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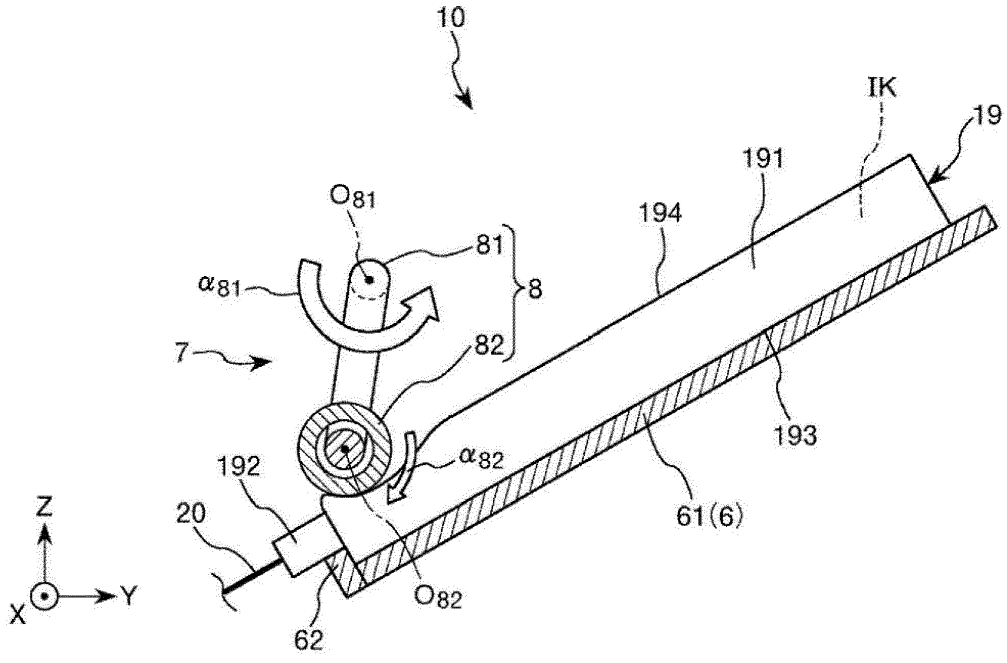
(54) PRINTING APPARATUS AND PRINTING METHOD

(57) A printing apparatus includes a holding unit holding a bag with a storage portion that is pliable and in which ink used for printing is stored, and a discharge port through which the ink is discharged; and an agitating unit configured to agitate the ink. In the printing apparatus, the holding unit is configured to incline the storage portion with respect to a horizontal direction, and hold the bag in a posture where the discharge port is disposed below the storage portion in an inclination direction; and the agitating unit includes a pressing member configured to press the storage portion in the posture from a lower side toward an upper side in the inclination direction and deform the storage portion.

FIG. 6



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Description

BACKGROUND

1. Technical Field

[0001] The present invention relates to a printing apparatus and a printing method.

[0002] Printing apparatuses are known that print on a recording medium that has a sheet-like shape (e.g. JP-A-2006-326929, JP-A-2011-240687, and JP-A-2013-237219). Such printing apparatuses are configured to supply ink from an ink cartridge filled with ink.

[0003] In recent years, there has been a growing trend for deeper colors of inks. As such, there is a relatively high proportion of poorly soluble components in these inks. Depending on the conditions, these poorly soluble components may become deposited as sediment in the ink cartridge. In such a case, there is a possibility that color unevenness, for example, may occur when printing. That is, there is a possibility that regions of lighter color and regions of darker color may be generated when printing media using the same color.

[0004] JP-A-2006-326929 and JP-A-2011-240687 describe the installation of a member for stirring the ink in an ink cartridge. However, in these cases, there is a possibility that ink cartridges of the related art, which do not include a member for stirring, will be rendered unusable.

[0005] JP-A-2013-237219 describes rocking the ink cartridge to agitate the ink. In this case, an allowable rocking range of the ink cartridge larger than the size of the ink cartridge itself needs to be secured in order to prevent interference of surrounding parts with the rocking ink cartridge. Consequently, the configuration of the apparatus increases in scale.

SUMMARY

[0006] A printing apparatus according to a first aspect of the invention includes a holding unit holding a bag including a storage portion that is pliable and in which ink used for printing is stored, and a discharge port through which the ink is discharged; and an agitating unit configured to agitate the ink. In such a printing apparatus, the holding unit is configured to incline the storage portion with respect to a horizontal direction, and hold the bag in a posture where the discharge port is disposed below the storage portion in an inclination direction; and the agitating unit includes a pressing member configured to press the storage portion in the posture, from a lower side toward an upper side in the inclination direction and deform the storage portion.

[0007] As a result, even when sediment is formed in the storage portion or before the sediment is formed, the deposition of sediment can be reliably reduced or prevented via a simple configuration, namely pressing on the outside of the storage portion using the pressing member. Additionally, bags of the related art in which ink is stored can be used as-is due to the fact that the configuration, that is, the pressing member pressing on the outside of the storage portion, is simple.

[0008] It is preferable that the pressing member includes a shaft portion that is rotatably supported, and at least one rotary pressing portion disposed eccentrically from a center of rotation of the shaft portion and that rotates with the shaft; and the rotary pressing portion is configured to deform the storage portion for a plurality of times by repeatedly moving toward and away from the storage portion.

[0009] In this case, the agitation of the ink can be continuously performed, which contributes to the elimination of sediment.

[0010] It is preferable that the rotation of the rotary pressing portion stops at a position where the rotary pressing portion is separated from the storage portion.

[0011] In this case, replacement work is easier when replacing a bag that has become empty with a new bag.

[0012] It is preferable that the pressing member includes two of the rotary pressing portions; and the two of the rotary pressing portions are disposed separated in an axial direction of the shaft portion.

[0013] In this case, the ink in the storage portion is also subjected to and agitated by the forces between the two rotary pressing portions and, as such, agitation efficiency is enhanced.

[0014] It is preferable that the pressing member includes two of the rotary pressing portions; and the two of the rotary pressing portions are disposed on sides opposite each other through the center of rotation of the shaft portion.

[0015] In this case, the storage portion is pressed two times from the lower side toward the upper side in the inclination direction during each rotation of the shaft portion around the center of rotation of the shaft portion. As such, agitation efficiency is enhanced.

[0016] It is preferable that the rotary pressing portion is constituted by a roller. In this case, the rotary pressing portion can smoothly press forward on the storage portion. Additionally, friction between the rotary pressing portion and the storage portion is reduced and, therefore, breakage and damage of the storage portion during the pressing can be prevented.

[0017] It is preferable that the pressing member includes a portion that expands when a working fluid is supplied to the portion and contracts when the working fluid is discharged from the portion.

[0018] In this case, the ink can be reliably agitated, which contributes to the elimination of sediment.

[0019] It is preferable that agitation conditions of the agitating unit for the ink differ depending on a type of the ink. In this case, agitation suited to various types of ink (ease of sediment forming) can be performed.

[0020] It is preferable that the agitating unit includes a position changing unit configured to change a position of the pressing member with respect to the storage portion in accordance with a remaining amount of the ink in the

storage portion. In this case, the ink can be reliably agitated regardless of the magnitude of the remaining amount of ink.

[0021] It is preferable that an angle of inclination of the holding unit with respect to the horizontal direction of the storage portion is 20 degrees or greater and 70 degrees or less.

[0022] In this case, for example, the ink can be reliably discharged from the discharge port and, therefore, all of the ink can be used.

[0023] A printing method according to a second aspect of the invention includes printing wherein a printing apparatus is used that includes a holding unit holding a bag including a storage portion that is pliable and in which ink used for printing is stored, and a discharge port through which the ink is discharged; and an agitating unit configured to agitate the ink. In the printing apparatus, the holding unit is configured to incline the storage portion with respect to a horizontal direction, and hold the bag in a posture where the discharge port is disposed below the storage portion in an inclination direction; and the agitating unit includes a pressing member configured to press the storage portion in the posture from a lower side toward an upper side in the inclination direction and deform the storage portion. Additionally, the pressing member is operated and the ink is agitated during the printing.

[0024] As a result, even when sediment is formed in the storage portion or before the sediment is formed, the deposition of sediment can be reliably reduced or prevented via a simple configuration, namely pressing on the outside of the storage portion using the pressing member. Additionally, bags of the related art in which ink is stored can be used as-is due to the fact that the configuration, that is, the pressing member pressing on the outside of the storage portion, is simple.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] 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 side view illustrating an exemplary embodiment of a printing apparatus of the invention.

Fig. 2 is a block diagram of the main components of the printing apparatus illustrated in Fig. 1.

Fig. 3 is a drawing illustrating a relationship between an ink jet head and ink cartridges of the printing apparatus illustrated in Fig. 1.

Fig. 4 is a schematic perspective view illustrating a relationship between an ink cartridge and an agitating unit.

Fig. 5 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit illustrated in Fig. 4, in order.

Fig. 6 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit illustrated in Fig. 4, in order.

Fig. 7 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit illustrated in Fig. 4, in order.

Fig. 8 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit illustrated in Fig. 4, in order.

Fig. 9 is a flowchart illustrating a control program stored in the printing apparatus illustrated in Fig. 1.

Fig. 10 is a graph illustrating a change over time of rotational speed of a rotary pressing portion of the agitating unit illustrated in Fig. 4.

Fig. 11 is a graph illustrating a change over time of the rotational speed of the rotary pressing portion of the agitating unit provided in the printing apparatus (second exemplary embodiment) of the invention.

Fig. 12 is a schematic drawing illustrating the agitating unit provided in the printing apparatus (third exemplary embodiment) of the invention.

Fig. 13 is a schematic drawing illustrating the agitating unit provided in the printing apparatus (fourth exemplary embodiment) of the invention.

Fig. 14 is a schematic drawing illustrating the agitating unit provided in the printing apparatus (fifth exemplary embodiment) of the invention.

Fig. 15 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit provided in the printing apparatus (sixth exemplary embodiment) of the invention, in order.

Fig. 16 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit provided in the printing apparatus (sixth exemplary embodiment) of the invention, in order.

Fig. 17 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit provided in the printing apparatus (sixth exemplary embodiment) of the invention, in order.

Fig. 18 is a vertical partial cross-sectional view illustrating an operating state of the agitating unit provided in the printing apparatus (sixth exemplary embodiment) of the invention, in order.

Fig. 19 is a schematic perspective view illustrating a relationship between an ink cartridge and an agitating unit in the printing apparatus (seventh exemplary embodiment) of the invention.

DESCRIPTION OF EMBODIMENTS

[0026] Hereinafter, the printing apparatus and the printing method of the invention are described in detail on the basis of the exemplary embodiments illustrated in the attached drawings.

