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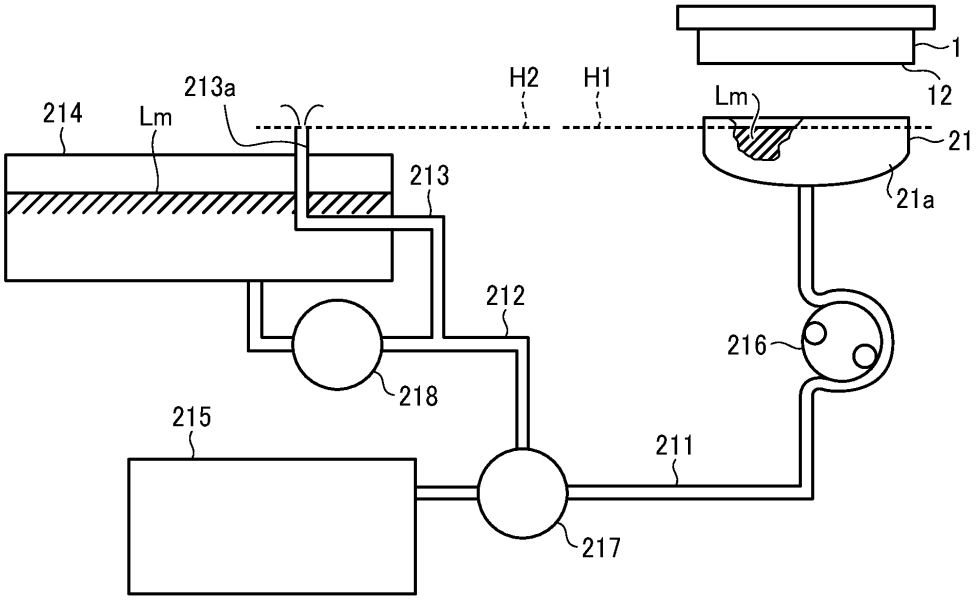
(54) **LIQUID DISCHARGE UNIT, LIQUID DISCHARGE APPARATUS, AND LINEAR MEDIUM TREATMENT SYSTEM**

(57) A liquid discharge unit (103) includes: a liquid discharge head (1) configured to discharge a liquid; a cap (21) configured to cap the liquid discharge head (1), the cap (21) having a reservoir space (21a) configured to store a moisturizing liquid; a moisturizing liquid container (214) configured to store the moisturizing liquid to be supplied to the reservoir space in the cap; a waste liquid collector (215) configured to collect a waste liquid discharged from the cap; a first channel (211) connected to the cap (21) and the waste liquid collector (215); a second channel (212) connected to the moisturizing liquid container (214) and the first channel (211); a channel switch (217) at a connection between the first channel (211) and the second channel (212); and a liquid feeder (218) configured to: feed the moisturizing liquid from the moisturizing liquid container (214) to the cap (21).

FIG. 5



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Description

BACKGROUND

Technical Field

[0001] The present disclosure relates to a liquid discharge unit, a liquid discharge apparatus, and a linear medium treatment system.

Related Art

[0002] Japanese Unexamined Patent Application Publication No. 2010-120266 discloses a liquid discharge type image forming apparatus that includes a maintenance unit (80) for maintaining and recovering ink discharging performance of a head unit (1). The maintenance unit (80) includes a cap (81) that covers each head (11), a cap opening/closing valve (86) that opens and closes a path of each cap, a waste liquid tank (84), a cleaning liquid tank (85), a switching valve (83a) that switches the paths, a pump (82), and the like. At the start of printing, suction of nozzle ink and supply of cleaning liquid to the cap are performed for a non-discharge head specified by a nozzle discharge detector.

[0003] In the conventional technique, a liquid level sensor is provided inside a cap so that the sensor detects the amount of cleaning liquid supplied into the cap. On the basis of a result of sensor detection, the driving of a pump is controlled to manage the amount of liquid in the cap. For this reason, the cap needs a dedicated constituent element such as the liquid level sensor. This causes an increase in size, complexity, and cost of the apparatus.

[0004] According to the present disclosure, it is possible to provide a liquid discharge unit that enables management of the amount of liquid in a cap with a simple configuration.

SUMMARY

[0005] A liquid discharge unit includes: a liquid discharge head configured to discharge a liquid; a cap configured to cap the liquid discharge head, the cap having a reservoir space configured to store a moisturizing liquid; a moisturizing liquid container configured to store the moisturizing liquid to be supplied to the reservoir space in the cap; a waste liquid collector configured to collect a waste liquid discharged from the cap; a first channel connected to the cap and the waste liquid collector; a second channel connected to the moisturizing liquid container and the first channel; a channel switch at a connection between the first channel and the second channel; a liquid feeder configured to: feed the moisturizing liquid from the moisturizing liquid container to the cap; and feed the moisturizing liquid from the cap to the moisturizing liquid container; and a third channel having one end connected to the second channel and another end in the moisturizing liquid container, said another end of the third channel having an opening at a level lower than an upper end of the cap in a vertical direction.

[0006] The liquid discharge unit according to the present embodiment can manage an amount of the moisturizing liquid in the cap with a simple configuration.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] A more complete appreciation of embodiments of the present 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 an overall schematic diagram of a linear medium treatment system according to an embodiment of the present disclosure;
FIG. 2 is a schematic configuration diagram of a liquid discharge unit according to the embodiment of the present disclosure;
FIG. 3 is an explanatory diagram of nozzle surfaces of heads according to the embodiment of the present disclosure;
FIGS. 4A to 4C are explanatory diagrams each illustrating a relationship between a head position and a maintenance unit in a head moving direction;
FIG. 5 is an explanatory diagram of a moisturizing liquid amount management mechanism according to the embodiment of the present disclosure;
FIG. 6 illustrates a modification of the moisturizing liquid amount management mechanism according to the embodiment of the present disclosure;
FIG. 7 illustrates another modification of the moisturizing liquid amount management mechanism according to the embodiment of the present disclosure; and
FIG. 8 is an explanatory diagram of an application example of the liquid discharge unit according to the embodiment of the present disclosure.

[0008] The accompanying drawings are intended to depict embodiments of the present disclosure 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

[0009] 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.

