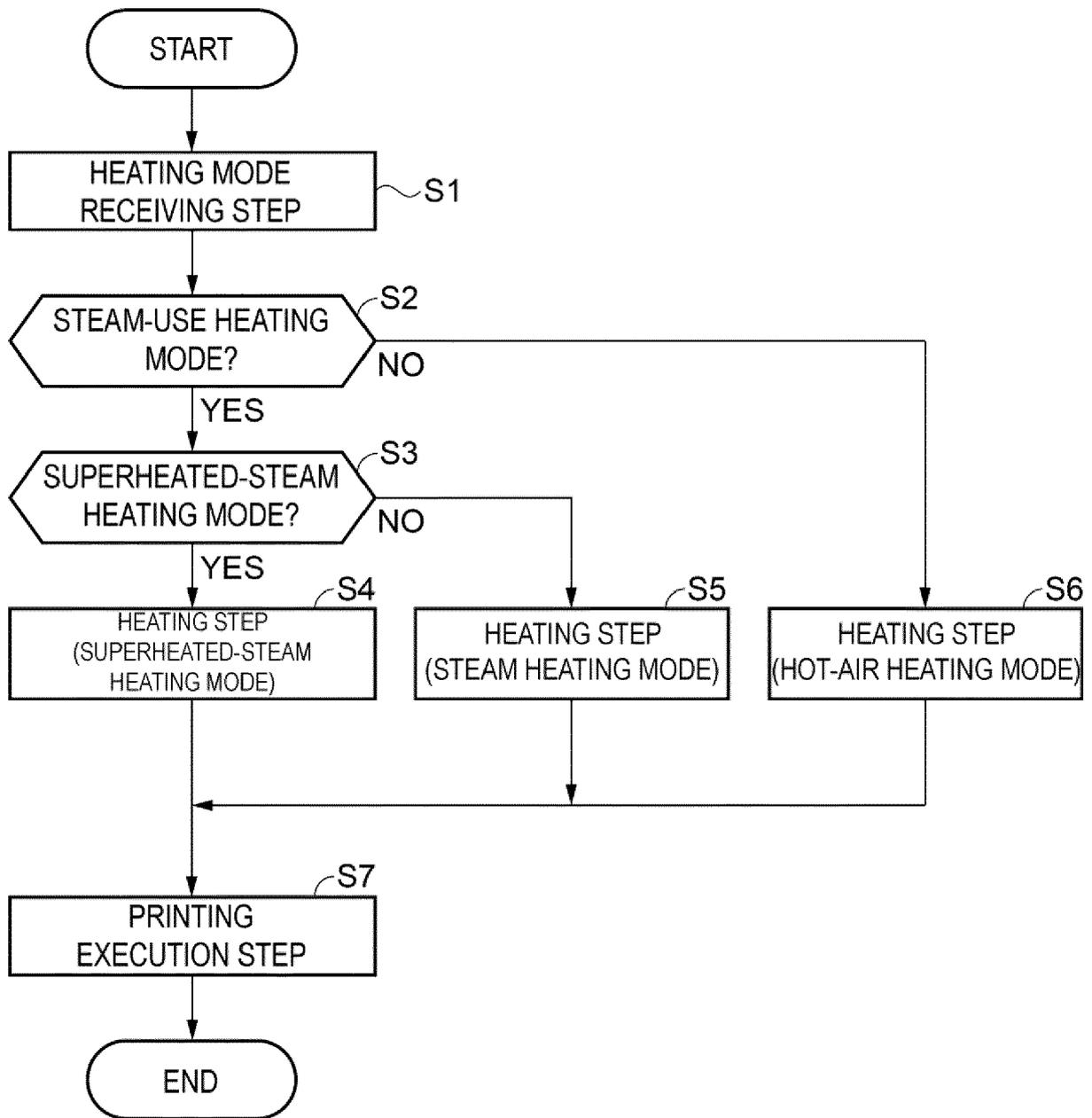


Fig. 7

TYPE OF INK		TYPE OF MEDIUM			SILK	
		COTTON	POLYESTER	NYLON	BAKING	STEAMING
PIGMENT	TEMPERATURE	170°C	130°C	120°C		
	HEATING MODE	SUPERHEATED STEAM	SUPERHEATED STEAM	HOT AIR		
REACTION	TEMPERATURE	100°C			150°C	100°C
	HEATING MODE	STEAM			HOT AIR	STEAM
ACIDIC	TEMPERATURE			100°C	150°C	100°C
	HEATING MODE			STEAM	HOT AIR	STEAM

Fig. 8

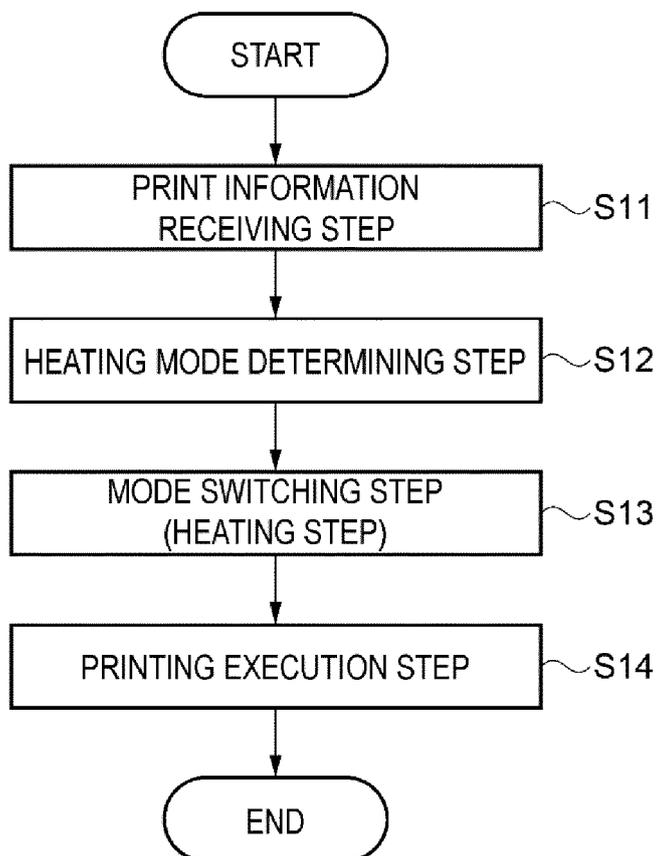


Fig. 9



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