First Exemplary Embodiment

[0027] Fig. 1 is a schematic side view illustrating an exemplary embodiment of a printing apparatus of the in-

vention. Fig. 2 is a block diagram of the main components of the printing apparatus illustrated in Fig. 1. Fig. 3 is a drawing illustrating a relationship between an ink jet head and ink cartridges of the printing apparatus illustrated in Fig. 1. Fig. 4 is a schematic perspective view illustrating a relationship between an ink cartridge and an agitating unit. Fig. 5 to Fig. 8 are vertical partial cross-sectional views illustrating operating states of the agitating unit illustrated in Fig. 4, in order. Fig. 9 is a flowchart illustrating a control program stored in the printing apparatus illustrated in Fig. 1. Fig. 10 is a graph illustrating a change over time of rotational speed of a rotary pressing portion of the agitating unit illustrated in Fig. 4. In the following, for the sake of convenience, a paper depth direction, a left-right direction, and a vertical direction in Fig. 1 are referred to respectively as a "direction X", a "direction Y", and a "direction Z". Additionally, the coordinate axes in Fig. 3 to Fig. 8 and Fig. 12 to Fig. 19 each correspond to the coordinate axes in Fig. 1. Moreover, the upper side and the lower side in Fig. 1, Fig. 4 to Fig. 8, and Fig. 12 to Fig. 19 are, at times, referred to respectively as "top" or "above" and "bottom" or "below".

[0028] A printing apparatus 1 of the invention is provided with a holding unit 6 on which a bag, namely an ink cartridge 19, is held, and an agitating unit 7 configured to agitate ink IK in the ink cartridge 19. The ink cartridge 19 is a bag including a storage portion 191 that is pliable and in which the ink IK used for printing is stored, and a discharge port 192 through which the ink IK is discharged. The holding unit 6 is configured to incline the storage portion 191 of the ink cartridge 19 with respect to a horizontal direction (XY plane), and hold the ink cartridge 19 (bag) in a posture where the discharge port 192 is disposed below the storage portion 191 in an inclination direction. Additionally, the agitating unit 7 includes a pressing member 8 configured to press the storage portion 191 in the posture from a lower side toward an upper side in the inclination direction and deform the storage portion 191.

[0029] The printing method of the invention includes printing. The printing apparatus 1 of the invention is used in the printing. Additionally, the pressing member 8 (agitating unit 7) of the printing apparatus 1 is operated and the ink IK is agitated during the printing process.

[0030] Thus, according to the invention, as described later, even when sediment is formed in the storage portion 191 of the ink cartridge 19 or before the sediment is formed, the deposition of sediment can be reliably prevented via a simple configuration, namely pressing on the outside of the storage portion 191 using the pressing member 8. Additionally, ink cartridges 19 of the related art in which the ink IK is stored can be used as-is due to the fact that the configuration, that is, the pressing member 8 pressing on the outside of the storage portion 191, is simple.

[0031] Next, the configuration of each component will be described. The printing apparatus 1 is a textile printing apparatus that prints on a work W as a medium while transporting the work W. In the present exemplary embodiment, the direction X is a direction orthogonal to a transport direction of the work W, the direction Y is a direction parallel to the transport direction, and the direction Z is a direction orthogonal to the direction X and the direction Y.

[0032] As illustrated in Fig. 1, the printing apparatus 1 is provided with a machine base 11, a transport unit 12 that transports the work W, a printing unit 13 that prints by discharging the ink IK onto the work W, a drying unit 16 that dries the ink IK on the work W, and a control unit 15 that controls the operations of each of these components. Additionally, as illustrated in Fig. 2, the printing apparatus 1 is further provided with a movement unit 14 that moves the printing unit 13, an agitating unit 7 configured to agitate the ink IK, and an input operation unit 18 where the input and configuration of various types of conditions to be applied when printing are performed. Moreover, the control unit 15 of the printing apparatus 1 is electrically connected to an external power supply source 200.

[0033] The transport unit 12 is provided with an unwinding device 3 that conveys an elongated work W wound into a roll shape, a winding device 4 that winds the work W on which printing has be performed, and a support device 5 provided on the machine base 11 and supports the work W when printing.

[0034] The unwinding device 3 is disposed farther upstream in a feed direction (the direction Y) of the work W than the machine base 11. The unwinding device 3 includes a feed-out roller (feed reel) 31 on which the work W is wound into a roll shape and that feeds out the work W, and a tensioner 32 that applies tension to the work W between the feed-out roller 31 and the support device 5. The feed-out roller 31 is connected to a motor (not illustrated in the drawings) and can be rotated by the operations of the motor.

[0035] Material to be printed can be used as the work W. Here, the phrase, "material to be printed" means fabrics, clothing, other apparel products, and the like on which printing is to be performed. Examples of fabrics include woven fabrics, knitted fabrics, nonwoven fabrics, and the like constituted from natural fibers such as cotton, silk, and wool, chemical fibers such as nylon, or composite fibers obtained by mixing these fibers. Examples of clothing and other apparel products include sewn t-shirts, handkerchiefs, scarves, towels, handbags, and cloth bags; curtains, sheets, bed coverings, and similar furniture products; cut or uncut fabric that exists as pre-sewn parts; and the like.

[0036] In addition to the material to be printed described above, dedicated paper for ink jet recording such as plain paper, high quality paper, glossy paper, and the like may be used as the work W. Furthermore, plastic film that has not been subjected to surface treating for use in ink jet printing, that is, plastic film on which an ink absorbing layer has not been formed; media obtained by coating plastic on a base material such as paper or the

like; and media to which plastic film is adhered can be used as the work W. The plastic is not particularly limited and examples thereof include polyvinyl chloride, polyethylene terephthalate, polycarbonate, polystyrene, polyurethane, polyethylene, and polypropylene.

[0037] In contrast with the unwinding device 3, the winding device 4 is disposed farther downstream in the feed direction (the direction Y) of the work W than the machine base 11.

[0038] The winding device 4 includes a winding roller (winding reel) 41 that winds the work W in a roll shape, and a tensioner 42, a tensioner 43, and a tensioner 44 that apply tension on the work W between the winding roller 41 and the support device 5. The winding roller 41 is connected to a motor (not illustrated in the drawings) and can be rotated by the operations of the motor. The tensioners 42, 43, and 44 are disposed in this order at intervals in a direction away from the winding roller 41.

[0039] The support device 5 is disposed between the unwinding device 3 and the winding device 4. The support device 5 includes a driving roller 51 and a driven roller 52 disposed separated from each other in the direction Y, an endless belt 53 wrapped around the driving roller 51 and the driven roller 52, and a tensioner 54 and a tensioner 55 that apply tension on the work W between the driving roller 51 and the driven roller 52.

[0040] The driving roller 51 is connected to a motor (not illustrated in the drawings) and can be rotated by the operations of the motor. Rotational force of the driving roller 51 is transmitted to the driven roller 52 via the endless belt 53, thereby enabling the driven roller 52 to be rotated in conjunction with the driving roller 51.

[0041] The endless belt 53 is a glue belt, that is, an adhesive layer having stickiness is formed on a surface of a front side of the endless belt 53. A portion of the work W becomes adhesively fixed to the adhesive layer. Thus, the work W is transported in the direction Y. Additionally, during this transporting, a printing is performed on the work W. After the printed has been performed, the work W is peeled from the endless belt 53.

[0042] As with the driving roller 51 and the driven roller 52, the tensioner 54 and the tensioner 55 are disposed separated from each other in the direction Y.

[0043] The work W can be sandwiched together with the endless belt 53 between the tensioner 54 and the driving roller 51, and the work W can be sandwiched together with the endless belt 53 between the tensioner 55 and the driven roller 52. As such, the work W on which tension is applied by the tensioner 54 and the tensioner 55 is fixed in a tensioned state on the endless belt 53 and transported. As a result, wrinkling and the like of the work W during transport is prevented and, thus, when performing printing, the printing will be accurate and of high quality.

[0044] The printing unit 13 is provided with a carriage unit 131 on which an ink jet head 2 is mounted that draws (records) by printing by discharging the ink IK onto the work W.

[0045] The ink IK is obtained by adding or dispersing a pigment as a coloring agent in water as a solvent. In the exemplary embodiment, four colors of the ink IK are used, namely yellow (Y), magenta (M), cyan (C), and black (K). As such, the printing apparatus 1 is capable of color printing.

[0046] As illustrated in Fig. 3, the ink jet head 2 is a discharge unit that includes multiple nozzles 21 that discharge the ink IK as droplets. The nozzles 21 are divided into nozzle rows 22 in the ink jet head 2 by the color of the ink IK that will be discharged. In the configuration illustrated in Fig. 3, there is a nozzle row 22Y, a nozzle row 22M, a nozzle row 22C, and a nozzle row 22K. The nozzle row 22Y includes multiple nozzles 21 for discharging yellow (Y) ink IK, and these nozzles 21 are disposed in the direction Y. The nozzle row 22M includes multiple nozzles 21 for discharging magenta (M) ink IK, and these nozzles 21 are disposed in the direction Y. The nozzle row 22C includes multiple nozzles 21 for discharging cyan (C) ink IK, and these nozzles 21 are disposed in the direction Y. The nozzle row 22K includes multiple nozzles 21 for discharging black (K) ink IK, and these nozzles 21 are disposed in the direction Y. The ink IK is discharged independently from each of the nozzles 21.

[0047] As illustrated in Fig. 3, in the printing apparatus 1, each color of the ink IK is prepared and stored in advance in a reservoir, namely an ink cartridge 19. In the configuration illustrated in Fig. 3, there is an ink cartridge 19Y in which the yellow (Y) ink IK is stored, an ink cartridge 19M in which the magenta (M) ink IK is stored, an ink cartridge 19C in which the cyan (C) ink IK is stored, and an ink cartridge 19K in which the black (K) ink IK is stored. When the ink IK runs out, these ink cartridges 19 are replaced with new cartridges, that is, cartridges sufficiently filled with the ink IK. Additionally, these ink cartridges 19 are installed and secured at a position separated from the printing unit 13.

[0048] As illustrated in Fig. 4, the ink cartridge 19 includes the storage portion 191 in which the ink IK is stored, and the discharge port 192 through which the ink IK in the storage portion 191 is discharged.

[0049] The storage portion 191 is a hollow body that has a flat shape. The volume of the storage portion 191 is not particularly limited but, for example, the storage portion 191 preferably is capable of storing 1L or more and 5L or less of the ink IK, and more preferably is capable of storing 2L or more and 4L or less of the ink IK. The storage portion 191 is constituted from a pliable resin material such as polyethylene or the like.