[0010] 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.

[0011] Hereinafter, an embodiment for carrying out the invention will be described with reference to the drawings. In the description of the drawings, the same elements are denoted by the same reference numerals, and redundant description is omitted.

[Outline of Linear Medium Treatment System]

[0012] First, an outline of a linear medium treatment system will be described with reference to FIG. 1.

[0013] FIG. 1 is an overall schematic diagram of a linear medium treatment system according to an embodiment of the present disclosure. The linear medium treatment system exemplified here is an embroidering system that dyes a thread, and performs embroidery by using the dyed thread.

[0014] In FIG. 1, an embroidering system 1000 includes a liquid discharge apparatus 100 and an embroidering unit 106. In addition, the liquid discharge apparatus 100 includes a feed reel 102, a liquid discharge unit 103, a drying unit 104, and a post-processing unit 105. The embroidering system 1000 is an example of the linear medium treatment system is not limited to

[0015] The feed reel 102 holds an embroidery thread 101 (hereinafter referred to as a thread.), and feeds the thread 101 to the liquid discharge unit 103. The feed reel 102 is an example of a recording medium feeding unit.

[0016] Rollers 108 and 109 are provided between the feed reel 102 and the liquid discharge unit 103. The roller 109 includes a rotary encoder 405 including an encoder sensor 405a and an encoder wheel 405b. The encoder wheel 405b is provided coaxially with the roller 109. The encoder sensor 405a reads an encoder slit provided in the encoder wheel 405b. The rotary encoder 405 detects the state of conveyance of the thread 101.

[0017] The liquid discharge unit 103 includes liquid discharge heads 1 (hereinafter referred to as heads) and maintenance units 2. Each head 1 applies liquid to the thread 101 passing below the head 1. In the present embodiment, the head 1 adopts an inkjet recording system, and the liquid to be applied to the thread 101 is mainly a coloring ink. The maintenance unit 2 includes a dummy discharge receiver, a wiping unit, a capping unit, and the like. When the head 1 is located at these units, these units apply respective treatments to the head 1 to maintain liquid discharging performance of the head 1.

[0018] The drying unit 104 includes a heating member such as a heater, and heats and dries the thread 101 to which ink has been applied. As a result, the thread 101 is dyed in a desired color. The post-processing unit 105 includes a cleaning device, a lubricant applying device, and the like so as to improve the condition of the thread 101 as a post-process. The cleaning device removes coloring material remaining on the thread 101 and not fixed to the thread 101 to clean the thread 101. The lubricant applying device applies a lubricant such as wax to the surface of the thread 101. The embroidering unit 106 includes an embroidering head. The embroidering unit 106 sews the dyed thread 101 into cloth to embroider patterns on the cloth.

[0019] In the above configuration, the rotary encoder 405 detects a conveyance speed of the thread 101 being taken in by the embroidering unit 106. The liquid discharge unit 103 controls ink discharge from the head 1 according to the detected conveyance speed of the thread 101. In other words, when the conveyance speed of the thread 101 being taken in by the embroidering unit 106 is slow, the frequency of discharging ink onto the thread 101 is lowered. Meanwhile, when the conveyance speed of the thread 101 being taken in by the embroidering unit 106 is high, the frequency of discharging ink onto the thread 101 is increased. Thus, the liquid discharge unit 103 can dye the thread 101 in synchronization with the conveyance speed of the thread 101 being taken in by the embroidering unit 106. When dyeing the thread 101, it is possible to achieve a wide range of color expression by combining colors of, for example, black, cyan, magenta, and yellow.

[0020] The thread 101 is an example of a "linear recording medium" or a "linear medium". Examples of the "thread" include a fiberglass thread, a wool thread, a cotton thread, a synthetic thread, a metal thread, wool, cotton, a polymer, a blended yarn containing metal, yarn, a filament, and linear objects to which liquid can be applied. Examples of the "thread" also include a braid and a flat string. In addition to the linear objects, examples of the "thread" further include band-shaped members (continuous base materials) to which liquid can be applied, such as a rope, a cable, and a cord, as discharge-target media that can be dyed by ink droplets. Each of the discharge-target media is a linear or band-shaped medium having a narrow width and being continuous in a conveyance direction.

[0021] Note that the linear medium treatment system is not limited to the embroidering system 1000. For example, instead of the embroidering unit 106, another processing device such as a weaving machine or a sewing machine may be provided at the subsequent stage of the post-processing unit 105. Furthermore, in a case where the embroidering unit is installed at another location (in the case of a system other than an in-line type system), a winding unit that winds the dyed thread may be provided instead of the embroidering unit 106, at the subsequent stage of the post-processing unit 105. In this case, the once wound thread is carried to a location where a processing device is installed, and then loaded into the processing device to perform desired processing.

[Configuration of Liquid Discharge Unit]

[0022] FIG. 2 is a schematic configuration diagram of

the liquid discharge unit according to the embodiment of the present disclosure. FIG. 2 supplements the description of the liquid discharge unit 103 illustrated in FIG. 1.

[0023] In FIG. 2, the liquid discharge unit 103 includes a plurality of heads 1a, 1b, 1c, and Id arranged in tandem along the thread conveyance direction. The heads 1a to Id discharge inks of different colors. For example, the head 1a discharges ink droplets of black (K), the head 1b discharges ink droplets of cyan (C), the head 1c discharges ink droplets of magenta (M), and the head Id discharges ink droplets of yellow (Y). The above-described order of colors is an example. In some embodiments, the colors may be arranged in an order different from the above-described order. The number of heads is not limited to four, and may be increased or decreased according to the number of colors of inks to be used.

[0024] The liquid discharge unit 103 also includes a plurality of maintenance units 2a, 2b, 2c, and 2d below the heads 1a to 1d with a conveyance path of the thread 101 interposed therebetween. The maintenance units 2a to 2d each include a dummy discharge receiver, a wiping unit, a capping unit, and the like, and apply treatments to the heads 1a to 1d located at these units, respectively.

[Configuration of Nozzle Surface of Head]

[0025] Next, the configuration of a nozzle surface of the head will be described with reference to FIG. 3. FIG. 3 is an explanatory diagram of nozzle surfaces of the heads according to the embodiment of the present disclosure. FIG. 3 illustrates the heads 1 of the liquid discharge unit 103 as viewed from below.