[0050] The discharge port 192 is provided at an edge of the storage portion 191. While the ink cartridge 19 is unopened, this discharge port 192 is sealed using a sealing member such as a cap, film, or the like so as to be liquid-tight. Additionally, when using the ink cartridge 19, the ink IK can be made to flow through the discharge port 192 and into a flow channel 20 by removing the sealing member.

[0051] Each of the ink cartridges 19 is connected via

a flow channel 20 to the nozzle row 22 corresponding to the ink cartridge 19 in a liquid-tight manner. That is, the ink cartridge 19Y is connected to the nozzle row 22Y via a flow channel 20, the ink cartridge 19M is connected to the nozzle row 22M via a flow channel 20, the ink cartridge 19C is connected to the nozzle row 22C via a flow channel 20, and the ink cartridge 19K is connected to the nozzle row 22K via a flow channel 20. Thus, the ink IK can be directed from the ink cartridges 19 toward the nozzle rows 22 via the flow channels 20. Note that the flow channels 20 are constituted from, for example, tubes, fittings connecting the tubes in a liquid-tight manner, and the like.

[0052] In the printing apparatus 1, the work W unwound by the unwinding device 3 is intermittently fed (sub scanning) in the direction Y while adheredly fixed to the endless belt 53, and the ink IK is discharged from the ink jet head 2 toward the fixed work W while the movement unit 14 causes the carriage unit 131 to reciprocate (main scanning) in the direction X. These operations are performed until the printing is complete and a predetermined image is formed on the work W.

[0053] The movement unit 14 supports the printing unit 13 such that the printing unit 13 is capable of moving in the direction X. As such, the printing unit 13 can reciprocate in a manner straddling the work W. Note that the configuration of the movement unit 14 preferably includes a ball screw and a linear guide, for example.

[0054] The drying unit 16 is disposed farther downstream in the transport direction of the work W than the printing unit 13 and between the support device 5 and the winding roller 41 of the winding device 4. The drying unit 16 includes a chamber 161 in which a heater is housed. As such, the undried ink IK on the work W can be dried by the heat of the heater when the work W passes through the chamber 161.

[0055] A tensioner 42 and a tensioner 43 are disposed on either side in the direction Y of the drying unit 16. As such, the work W can pass through the chamber 161 in a tensioned state. As a result, wrinkling and the like of the work W when passing through the chamber 161 is prevented and, thus, the ink IK can be reliably dried.

[0056] The input operation unit 18 is constituted by a touch panel or the like. The user, or operator, of the printing apparatus 1 can input various conditions to be applied when printing via the input operation unit 18. The various conditions are not particularly limited and examples thereof include printing programs, transport speed and thickness of the work W, and the like. Additionally, the input operation unit 18 can also function as a notification unit that displays various information of the printing apparatus 1, thereby notifying the operator of such information.

[0057] The control unit 15 is electrically connected to the transport unit 12, the printing unit 13, the movement unit 14, the drying unit 16, the agitating unit 7, and the input operation unit 18, and includes functions for controlling each of these components. As illustrated in Fig. 2, the control unit 15 includes a central processing unit (CPU) 151 and a storage unit 152.

[0058] The CPU 151 executes programs for various types of processing including, for example, the printing processing described above and the like.

[0059] The storage unit 152 includes, for example, a type of nonvolatile semiconductor memory, namely electrically erasable programmable read-only memory (EEPROM), or the like. The various programs and the like can be stored in the storage unit 152.

[0060] The external power supply source 200, which applies voltage of 200 V, for example, is electrically connected to the control unit 15. As such, power is supplied to the various components of the printing apparatus 1.

[0061] In recent years, there has been a growing trend for deeper colors of the ink IK. As such, there is a relatively high proportion of poorly soluble components such as pigment and the like in the ink IK. A portion of these poorly soluble components settles over time in the ink cartridge 19 installed and used in the printing apparatus 1. Moreover, this settled matter sometimes may become deposited as sediment in the vicinity of the discharge port 192. In such a case, depending on the magnitude of the amount of deposition of sediment, there is a possibility that color unevenness, for example, may occur when printing on the work W. That is, there is a possibility that regions of lighter color and regions of darker color may be generated when printing on the work W using the same color. Additionally, there is a possibility that the discharge port 192 of the ink cartridge 19 may become clogged.

[0062] As such, the printing apparatus 1 is provided with a configuration whereby these problems can be reduced or prevented. This configuration is described below.

[0063] As illustrated in Fig. 4, the ink cartridge 19 is used while loaded in an ink supply unit 10. The ink supply unit 10 supplies the ink IK in the ink cartridge 19 to the ink jet head 2 via the flow channel 20. In the printing apparatus 1, the ink cartridge 19Y, the ink cartridge 19M, the ink cartridge 19C, and the ink cartridge 19K are each used while loaded in an ink supply unit 10. Here, one representative ink supply unit 10 will be described.

[0064] The ink supply unit 10 is constituted by the holding unit 6 (ink cartridge holder) that holds the ink cartridge 19 (bag), and the agitating unit 7 configured to agitate the ink IK in the ink cartridge 19 held on the holding unit 6.

[0065] As illustrated in Fig. 5 to Fig. 8, the holding unit 6 includes a support plate 61 that supports the storage portion 191 from a bottom surface 193 side thereof in a state where the ink cartridge 19 is inclined. The support plate 61 is inclined with respect to the direction Y. As such, the ink cartridge 19 can assume a posture in which the storage portion 191 is inclined on the support plate 61 with respect to the direction Y (horizontal direction), and the discharge port 192 is disposed below the storage portion 191 in the inclination direction (hereinafter, this posture is referred to as the "inclined posture").

[0066] An angle of inclination θ_{191} of the storage por-

tion 191 on the support plate 61 (holding unit 6) with respect to the direction Y (horizontal direction) is preferably 20 degrees or greater and 70 degrees or less, and is more preferably 20 degrees or greater and 50 degrees or less. In this case, for example, the ink IK can be reliably discharged from the discharge port 192 and, therefore, all of the ink IK can be used. Additionally, the holding unit 6 may have a configuration whereby the support plate 61 is capable of adjusting the angle of inclination θ_{191} within the range described above depending on the amount of the ink IK remaining in the ink cartridge 19.

[0067] An abutting plate 62 against which an edge of the storage portion 191 abuts is provided at the lower portion in the inclination direction of the support plate 61. As such, the ink cartridge 19 can be prevented from sliding off the support plate 61 and, thus, the inclined posture of the ink cartridge 19 can be maintained.

[0068] As illustrated in Fig. 4, the agitating unit 7 includes a pressing member 8 configured to press the storage portion 191 of the ink cartridge 19 from a top surface 194 side of the storage portion 191, and a driving unit 71 that drives the pressing member 8. The driving unit 71 can be constituted by a motor, a reduction gear or the like, for example.

[0069] As illustrated in Fig. 5 to Fig. 8, the pressing member 8 is configured to press the storage portion 191 in the inclined posture from the lower side toward the upper side in the inclination direction and deform the storage portion 191. The pressing member 8 includes a shaft portion 81 that is rotatably supported, and at least one (one in the exemplary embodiment) rotary pressing portion 82 that rotates together with the shaft portion 81.

[0070] Both ends in the direction X of the shaft portion 81 illustrated in Fig. 4 are supported, and a first side of the shaft portion 81 is connected to the driving unit 71. As such, the shaft portion 81 can rotate in the direction of an arrow α_{81} around an axis O_{81} parallel to the direction X and orthogonal to the inclination direction of the ink cartridge 19 (support plate 61).

[0071] The shaft portion 81 has a crank-like shape. Moreover, the rotary pressing portion 82 is disposed eccentrically from the center of rotation of the shaft portion 81, namely the axis O_{81}, at a center portion in the longitudinal direction of the shaft portion 81. This rotary pressing portion 82 is, for example, preferably constituted from a resin material.

[0072] As illustrated in Fig. 5 to Fig. 8, the rotary pressing portion 82 has a cylindrical shape and is configured as a roller through which the shaft portion 81 is inserted. As such, the rotary pressing portion 82 can rotate together with the shaft portion 81 around the axis O_{81} and, at the same time can also rotate in a direction of an arrow α_{82} around an axis O_{82}, which is eccentric from the axis O_{81}. As a result of this rotation, the rotary pressing portion 82 can press the top surface 194 of the storage portion 191 from the lower side toward the upper side in the inclination direction and reliably deform the top surface 194. Thus, the ink IK in the deformed storage portion 191 will be agitated.

[0073] As a result, even when sediment is formed in the storage portion 191 (the ink cartridge 19) or before the sediment is formed, the deposition of sediment can be reliably prevented via a simple configuration, namely pressing the outside of the storage portion 191. As such, various benefits can be obtained such as, for example, the occurrence of color unevenness in the printing on the work W can be reduced or prevented, and clogging of the discharge port 192 can be reduced or prevented. Note that it is preferable that the location where the pressing member 8 presses the storage portion 191 be set as close to the discharge port 192 as possible. This is because sediment is more likely to become deposited on the discharge port 192 side in the storage portion 191.

[0074] Here, the storage portion 191 is pressed from the lower side toward the upper side in the inclination direction. On the other hand, the ink IK in the storage portion 191 flows from the upper side to the lower side in the inclination direction, which is opposite the direction in which the storage portion 191 is pressed. As such, the agitation efficiency per press can be enhanced.

[0075] Additionally, ink cartridges 19 of the related art in which the ink IK is stored can be used as-is due to the fact that the configuration, that is, the pressing member 8 pressing the outside of the storage portion 191, is simple.

[0076] Additionally, the rotary pressing portion 82 is configured as a roller and, thus, the rotary pressing portion 82 can smoothly press forward on the storage portion 191. As such, friction between the rotary pressing portion 82 and the storage portion 191 is reduced and, therefore, breakage and damage of the storage portion 191 during the pressing can be prevented.

[0077] As described above, the pressing member 8 includes the shaft portion 81 that is rotatably supported, and at least one rotary pressing portion 82 that is disposed eccentrically from the center of rotation (axis O_{81}) of the shaft portion 81 and that rotates with the shaft portion 81. Moreover, the rotary pressing portion 82 can repeatedly move toward and away from the storage portion 191 while rotating around the axis O_{81}. As such, the storage portion 191 can be deformed a plurality of times. Additionally, due to this deformation, the agitation of the ink can be continuously performed, which contributes to the elimination of sediment.

[0078] It is preferable that the rotational speed of the rotary pressing portion 82 around the axis O_{81} from a start (for example, in the position shown in Fig. 6) to an end of the rotation of the rotary pressing portion 82 is as illustrated in Fig. 10. As illustrated in Fig. 10, the rotational speed of the rotary pressing portion 82 is gradually increased over time for a predetermined period of time from the start of the rotation of the rotary pressing portion 82. Additionally, the rotational speed of the rotary pressing portion 82 is gradually reduced toward the end the rotation of the rotary pressing portion 82. As such, the agitation of the ink IK can be gradually weakened, which is

preferable for the ink IK.

[0079] It is preferable that the rotation around the axis O_{81} of the rotary pressing portion 82 is stopped at a position where the rotary pressing portion 82 is separated from the storage portion 191, as illustrated in Fig. 5. In this case, replacement work can be done easily when replacing an ink cartridge 19 that has become empty with a new ink cartridge 19.

[0080] It is preferable that the agitating unit 7 is configured such that agitation conditions for the ink IK differ depending on a type (e.g. size, color or the like of the pigment) of the ink IK. The agitation conditions are not particularly limited and examples thereof include agitation frequency until the ink cartridge 19 becomes empty, rotating time of the rotary pressing portion 82 per operation of the agitating unit 7, average rotational speed of the rotary pressing portion 82 per operation of the agitating unit 7, and the like. With such a configuration, agitation suited to various types of the ink IK (ease of sediment forming) can be performed. For example, when the ink IK is a sublimation transfer ink (dispersion system), it is preferable that the agitation frequency for black ink IK is higher (about once every two weeks) than the agitation frequency for the other colors of ink IK.

[0081] Next, a description of the timing at which the agitating unit 7 is operated, that is, agitation timing, is given on the basis of the flowchart illustrated in Fig. 9.

[0082] Printing is started (step S101), and it is determined whether or not conditions for starting agitation are satisfied (step S102). These conditions are determined on the basis of the agitation conditions based on the type of ink IK described above. These conditions are stored in advance in the control unit 15.

[0083] At S102, when it is determined that the conditions for starting agitation are satisfied, agitation is started (step S103) and, thereafter, ended (step S104). Next, when it is determined that printing has completed (step S105), printing is ended (step S106).

[0084] At S102, when it is not determined that the conditions for starting agitation are satisfied, step S105 is carried out and, then all subordinate steps are sequentially carried out.

[0085] The ink IK can be agitated during the printing by using such control programs described above. As a result, it is not necessary to separately provide time dedicated for agitating the ink IK and, thus, the operating rate of the printing operation of the printing apparatus 1 is enhanced. Note that in the exemplary embodiment, step S101 to step S106 constitutes the printing process for printing.

Second Exemplary Embodiment

[0086] Fig. 11 is a graph illustrating a change over time of the rotational speed of the rotary pressing portion of the agitating unit provided in the printing apparatus (second exemplary embodiment) of the invention.

[0087] Next, a description is given of a second exemplary embodiment of the printing apparatus and the printing method of the invention while referencing Fig. 11. However, this description will focus on differences with the previously described exemplary embodiment and, therefore, descriptions of identical matters are omitted.

[0088] The present exemplary embodiment is identical to the first exemplary embodiment with the exception that a state of change of the rotational speed of the rotary pressing portion is different.

[0089] In the exemplary embodiment, the rotational speed of the rotary pressing portion 82 around the axis 081 during the period from a start to an end the rotation of the rotary pressing portion 82 is as illustrated in Fig. 11. As illustrated in Fig. 11, the rotational speed of the rotary pressing portion 82 increases dramatically immediately after the start of rotation. As such, agitation can be started quickly. Additionally, as in the first exemplary embodiment, the rotational speed of the rotary pressing portion 82 is gradually reduced toward the end of the rotation of the rotary pressing portion 82.

Third Exemplary Embodiment

[0090] Fig. 12 is a schematic drawing illustrating the agitating unit provided in the printing apparatus (third exemplary embodiment) of the invention.

[0091] Next, a description is given of a third exemplary embodiment of the printing apparatus and the printing method of the invention while referencing Fig. 12. However, this description will focus on differences with the previously described exemplary embodiments and, therefore, descriptions of identical matters are omitted.

[0092] The present exemplary embodiment is identical to the first exemplary embodiment with the exception that the number of rotary pressing portions disposed is different.

[0093] As illustrated in Fig. 12, in the exemplary embodiment, the pressing member 8 includes two of the rotary pressing portions 82. These two rotary pressing portions 82 are disposed separated in the axis 081 direction. The separation distance is not particularly limited but, for example, is preferably not greater than the length of one of the rotary pressing portions 82.

[0094] With such a configuration, the ink IK in the storage portion 191 of the ink cartridge 19 is also subjected to and agitated by the forces between the two rotary pressing portions 82 and, as such, agitation efficiency is enhanced.

Fourth Exemplary Embodiment

[0095] Fig. 13 is a schematic drawing illustrating the agitating unit provided in the printing apparatus (fourth exemplary embodiment) of the invention.

[0096] Next, a description is given of a fourth exemplary embodiment of the printing apparatus and the printing method of the invention while referencing Fig. 13. However, this description will focus on differences with

the previously described exemplary embodiments and, therefore, descriptions of identical matters are omitted.

[0097] The present exemplary embodiment is identical to the third exemplary embodiment with the exception that the disposal locations of the rotary pressing portions are different.

[0098] As illustrated in Fig. 13, in the exemplary embodiment, the pressing member 8 includes two of the rotary pressing portions 82. These two rotary pressing portions 82 are disposed on sides opposite each other through the axis 081 (the center of rotation of the shaft portion 81).

[0099] With such a configuration, the storage portion 191 of the ink cartridge 19 is pressed two times from the lower side toward the upper side in the inclination direction during one rotation of the shaft portion 81 around the axis 081. As such, agitation efficiency is enhanced.

Fifth Exemplary Embodiment

[0100] Fig. 14 is a schematic drawing illustrating the agitating unit provided in the printing apparatus (fifth exemplary embodiment) of the invention.

[0101] Next, a description is given of a fifth exemplary embodiment of the printing apparatus and the printing method of the invention while referencing Fig. 14. However, this description will focus on differences with the previously described exemplary embodiments and, therefore, descriptions of identical matters are omitted.

[0102] The present exemplary embodiment is identical to the third exemplary embodiment with the exception that the disposal locations of the rotary pressing portions are different.

[0103] As illustrated in Fig. 14, in the exemplary embodiment, the pressing member 8 includes two of the rotary pressing portions 82. These two rotary pressing portions 82 are disposed separated in the axis 081 direction and on sides opposite each other through the axis 081 (the center of rotation of the shaft portion 81).

[0104] With such a configuration, the storage portion 191 of the ink cartridge 19 is pressed two times from the lower side toward the upper side in the inclination direction during one rotation of the shaft portion 81 around the axis 081 and, also, the ink IK in the storage portion 191 of the ink cartridge 19 is also subjected to and agitated by the forces between the two rotary pressing portions 82. As such, agitation efficiency is enhanced. Such a configuration is suited for cases where the ink cartridge 19 has a comparatively large direction X dimension.

Sixth Exemplary Embodiment

[0105] Fig. 15 to Fig. 18 are vertical partial cross-sectional views illustrating operating states of the agitating unit provided in the printing apparatus (sixth exemplary embodiment) of the invention, in order.

[0106] Next, a description is given of a sixth exemplary embodiment of the printing apparatus and the printing method of the invention while referencing Fig. 15 to Fig. 18. However, this description will focus on differences with the previously described exemplary embodiments and, therefore, descriptions of identical matters are omitted.

[0107] The present exemplary embodiment is identical to the first exemplary embodiment with the exception that the configuration of the pressing member is different.

[0108] As illustrated in Fig. 15 to Fig. 18, in the exemplary embodiment, the pressing member 8 includes a base portion 83 that has a plate-like shape, and a balloon portion 84, a balloon portion 85, and a balloon portion 86 supported on a bottom surface of the base portion 83 and disposed along the inclination direction of the holding unit 6. The balloon portions 84 to 86 are connected to a flow channel 87, constituted from a tube, via the base portion 83. As such, the balloon portions 84 to 86 are portions that expand when a working fluid WF is supplied thereto, and contract when the working fluid WF is discharged therefrom. Additionally, the supplying and discharging of the working fluid WF to and from each of the balloon portions 84 to 86 is performed on an individual basis by, for example, operating switching values (not illustrated in the drawings) provided along the flow channel 87 or on the base portion 83. Note that the working fluid WF is not particularly limited and air can be used, for example.

[0109] When the working fluid WF is supplied to the balloon portion 84 while the balloon portions 84 to 86 are contracted as illustrated in Fig. 15, the balloon portion 84 expands as illustrated in Fig. 16. Next, when the working fluid WF is discharged from the balloon portion 84 and the working fluid WF is supplied to the balloon portion 85, the balloon portion 84 contracts and the balloon portion 85 expands as illustrated in Fig. 17. Next, when the working fluid WF is discharged from the balloon portion 85 and the working fluid WF is supplied to the balloon portion 86, the balloon portion 85 contracts and the balloon portion 86 expands as illustrated in Fig. 18. Thereafter, the operations illustrated in Fig. 15 to Fig. 18, or the operations illustrated in Fig. 16 to Fig. 18 can be repeated. As a result, the pressing member 8 can press the top surface 194 of the storage portion 191 from the lower side toward the upper side in the inclination direction and reliably deform the top surface 194. Thus, the ink IK in the deformed storage portion 191 will be agitated.

[0110] Note that the balloon portions 84 to 86 may also be disposed on the bottom surface 193 side of the storage portion of the ink cartridge 19.

Seventh Exemplary Embodiment

[0111] Fig. 19 is a schematic perspective view illustrating a relationship between an ink cartridge and an agitating unit in the printing apparatus (seventh exemplary embodiment) of the invention.

[0112] Next, a description is given of a seventh exemplary embodiment of the printing apparatus and the print-

ing method of the invention while referencing Fig. 19. However, this description will focus on differences with the previously described exemplary embodiments and, therefore, descriptions of identical matters are omitted.

[0113] The present exemplary embodiment is identical to the first exemplary embodiment with the exception that a position changing unit is provided. As illustrated in Fig. 19, in the exemplary embodiment, the agitating unit 7 includes a position changing unit 72 that changes the position of the pressing member 8, with respect to the storage portion 191 of the ink cartridge 19, in the direction of an arrow α83 along the inclination direction. As such, the position of the pressing member 8 along the arrow α83 with respect to the storage portion 191 can be changed depending on the amount of ink IK remaining in the storage portion 191. Thus, the ink IK can be reliably agitated, regardless of the magnitude of the remaining amount of the ink IK.

[0114] The position changing unit 72 can be constituted by, for example, a motor, a linear guide, a ball screw, or the like. Additionally, the position changing unit 72 may have a configuration capable of also changing the position of the pressing member 8 in the direction Z.

[0115] The remaining amount of the ink IK is detected on the basis of a discharge rate of the ink IK and/or a weight of the ink cartridge 19.