[0026] In FIG. 3, the heads 1a to Id provided in the liquid discharge unit 103 each include a nozzle surface 12 facing the thread 101. Each nozzle surface 12 of the heads 1a to Id includes two nozzle rows 10a and 10b. Each of the nozzle rows 10a and 10b includes a nozzle group including a plurality of nozzles 11 arranged in the thread conveyance direction. The heads 1a to Id are examples of a "liquid discharger".

[0027] The nozzle row 10a and the nozzle row 10b are arranged in parallel with the thread conveyance direction at a predetermined distance from each other in a direction (head moving direction) orthogonal to the thread conveyance direction. In the case of dyeing the thread 101, the heads 1a to Id are moved such that the nozzle rows 10a or the nozzle rows 10b of the heads 1a to Id are located directly above the thread 101. Thus, the heads 1a to Id discharge and apply ink to the thread 101 moving in the thread conveyance direction (FIG. 3 illustrates a case where the nozzle rows 10a are used for dyeing the thread 101).

[0028] When a predetermined timing is reached, the heads 1a to Id are moved in the head moving direction to switch between the nozzle rows 10a and the nozzle rows 10b with respect to the thread 101. The predetermined timing is determined on the basis of the duration of use, the amount of discharged ink, and the like.

[Outline of Maintenance Unit]

[0029] Next, an outline of the maintenance unit will be described with reference to FIGS. 4A to 4C. FIGS. 4A to 4C are explanatory diagrams each illustrating a relationship between a head position and the maintenance unit in the head moving direction.

[0030] The liquid discharge unit 103 includes the maintenance unit 2 below the head 1 with the conveyance path of the thread 101 interposed therebetween. The maintenance unit 2 includes a cap 21 located at its top. The cap 21 can move forward and backward with respect to the maintenance unit 2 (movable in a direction indicated by an arrow A in FIG. 4A). As a result, the cap 21 can come into contact with and separate from the nozzle surface of the head 1.

[0031] The head 1 located above the maintenance unit 2 is movable in the head moving direction with respect to the maintenance unit 2. FIG. 4A illustrates a state in which the nozzle row 10a of the head 1 is located directly above the thread 101, where the nozzle row 10a discharges ink onto the thread 101 to dye the thread 101. FIG. 4B illustrates a state in which the nozzle row 10b of the head 1 is located directly above the thread 101, where the nozzle row 10b discharges ink onto the thread 101 to dye the thread 101.

[0032] FIG. 4C illustrates a state in which the head 1 is located in such a way as to face the cap 21. When the head 1 moves to a position where the head 1 faces the cap 21, the cap 21 moves (rises in the present embodiment) toward the head 1 to cover (cap) the nozzle surface of the head 1. Thus, the nozzle surface is prevented from drying. Furthermore, the cap 21 performs suction for the nozzle in a state where the nozzle surface is capped, to prevent discharge failure of the nozzle due to ink clogging. The cap 21 is an example of a "cap".

[0033] In addition to the cap 21, the maintenance unit 2 includes the wiping unit, the dummy discharge receiver, and the like. The wiping unit includes a wiper member that wipes the nozzle surface while moving in the head moving direction relative to the nozzle surface of the head 1. The dummy discharge receiver includes a collecting container. When dummy discharge is performed for a nozzle not used for applying ink to the thread 101, the collecting container receives ink discharged from the nozzle.

[0034] In the above configuration, when the cap 21 is separated from the nozzle surface of the head 1, the cap 21 in an open state. If the open state continues, the inside of the cap 21 dries. As a result, there is a possibility that ink clogging may occur in a channel connected to the cap 21, causing an adverse effect on an action such as nozzle suction described above. Therefore, in the present embodiment, when the cap 21 is in the open state, a moisturizing liquid is supplied into the cap 21, and the amount of the moisturizing liquid in the cap 21 can be managed with a simple configuration. Hereinafter, the configuration of a mechanism for managing the

amount of moisturizing liquid in the cap 21 will be described.

[Management of Amount of Moisturizing Liquid]

[0035] FIG. 5 is an explanatory diagram of a moisturizing liquid amount management mechanism according to the embodiment of the present disclosure.

[0036] In FIG. 5, the cap 21 includes a liquid reservoir 21a having a substantially U-shaped cross section. The liquid reservoir 21a can store a moisturizing liquid Lm. In addition, the cap 21 is installed with its open side facing the nozzle surface 12 of the head 1. The bottom of the cap 21 is connected to one end of a first channel 211. The other end of the first channel 211 is connected to a waste liquid tank 215. An openable and closable pump mechanism 216 and a switching valve 217 are provided partway along the first channel 211.

[0037] The switching valve 217 is connected to one end of a second channel 212 provided separately from the first channel 211. The other end of the second channel 212 is connected to a moisturizing liquid tank 214 storing the moisturizing liquid Lm. Furthermore, a moisturizing liquid pump 218 is provided partway along the second channel 212. The moisturizing liquid tank 214 is an example of a "moisturizing liquid container". The waste liquid tank 215 is an example of a "waste liquid collector". The switching valve 217 is an example of a "channel switch". In addition, the moisturizing liquid pump 218 is an example of a "liquid feeder".

[0038] A third channel 213 diverges from the second channel 212 partway along the second channel 212 (between the switching valve 217 and the moisturizing liquid pump 218 in the present embodiment). The third channel 213 has one end connected to the second channel 212, and the other end with an opening 213a.

[0039] In the above configuration, when the dyeing of the thread is started, the cap 21 is separated from the head 1, and the head 1 is moved to be located above the thread as described above. The pump mechanism 216 is opened with respect to the cap 21 separated from the head 1. As a result, the cap 21 and the switching valve 217 communicate with each other through the first channel 211. The switching valve 217 also operates to cause the second channel 212 to communicate with the first channel 211.