[0116] The printing apparatus and the printing method of the invention have been described using the illustrated exemplary embodiments, but the invention should not be construed to be limited to these exemplary embodiments. The components constituting the printing apparatus can be replaced with components of any other configuration capable of exhibiting the same functions. Moreover, other components may be added as desired.

[0117] With the printing apparatus and the printing method of the invention, two or more configurations (features) among the various exemplary embodiments described above may be combined.

[0118] In the exemplary embodiments described above, four colors of ink were used in the printing apparatus, but the number of colors of ink is not limited thereto and, for example, eight colors of ink may be used.

[0119] In the exemplary embodiments described above, the transport unit included an endless belt to which the work was fixed via adhesion, however the means by which the work is fixed to the endless belt is not limited thereto and, for example, the transport unit may include a platen (stage) to which the work is fixed by suction.

[0120] In the first exemplary embodiment, the number of rotary pressing portions disposed is one and in the third to fifth exemplary embodiments, the number of rotary pressing portions disposed is two. However, the number of rotary pressing portion disposed is not limited thereto and, for example, three of more may be disposed.

[0121] The roller that functions as the rotary pressing portion may be omitted from the pressing member. In this case, the middle of the shaft portion, that is, the central portion in the longitudinal direction of the shaft portion functions directly as the rotary pressing portion, and it is preferable that this rotary pressing portion is subjected to low friction treatment such as Teflon™ treatment or the like.

[0122] The pressing member may also include biasing means such as a spring or the like that bias the rotary pressing portion toward the ink cartridge.

[0123] One or a plurality of pressing members or agitating units may be used for each ink cartridge. Likewise, one pressing member or agitating unit may be used for a plurality of cartridges.

Claims

1. A printing apparatus (1) comprising:

a holding unit (6) for holding a bag (19) including a storage portion (191) that is pliable and in which ink used for printing is stored and a discharge port (192) through which the ink is discharged; and
an agitating unit (7) configured to agitate the ink; wherein
the holding unit is configured to incline the storage portion with respect to a horizontal direction, and hold the bag in a posture where the discharge port is disposed below the storage portion in an inclination direction; and
the agitating unit includes a pressing member (8) configured to press the storage portion in the posture from a lower side toward an upper side in the inclination direction and deform the storage portion.

2. The printing apparatus according to claim 1, wherein:

the pressing member includes a shaft portion (81) that is rotatably supported, and at least one rotary pressing portion (82) disposed eccentrically from a center of rotation (O_{81}) of the shaft portion and that rotates with the shaft; and
the rotary pressing portion is configured to deform the storage portion a plurality of times by repeatedly moving toward and away from the storage portion.

3. The printing apparatus according to claim 2, wherein rotation of the rotary pressing portion stops at a position where the rotary pressing portion is separated from the storage portion.

4. The printing apparatus according to claim 2 or claim 3, wherein:

the pressing member (8) includes two of the rotary pressing portions (82); and

the two of the rotary pressing portions are disposed separated in an axial direction (X) of the shaft portion (81).

5. The printing apparatus according to any one of claims 2 to 4, wherein:

the pressing member (8) includes two of the rotary pressing portions (82); and
the two of the rotary pressing portions are disposed on sides opposite each other through the center of rotation (O_{81}) of the shaft portion.

6. The printing apparatus according to any one of claims 2 to 5, wherein the rotary pressing portion is constituted by a roller (82).

7. The printing apparatus according to claim 1, wherein the pressing member (8) includes a portion (84, 86) that expands when a working fluid is supplied to the portion and contracts when the working fluid is discharged from the portion.

8. The printing apparatus according to any one of the preceding claims, wherein agitation conditions of the agitating unit for the ink differ depending on a type of the ink.

9. The printing apparatus according to any one of the preceding claims, wherein:

the agitating unit includes a position changing unit (72) configured to change a position of the pressing member with respect to the storage portion in accordance with a remaining amount of the ink in the storage portion.

10. The printing apparatus according to any one of the preceding claims, wherein:

an angle of inclination (O_{191}) of the holding unit (6) with respect to the horizontal direction of the storage portion is 20 degrees or greater and 70 degrees or less.

11. A printing method comprising printing, wherein:

a printing apparatus (1) is used that includes a holding unit (6) holding a bag (19) including a storage portion (191) that is pliable and in which ink used for the printing is stored, and a discharge port (192) through which the ink is discharged; and
an agitating unit (7) configured to agitate the ink; wherein
the holding unit is configured to incline the storage portion with respect to a horizontal direction, and hold the bag in a posture where the discharge port is disposed below the storage portion in an inclination direction; and
the agitating unit includes a pressing member (8) configured to press the storage portion in the posture from a lower side toward an upper side in the inclination direction and deform the storage portion; and
the pressing member is operated and the ink is agitated during the printing.

FIG. 1

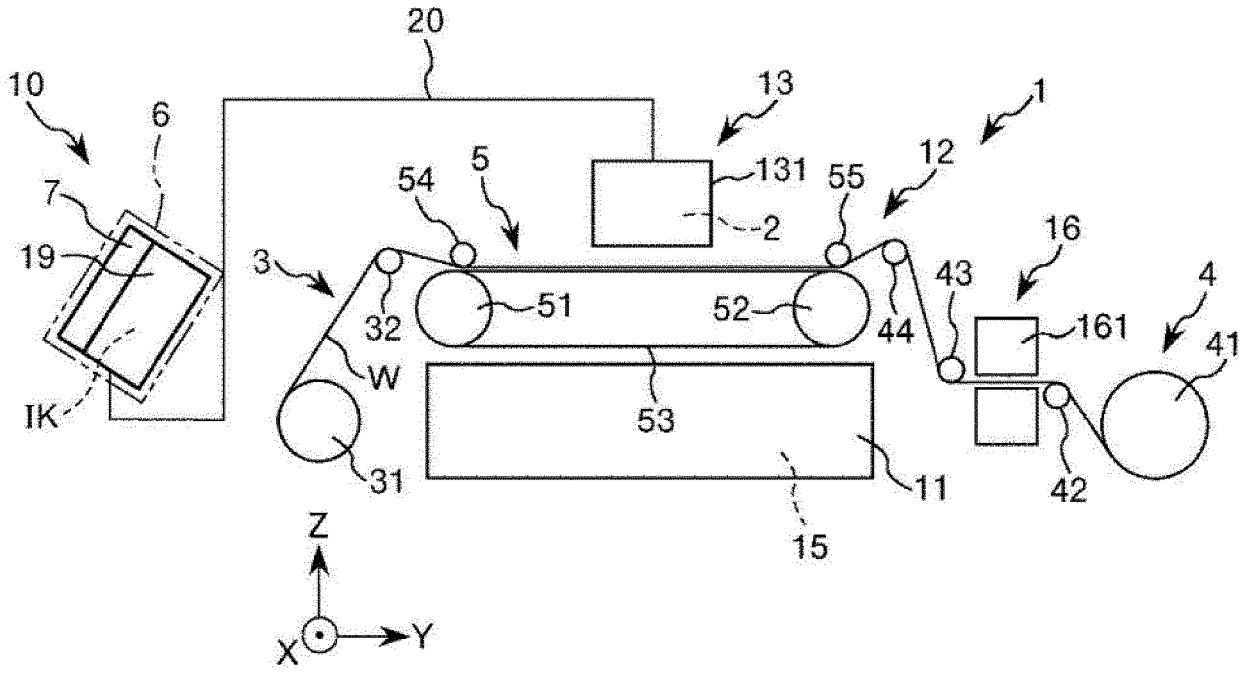

20
10
6
13
1
7
54
5
131
55
12
19
2
16
3
43
4
51
52
44
161
32
41
W
53
IK
31
11
42
15
Z
X
Y

FIG. 2

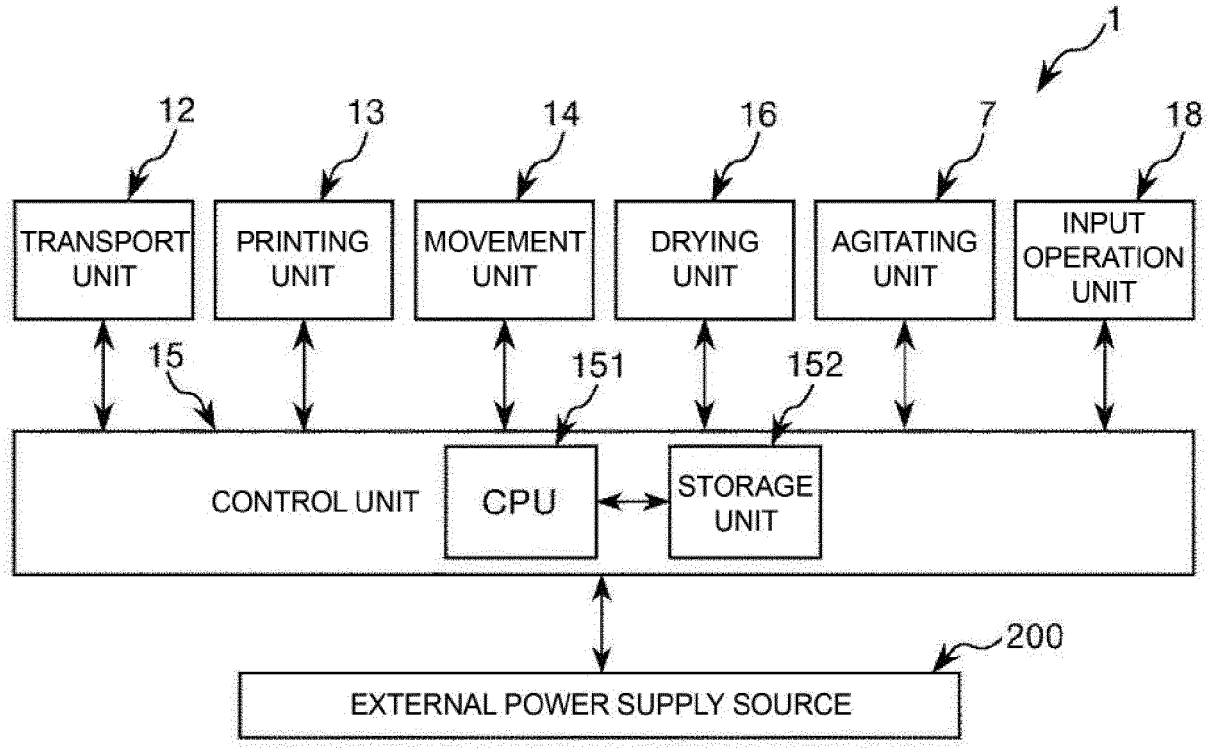

1
12
13
14
16
7
18
TRANSPORT UNIT
PRINTING UNIT
MOVEMENT UNIT
DRYING UNIT
AGITATING UNIT
INPUT OPERATION UNIT
15
151
152
CONTROL UNIT
CPU
STORAGE UNIT
200
EXTERNAL POWER SUPPLY SOURCE

FIG. 3

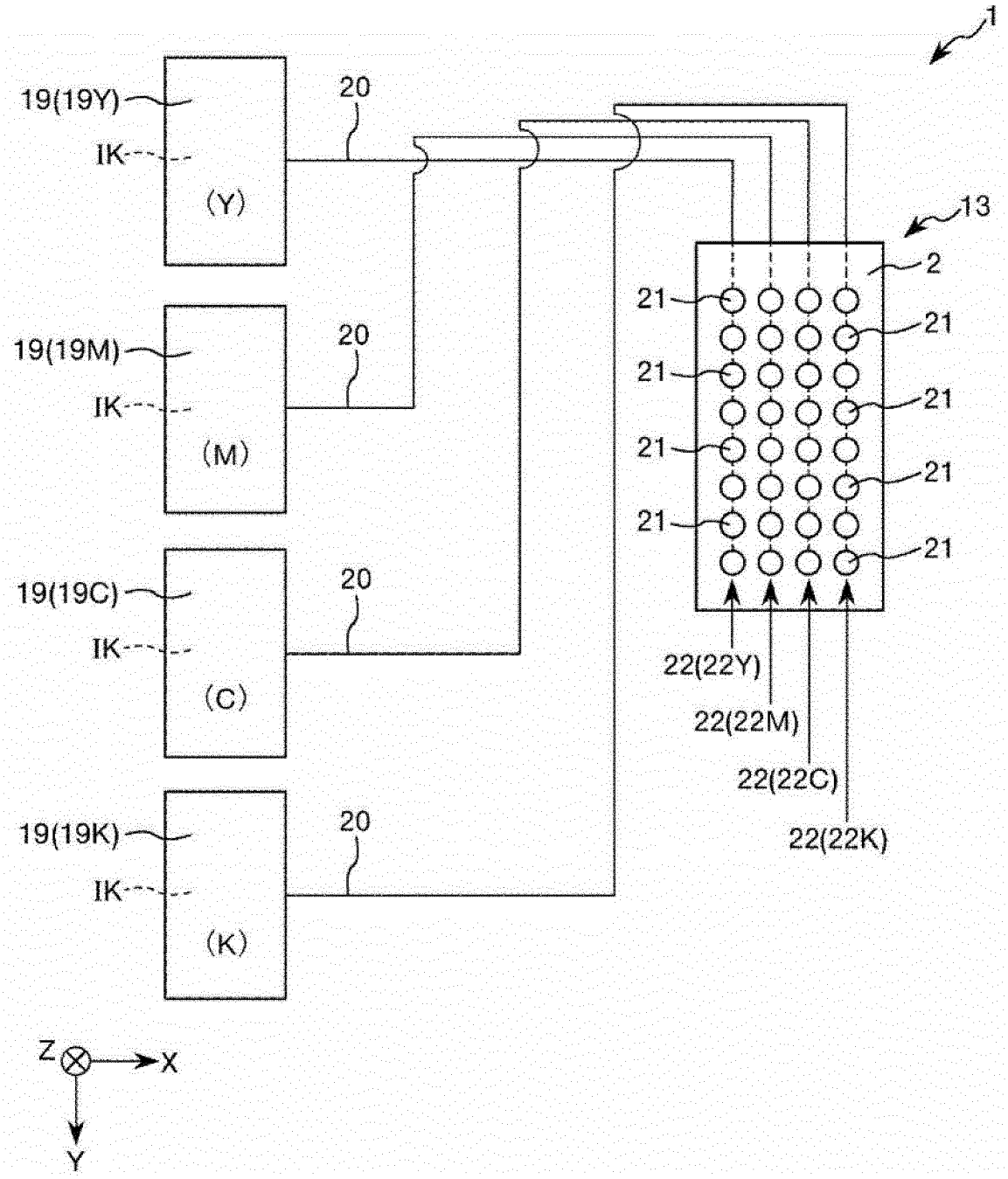

1
19(19Y)
IK
(Y)
20
19(19M)
IK
(M)
20
19(19C)
IK
(C)
20
19(19K)
IK
(K)
20
13
2
21
21
21
21
21
21
21
21
22(22Y)
22(22M)
22(22C)
22(22K)
Z
X
Y