[0040] In this state, the moisturizing liquid pump 218 is activated (for example, driven to rotate in a forward direction) to supply the moisturizing liquid Lm in the moisturizing liquid tank 214 to the first channel 211 via the second channel 212. As a result, the moisturizing liquid Lm reaches the cap 21. At the same time, the moisturizing liquid Lm from the moisturizing liquid tank 214 also flows into the third channel 213 to be used for liquid level management, and overflows from the opening 213a of the third channel 213. Thus, the level of the moisturizing liquid Lm is managed.

[0041] In other words, the head of the moisturizing liquid Lm supplied to the first channel 211 is at the same level as the head of the moisturizing liquid Lm supplied to the third channel 213. Thus, assuming that an upper limit of the liquid level of the liquid reservoir 21a that should not be exceeded is, for example, HI, the opening 213a is provided at a level equal to or lower than the level H1. In the present embodiment, the opening 213a is set at a level H2 lower than the upper end of the cap 21 in a vertical direction. As a result, the head of the moisturizing liquid Lm in the cap 21 and the head of the moisturizing liquid Lm in the third channel 213 are kept at the same level, and rise until the heads reach the level H2. When the heads exceed the level H2, the moisturizing liquid Lm overflows from the opening 213a. Meanwhile, the level of the moisturizing liquid Lm in the liquid reservoir 21a can be managed within a range not exceeding the level H1. The moisturizing liquid Lm having overflowed from the opening 213a returns to the moisturizing liquid tank 214, and is reused. With the configuration as described above, it is possible to grasp the liquid level of the liquid reservoir 21a at a distance from the cap 21 without the need to add a member or mechanism for detecting the liquid level to the cap 21.

[0042] When the dyeing of the thread is finished, the moisturizing liquid pump 218 is reversely driven to collect, into the moisturizing liquid tank 214, the moisturizing liquid Lm stored in the liquid reservoir 21a and the moisturizing liquid Lm remaining in each of the channels 211, 212, and 213. After the moisturizing liquid Lm is collected, the switching valve 217 is activated to connect the first channel 211 and the waste liquid tank 215 again.

[0043] As described above, the moisturizing liquid amount management mechanism of the present embodiment includes the cap 21 including the liquid reservoir 21a that stores the moisturizing liquid Lm, the moisturizing liquid tank 214 that stores the moisturizing liquid Lm to be supplied to the liquid reservoir 21a, the waste liquid tank 215 that collects waste liquid, the first channel 211 that connects the cap 21 and the waste liquid tank 215, the second channel 212 that connects the moisturizing liquid tank 214 and the first channel 211, the switching valve 217 provided at the point of connection between the first channel 211 and the second channel 212, the moisturizing liquid pump 218 that is provided on the second channel 212 and causes the moisturizing liquid Lm to be supplied from the moisturizing liquid tank 214 and be collected into the moisturizing liquid tank 214, and the third channel 213 having one end connected to the second channel 212 and the other end with the opening 213a. The opening 213a is provided at the level H2 lower than the upper end of the cap 21 in the vertical direction. As a result, the amount of liquid in the cap 21 can be managed with a simple configuration, without the need to add a member or mechanism for detecting the liquid level to the cap 21.

[0044] As described above, the cap 21 can come into contact with and separate from the head 1. Thus, when the cap 21 and the head 1 are separated from each other,

the liquid reservoir 21a of the cap 21 is in an open state. Since the moisturizing liquid Lm is supplied to the cap 21 in the open state as described above, the inside of the cap 21 can be prevented from drying. As a result, it is possible to prevent ink clogging or the like in the channel connected to the cap 21.

[Variation Example]

[0045] Hereinafter, variations of the moisturizing liquid amount management mechanism according to the embodiment of the present disclosure will be described with reference to FIGS. 6 and 7.

[0046] The opening of the third channel 213 is not limited to an opening with a fountain-type structure (a structure in which the moisturizing liquid Lm is discharged upward from the opening 213a) as illustrated in FIG. 5. For example, as illustrated in FIG. 6, the opening of the third channel 213 may be formed as an opening 213b with a structure in which the moisturizing liquid Lm is laterally guided and discharged. Alternatively, as illustrated in FIG. 7, the opening of the third channel 213 may be formed as an opening 213c with a structure in which the moisturizing liquid Lm is discharged from the opening 213c provided in a side surface of the other end of the third channel 213.

[Application Example]

[0047] FIG. 8 is an explanatory diagram of an application example of the liquid discharge unit according to the embodiment of the present disclosure.

[0048] The liquid discharge unit 103 according to the present embodiment can be applied not only to a device or a system for dyeing a linear medium, but also to a device or the like for forming an image on a planar medium such as paper or cloth.

[0049] A printing apparatus 800 that forms an image on a planar medium 801 is illustrated in the present application example. The liquid discharge unit 103 serves as a full-line type inkjet recording device in the printing apparatus 800, and includes heads 1a to Id that discharge ink droplets of desired colors onto the medium 801 to form an image. The liquid discharge unit 103 includes a plurality of maintenance units 2a to 2d below the heads 1a to Id with a conveyance path of the medium 801 interposed therebetween. The maintenance units 2a to 2d each include a dummy discharge receiver, a wiping unit, a capping unit, and the like, and apply treatments to the heads 1a to Id located at these units, respectively. In the liquid discharge unit 103, the heads 1a, 1b, 1c, and Id that are full-line type recording heads for four colors are arranged in this order from, for example, an upstream side in a conveyance direction of the medium 801. The heads 1a to Id discharge ink droplets of black, cyan, magenta, and yellow onto the medium 801 that is moving, respectively. Note that the type, number, and order of colors are not limited thereto.

[0050] A feed roller 802 rotates counterclockwise as indicated by an arrow to send the medium 801 toward the liquid discharge unit 103. Next, conveyance rollers 803 convey the medium 801 from the feed roller 802 to the liquid discharge unit 103. The heads 1a to 1d discharge droplets (ink droplets) onto the medium 801 that has reached the liquid discharge unit 103, to form an image on the medium 801. The medium 801 with the image thereon then enters a drying device 804.

[0051] The drying device 804 internally includes a heating device, a hot-air device, and the like, and dries the image on the medium 801 with heat. Ejection rollers 805 cause the medium 801 having left the drying device 804 to move toward a winding roller 806. The winding roller 806 winds the medium 801.