FIG. 4

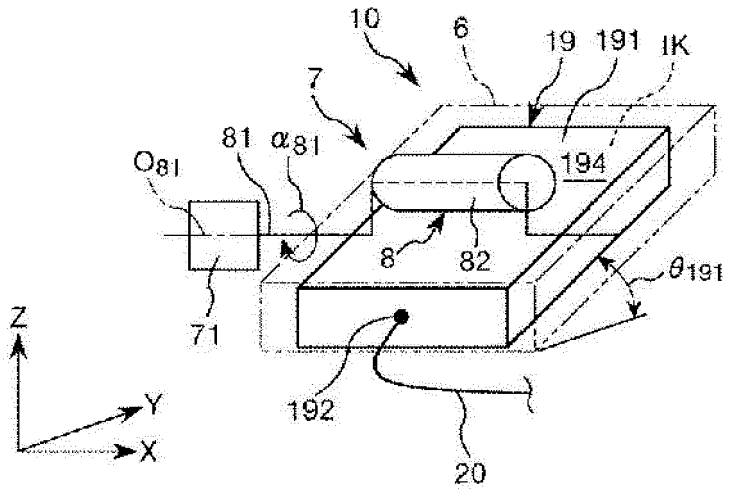


FIG. 5

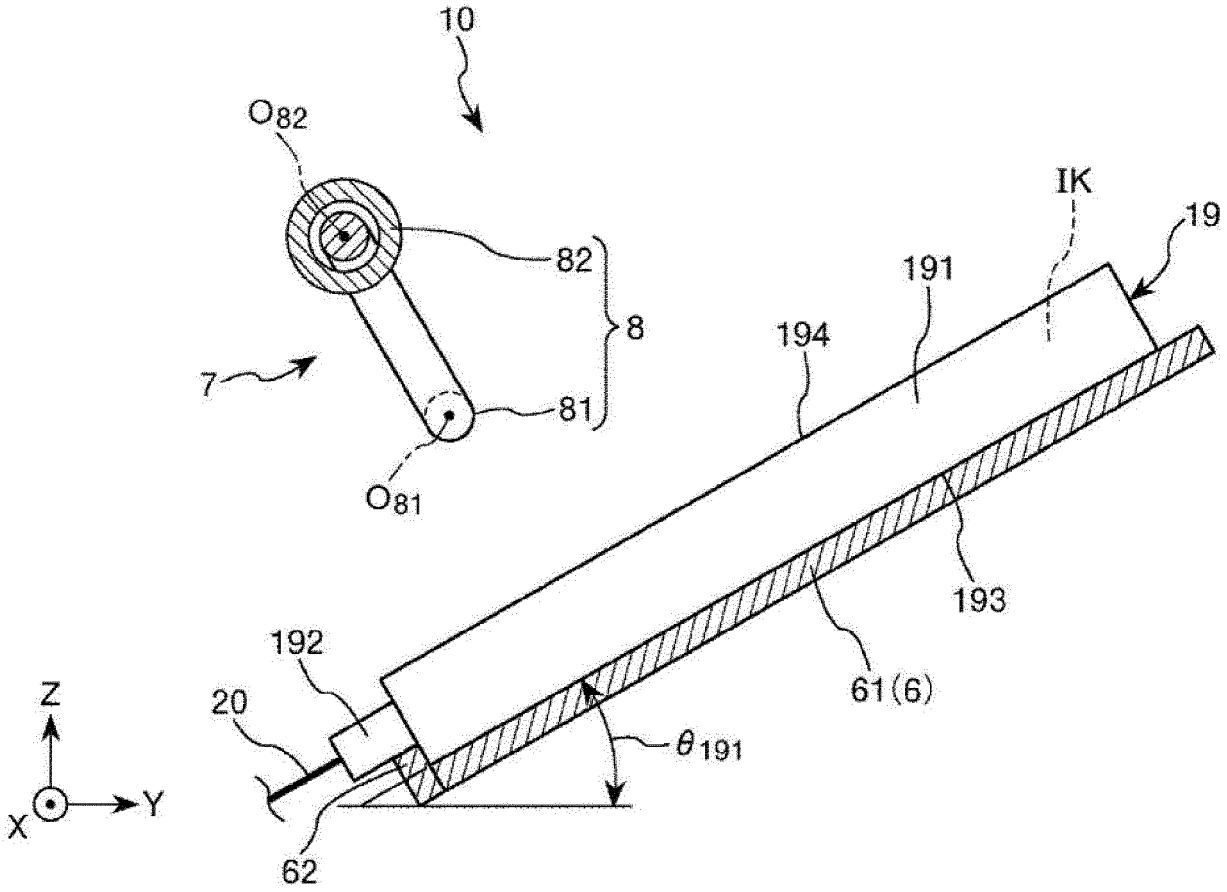


FIG. 6

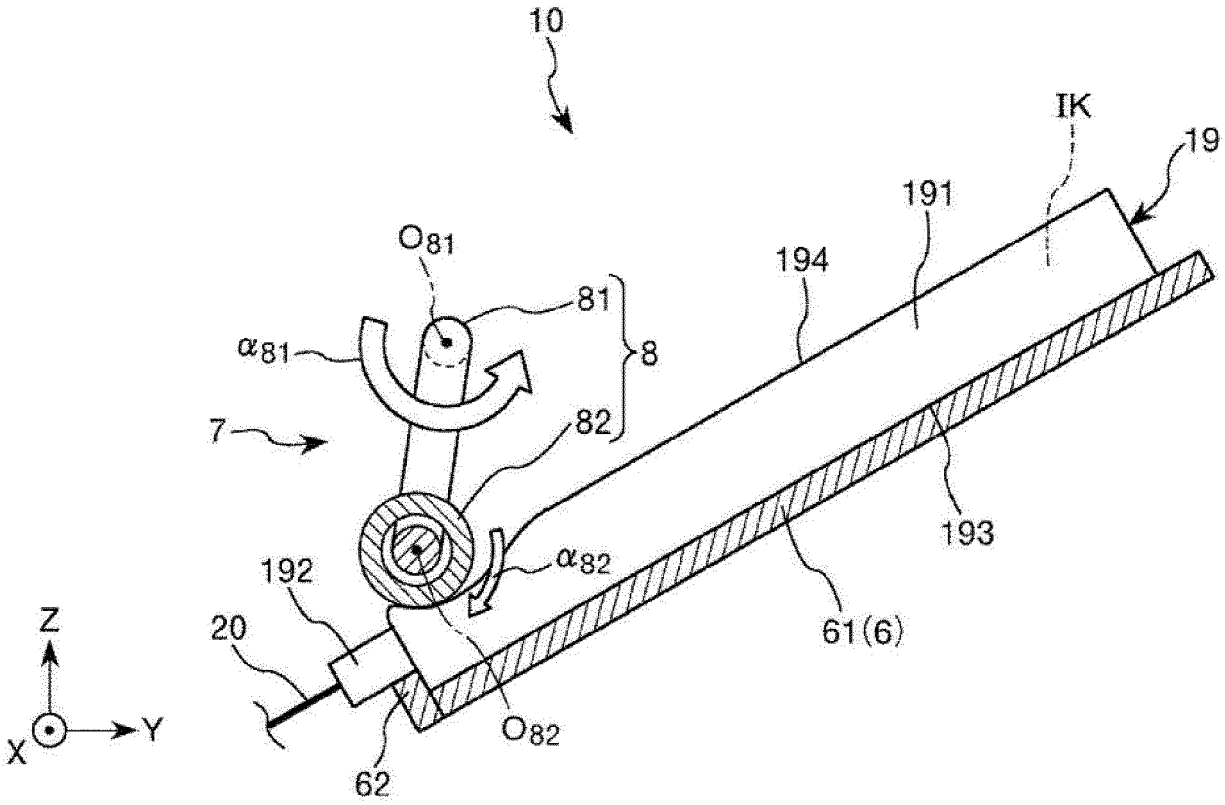

10
IK
19
191
194
O_{81}
81
8
α_{81}
7
82
193
192
α_{82}
20
61(6)
Z
X
Y
O_{82}
62

FIG. 7

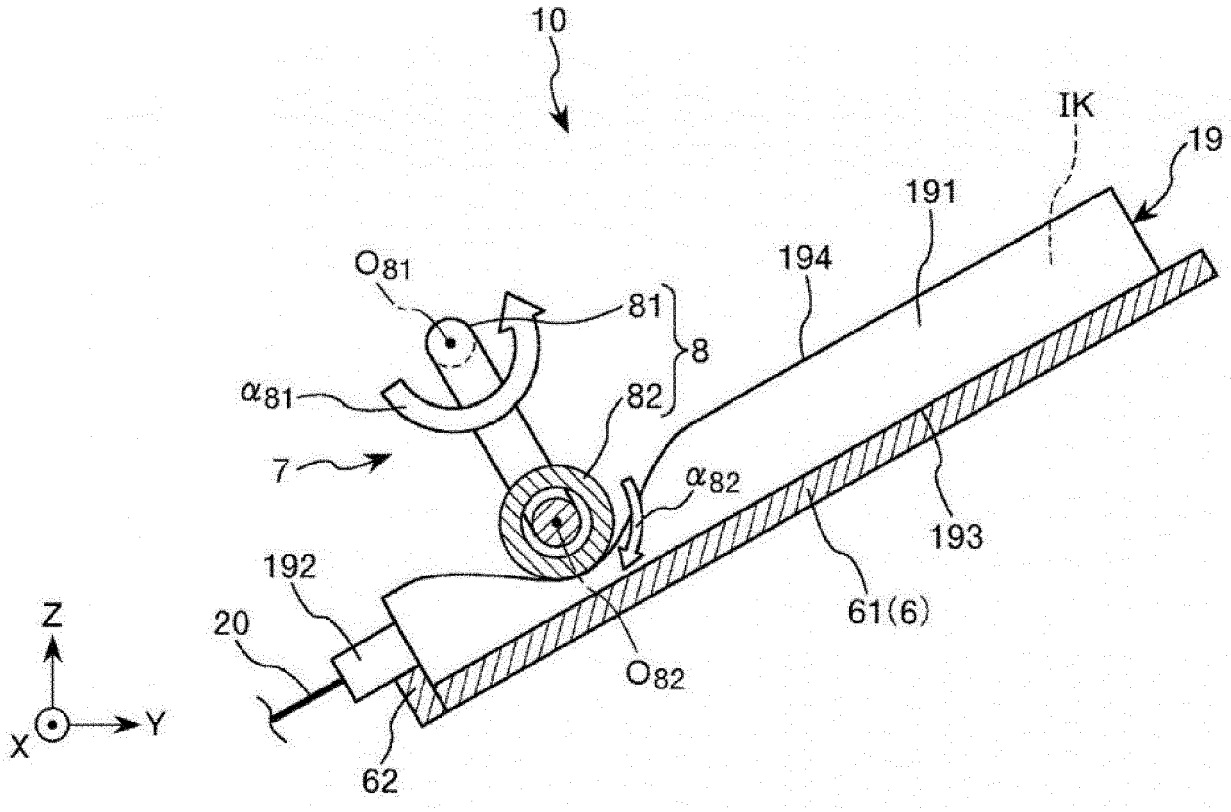

10
IK
19
191
194
O_{81}
81
8
α_{81}
82
7
α_{82}
193
192
61(6)
20
O_{82}
Z
Y
X
62

FIG. 8

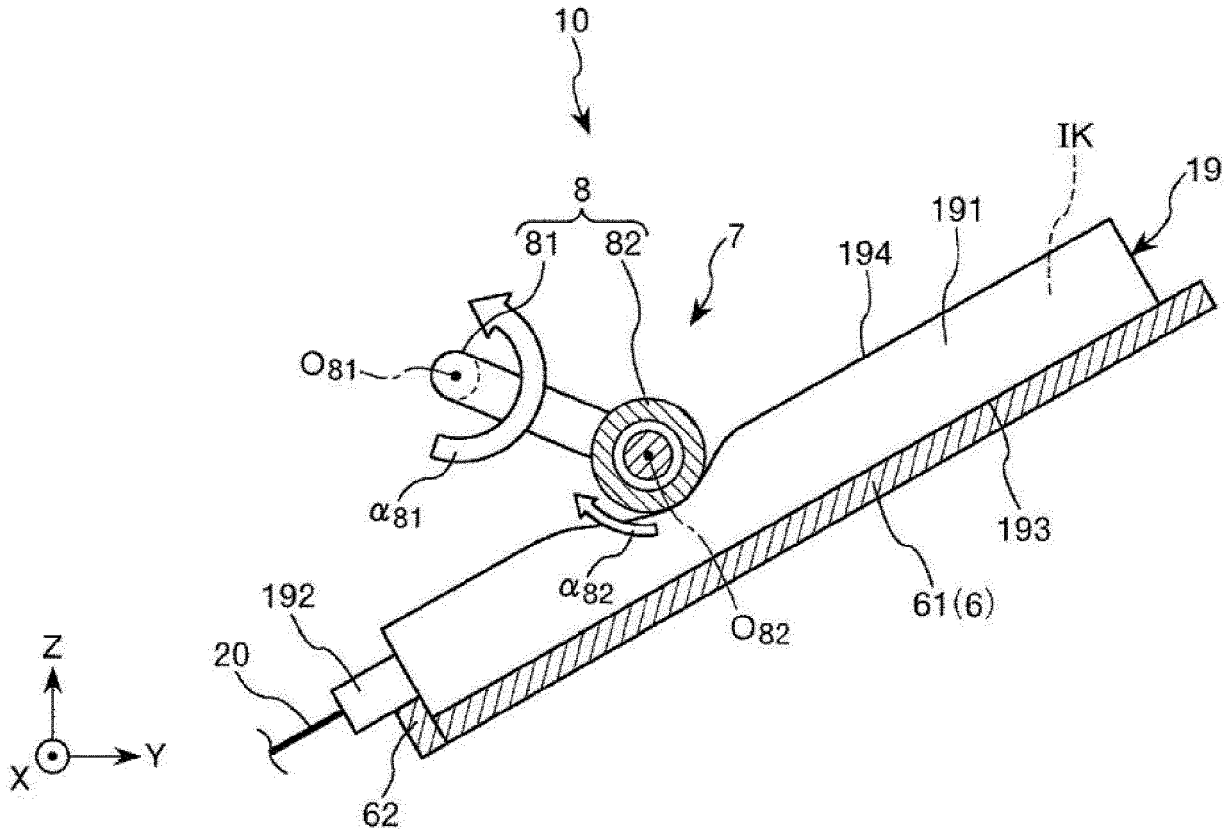


FIG. 9

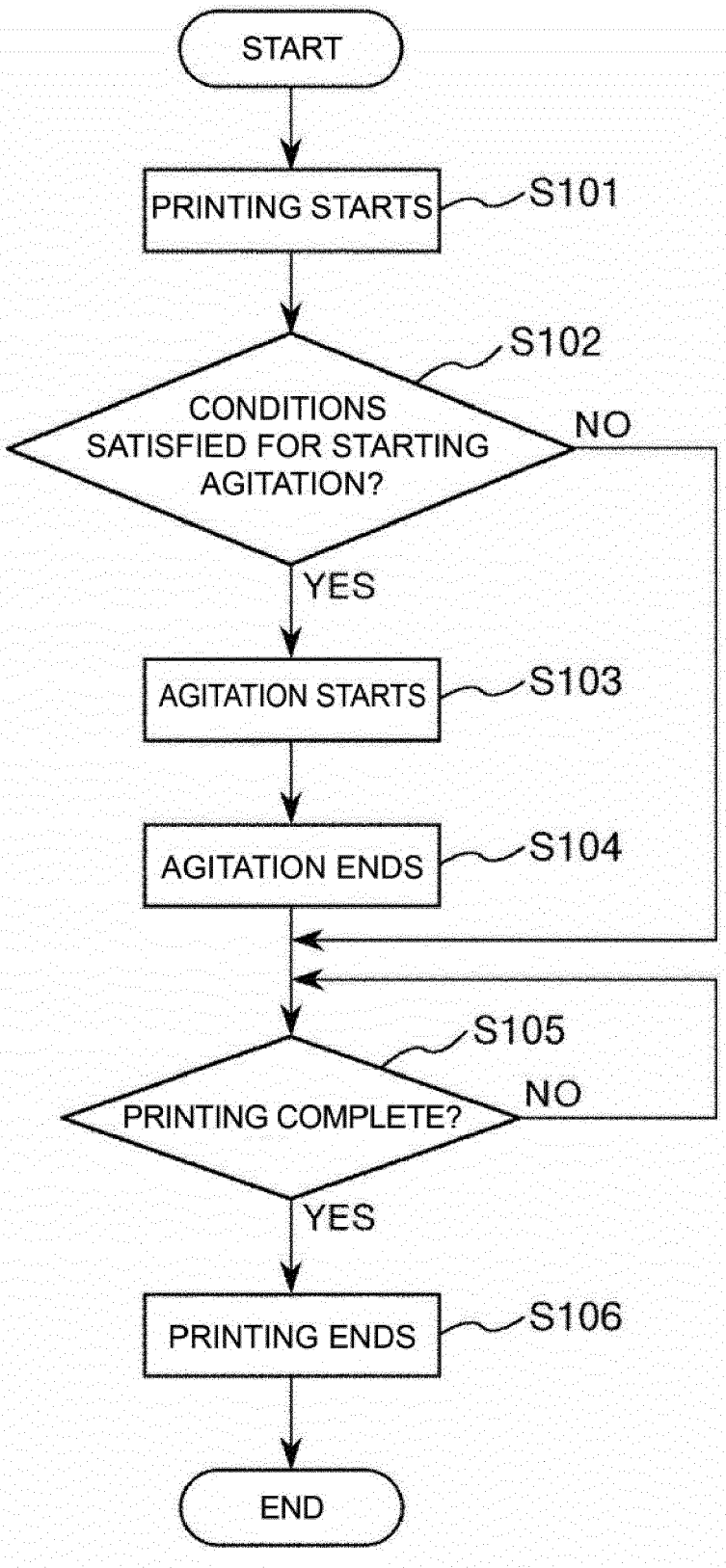

START
PRINTING STARTS
S101
S102
CONDITIONS SATISFIED FOR STARTING AGITATION?
NO
YES
AGITATION STARTS
S103
AGITATION ENDS
S104
S105
PRINTING COMPLETE?
NO
YES
PRINTING ENDS
S106
END