[0052] The liquid discharge unit of the present embodiment can also be applied to a printing apparatus as described above. The above-described functions and effects can also be obtained in such a case.

[0053] The above description is an example. The present embodiment achieves unique effects for each of the following aspects.

[Aspect 1]

[0054] A liquid discharge unit includes: a cap (for example, cap 21) including a liquid reservoir that stores a moisturizing liquid; a moisturizing liquid container (for example, moisturizing liquid tank 214) that stores the moisturizing liquid to be supplied to the liquid reservoir; a waste liquid collector (for example, waste liquid tank 215) that collects waste liquid; a first channel connecting the cap and the waste liquid collector; a second channel connecting the moisturizing liquid container and the first channel; a channel switch (for example, switching valve 217) provided at a point of connection between the first channel and the second channel; a liquid feeder (for example, moisturizing liquid pump 218) that is provided on the second channel, and causes the moisturizing liquid to be supplied from the moisturizing liquid container and be collected into the moisturizing liquid container; and a third channel having one end connected to the second channel and another end with an opening (for example, opening 213a, 213b, 213c), wherein the opening is provided at a level (for example, level H2) lower than an upper end of the cap in a vertical direction.

[0055] According to the first aspect, it is possible to provide the liquid discharge unit that enables management of the amount of liquid in the cap with a simple configuration.

[Aspect 2]

[0056] In a second aspect is the liquid discharge unit according to the Aspect 1, the cap (for example, cap 21) can come into contact with and separate from a liquid discharger (for example, head 1), and in a case where the cap and the liquid discharger are separated from each

other, the liquid reservoir is in an open state.

[Aspect 3]

[0057] A liquid discharge unit (103) includes: a liquid discharge head (1) configured to discharge a liquid; a cap (21) configured to cap the liquid discharge head (1), the cap (21) having a reservoir space (21a) configured to store a moisturizing liquid; a moisturizing liquid container (214) configured to store the moisturizing liquid to be supplied to the reservoir space in the cap; a waste liquid collector (215) configured to collect a waste liquid discharged from the cap; a first channel (211) connected to the cap (21) and the waste liquid collector (215); a second channel (212) connected to the moisturizing liquid container (214) and the first channel (211); a channel switch (217) at a connection between the first channel (211) and the second channel (212); a liquid feeder (218) configured to: feed the moisturizing liquid from the moisturizing liquid container (214) to the cap (21); and feed the moisturizing liquid from the cap to the moisturizing liquid container (214); and a third channel (213) having one end connected to the second channel (212) and another end (213a) in the moisturizing liquid container (214), said another end of the third channel (213) having an opening at a level lower than an upper end of the cap (21) in a vertical direction.

[Aspect 4]

[0058] In the liquid discharge unit (103) according to Aspect 3, wherein the cap (21) is detachably attachable to a nozzle surface of the liquid discharge head (1) to cap the liquid discharge head (1); and the cap (21) is detached from the nozzle surface of the liquid discharge head to open the reservoir space (21a) of the cap (21).

[Aspect 5]

[0059] In the liquid discharge unit (103) according to Aspect 3, said another end of the third channel (213) is directed upward to discharge the moisturizing liquid upward from the opening (213a) at said another end, and the moisturizing liquid discharged from the opening (213a) is collected to the moisturizing liquid container (214).

[Aspect 6]

[0060] In the liquid discharge unit (103) according to Aspect 3, said another end of the third channel (213) is directed laterally to discharge the moisturizing liquid laterally from the opening (213b), and the moisturizing liquid discharged from the opening (213b) is collected to the moisturizing liquid container (214).

[Aspect 7]

[0061] In the liquid discharge unit (103) according to Aspect 3, said another end of the third channel (213) has the opening (213c) in a side surface of said another end to discharge the moisturizing liquid laterally from the opening (213c), and the moisturizing liquid discharged from the opening (213c) is collected to the moisturizing liquid container (214).

[Aspect 8]

[0062] A liquid discharge apparatus (100) includes: the liquid discharge unit (103) according to any one of Aspects 3 to 7; a recording medium feeding unit (102) configured to feed a recording medium to the liquid discharge unit (103); a drying unit (104) configured to heat the recording medium fed from the liquid discharge unit (103); and a post-processing unit (105) configured to apply a post-process to the recording medium fed from the drying unit (104).

[Aspect 9]

[0063] A linear medium treatment system (1000) includes the liquid discharge unit (103) according to any one of Aspects 3 to 7 to discharge the liquid onto a linear recording medium.

[Aspect 10]

[0064] A linear medium treatment system (1000) includes the liquid discharge apparatus (100) according to Aspect 8 to discharge the liquid onto a linear recording medium.

[0065] According to the second aspect, it is possible to prevent the inside of the cap in the open state from drying and to prevent clogging of the channel connected to the cap.

[0066] 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.

[0067] 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-generation (3G)-compliant mobile telephone, and so on. 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. 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 unit (103) comprising:

a liquid discharge head (1) configured to discharge a liquid;
a cap (21) configured to cap the liquid discharge head (1), the cap (21) having a reservoir space (21a) configured to store a moisturizing liquid;
a moisturizing liquid container (214) configured to store the moisturizing liquid to be supplied to the reservoir space in the cap;
a waste liquid collector (215) configured to collect a waste liquid discharged from the cap;
a first channel (211) connected to the cap (21) and the waste liquid collector (215);
a second channel (212) connected to the moisturizing liquid container (214) and the first channel (211);
a channel switch (217) at a connection between the first channel (211) and the second channel (212);
a liquid feeder (218) configured to:

feed the moisturizing liquid from the moisturizing liquid container (214) to the cap (21); and
feed the moisturizing liquid from the cap to the moisturizing liquid container (214); and

a third channel (213) having one end connected to the second channel (212) and another end (213a) in the moisturizing liquid container (214), said another end of the third channel (213) having an opening at a level lower than an upper end of the cap (21) in a vertical direction.

2. The liquid discharge unit (103) according to claim 1,

wherein the cap (21) is detachably attachable to a nozzle surface of the liquid discharge head (1) to cap the liquid discharge head (1); and
the cap (21) is detached from the nozzle surface of the liquid discharge head to open the reservoir space (21a) of the cap (21).

3. The liquid discharge unit (103) according to claim 1,

wherein said another end of the third channel (213) is directed upward to discharge the moisturizing liquid upward from the opening (213a) at said another end, and
the moisturizing liquid discharged from the opening (213a) is collected to the moisturizing liquid container (214).

4. The liquid discharge unit (103) according to claim 1,

wherein said another end of the third channel (213) is directed laterally to discharge the moisturizing liquid laterally from the opening (213b), and
the moisturizing liquid discharged from the opening (213b) is collected to the moisturizing liquid container (214).

5. The liquid discharge unit (103) according to claim 1,

wherein said another end of the third channel (213) has the opening (213c) in a side surface of said another end to discharge the moisturizing liquid laterally from the opening (213c), and
the moisturizing liquid discharged from the opening (213c) is collected to the moisturizing liquid container (214).

6. A liquid discharge apparatus (100) comprising:

the liquid discharge unit (103) according to any one of claims 1 to 5;
a recording medium feeding unit (102) configured to feed a recording medium to the liquid discharge unit (103);
a drying unit (104) configured to heat the recording medium fed from the liquid discharge unit (103); and
a post-processing unit (105) configured to apply a post-process to the recording medium fed from the drying unit (104).

7. A linear medium treatment system (1000) comprising the liquid discharge unit (103) according to any one of claims 1 to 5 to discharge the liquid onto a linear recording medium.

8. A linear medium treatment system (1000) comprising the liquid discharge apparatus (100) according to claim 6 to discharge the liquid onto a linear recording medium.

FIG. 1

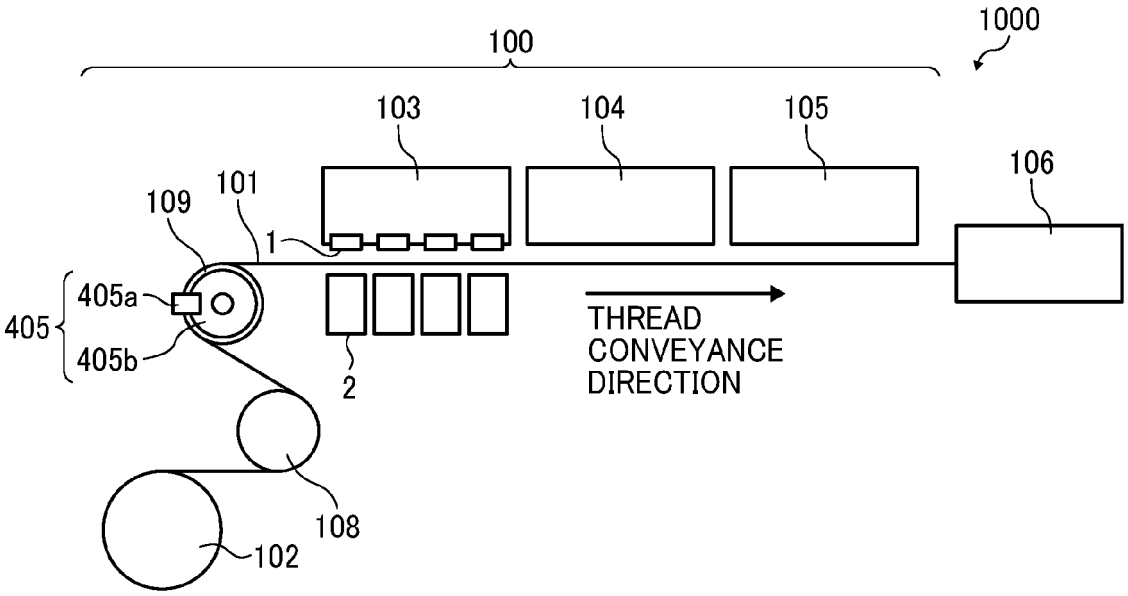


FIG. 2

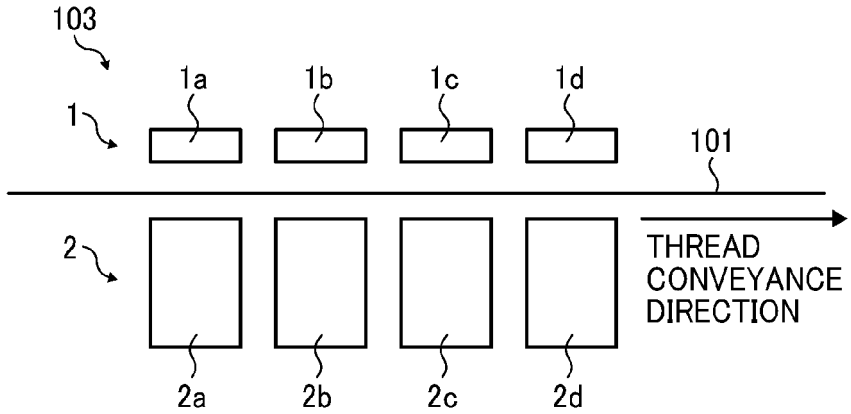


FIG. 3

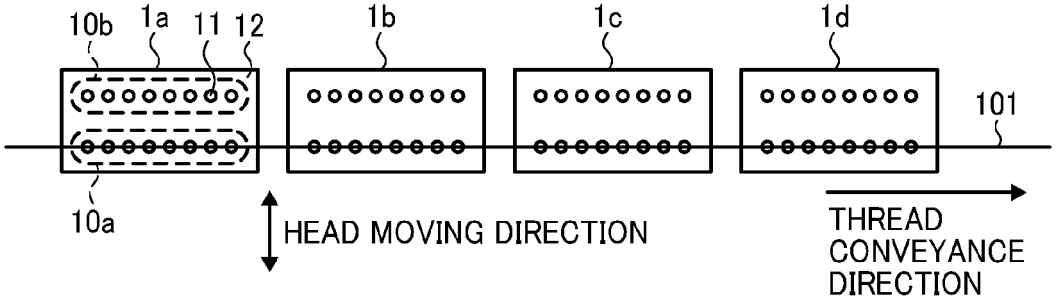


FIG. 4A

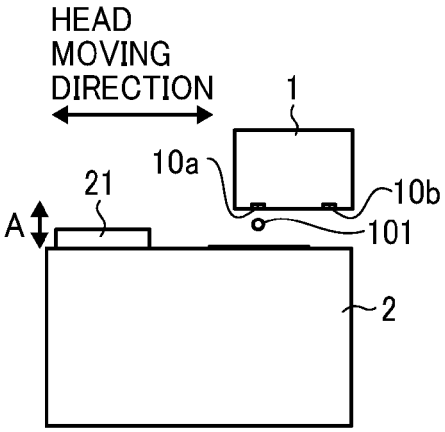


FIG. 4B

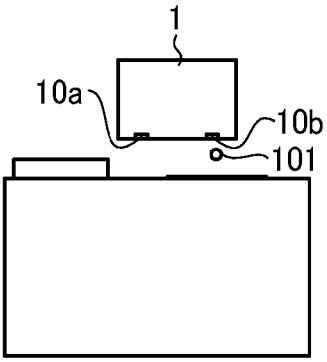


FIG. 4C

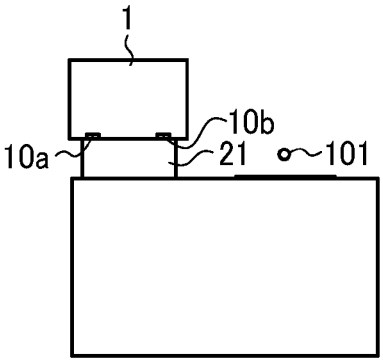


FIG. 5

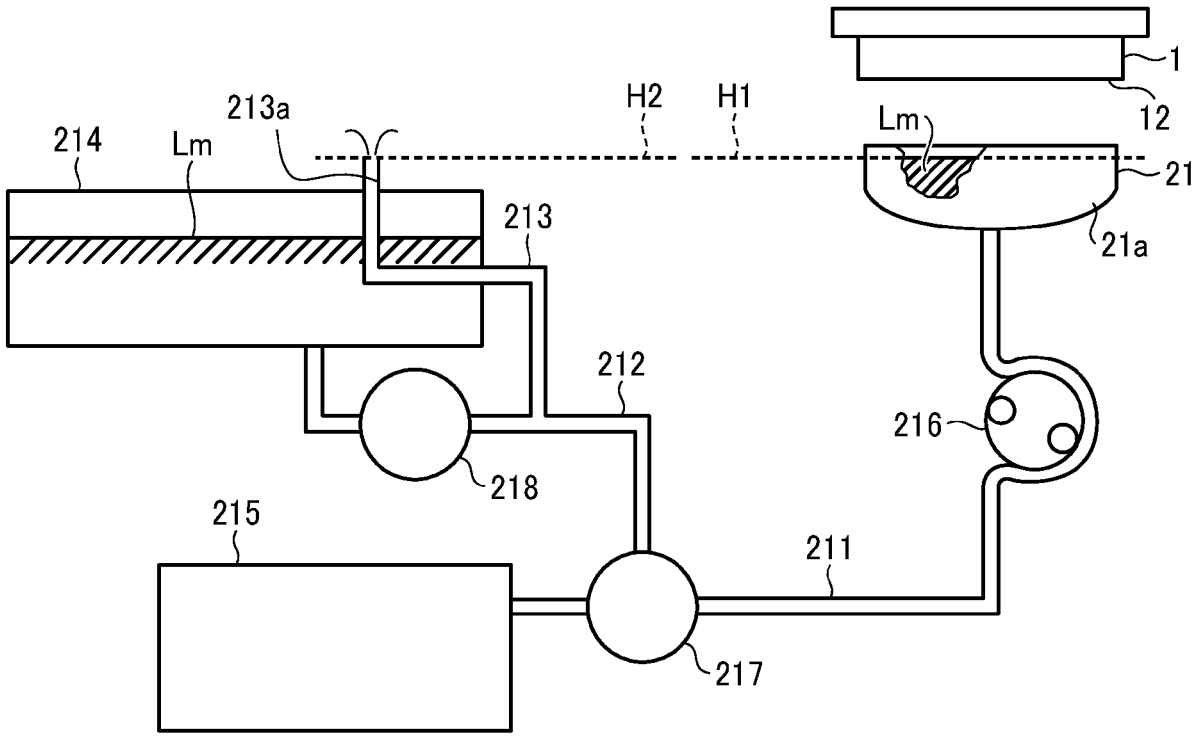


FIG. 6

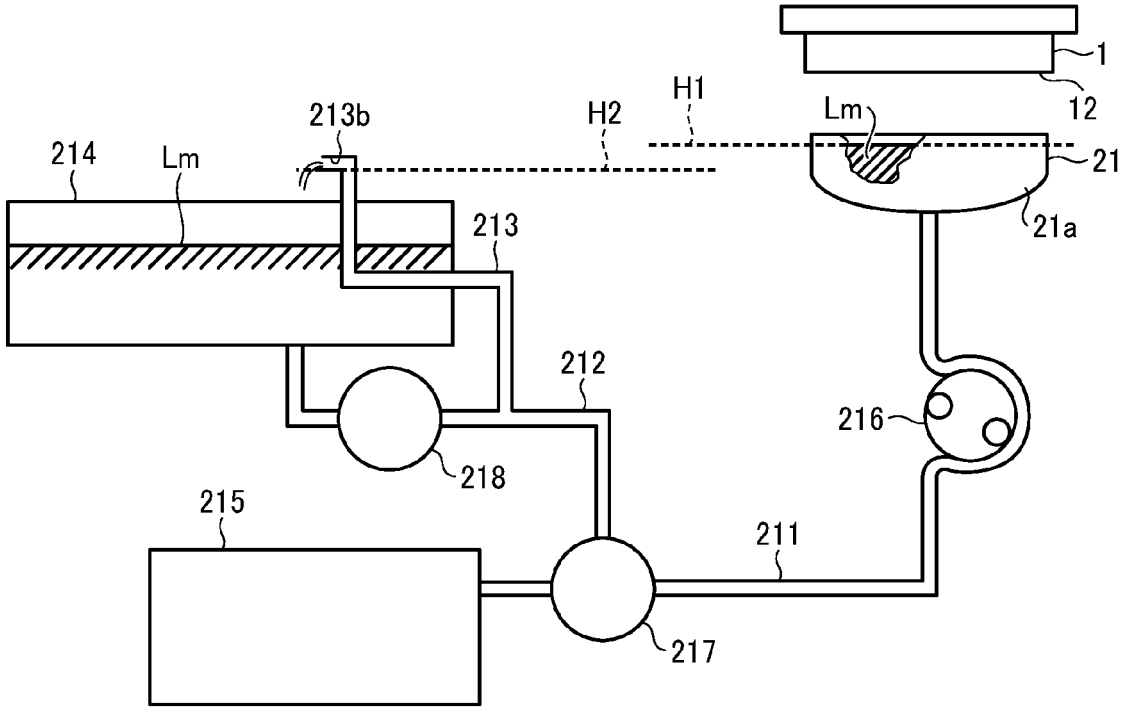

1
12
H1
H2
Lm
213b
214
Lm
21
213
21a
212
216
218
215
211
217

FIG. 7

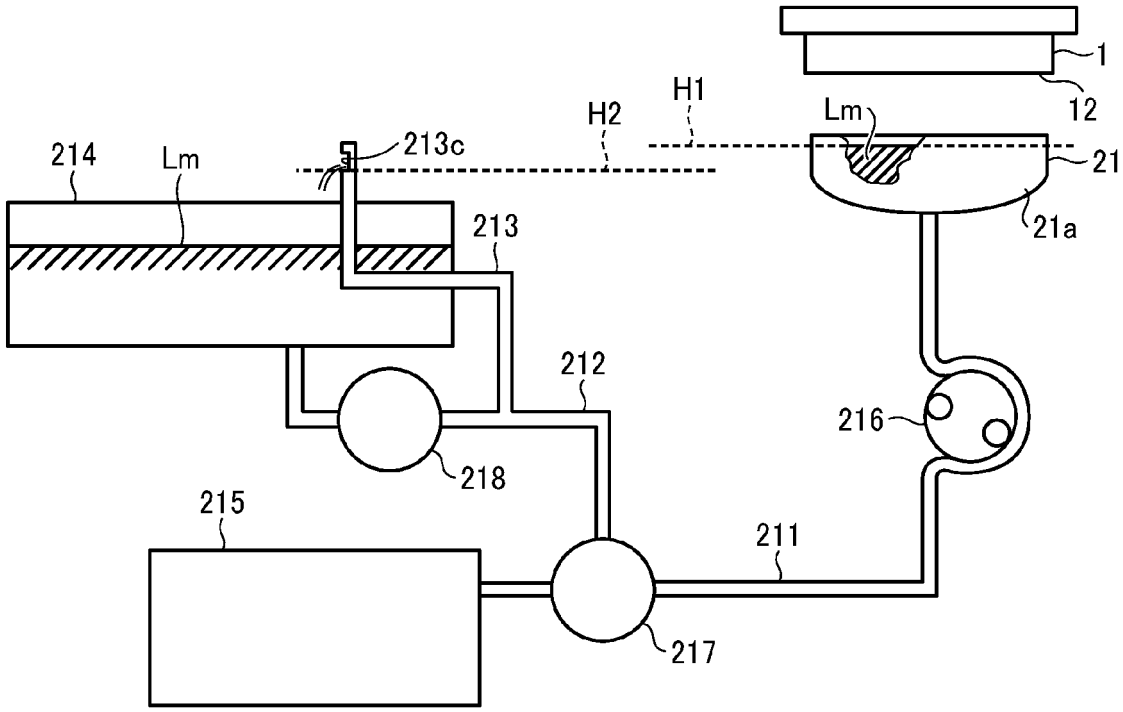
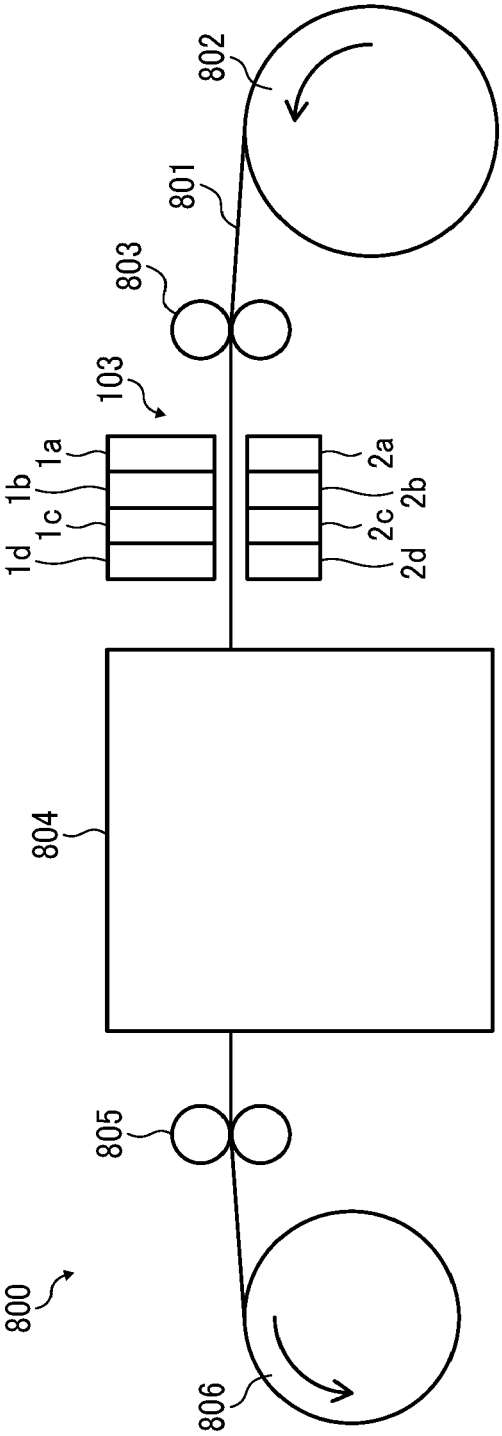

1
12
H1
H2
Lm
213c
214
Lm
21
213
21a
212
216
218
215
211
217

FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 4083

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 May 2023	Hartmann, Mathias

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