FIG. 10

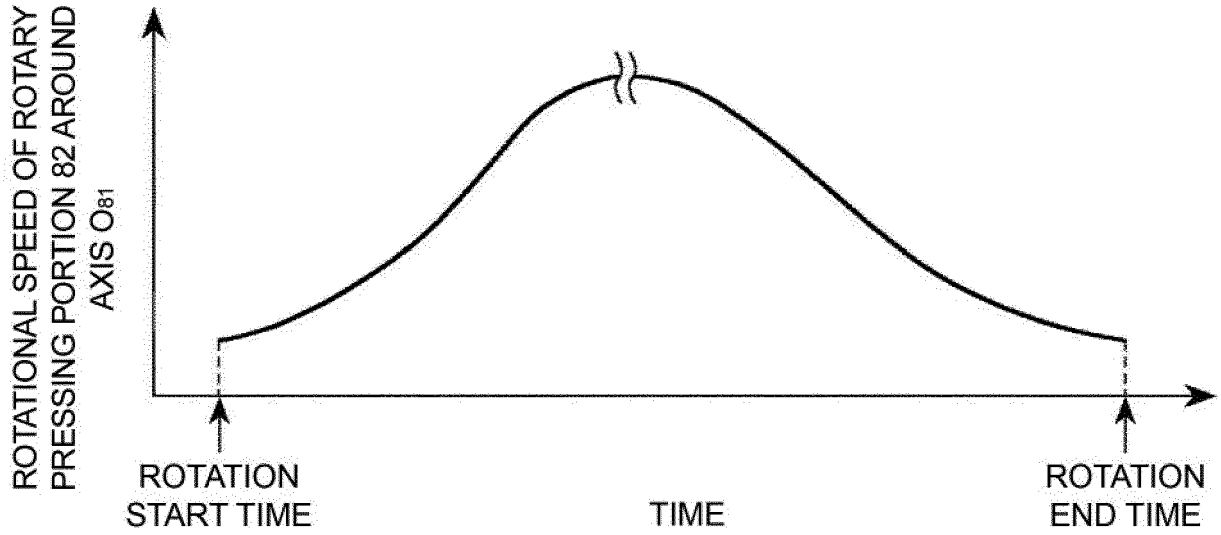

ROTATIONAL SPEED OF ROTARY PRESSING PORTION 82 AROUND AXIS O81
ROTATION START TIME
TIME
ROTATION END TIME

FIG. 11

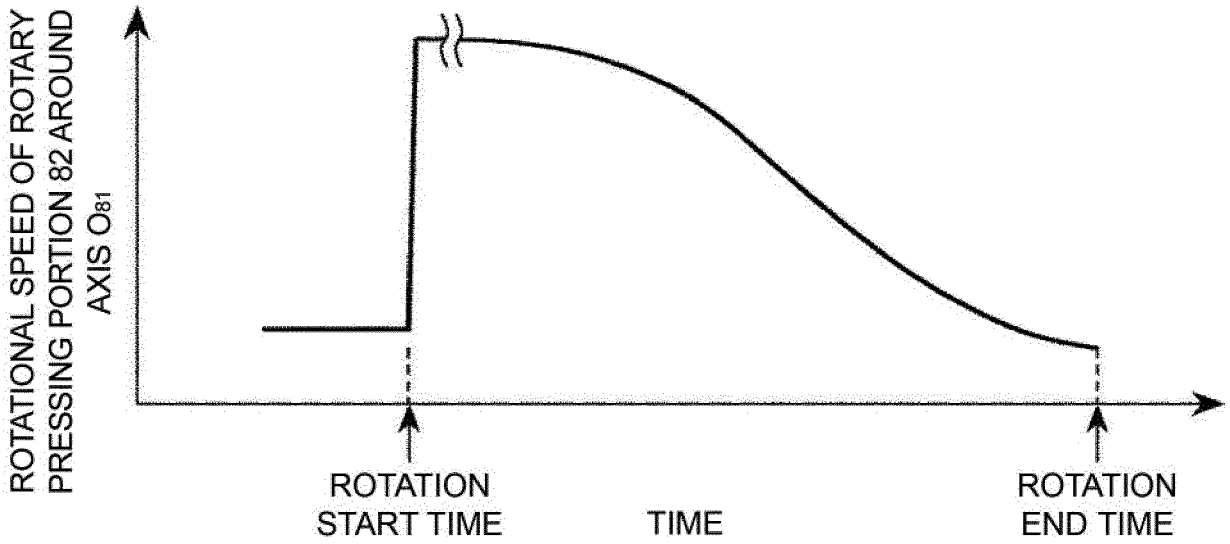

ROTATIONAL SPEED OF ROTARY PRESSING PORTION 82 AROUND AXIS O81
ROTATION START TIME
TIME
ROTATION END TIME

FIG. 12

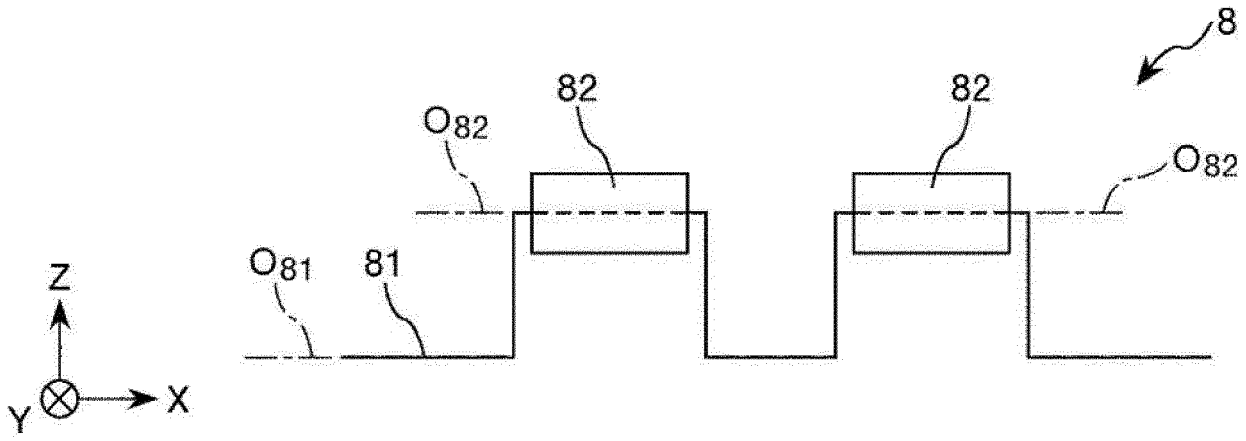


FIG. 13

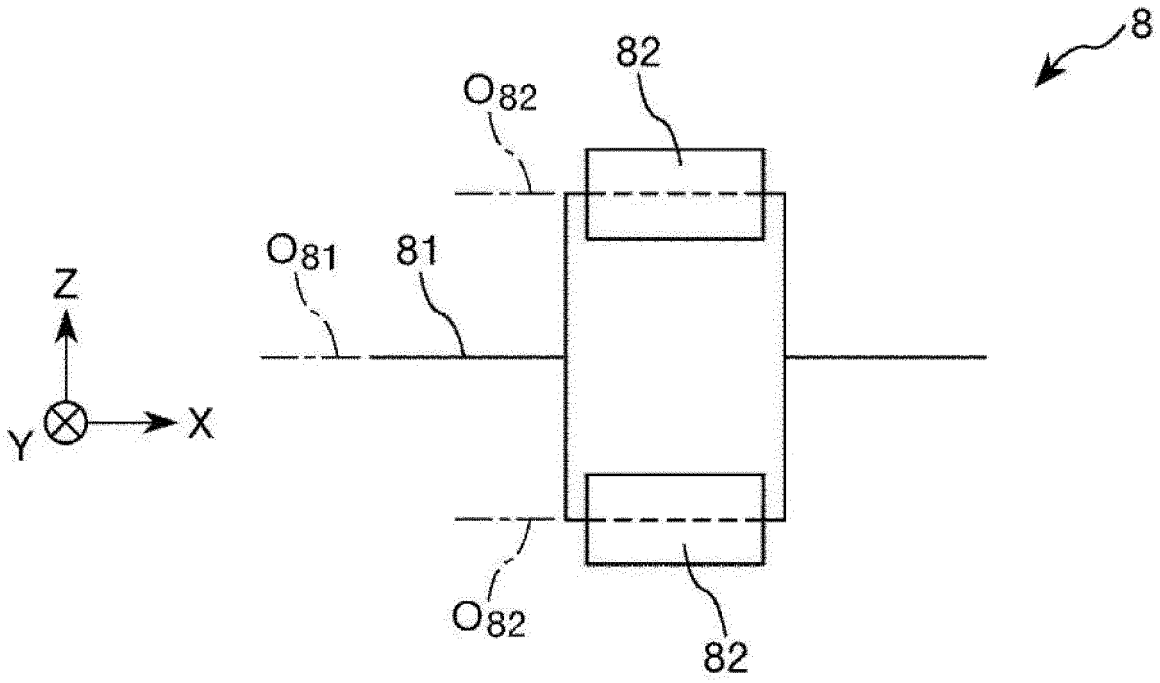


FIG. 14

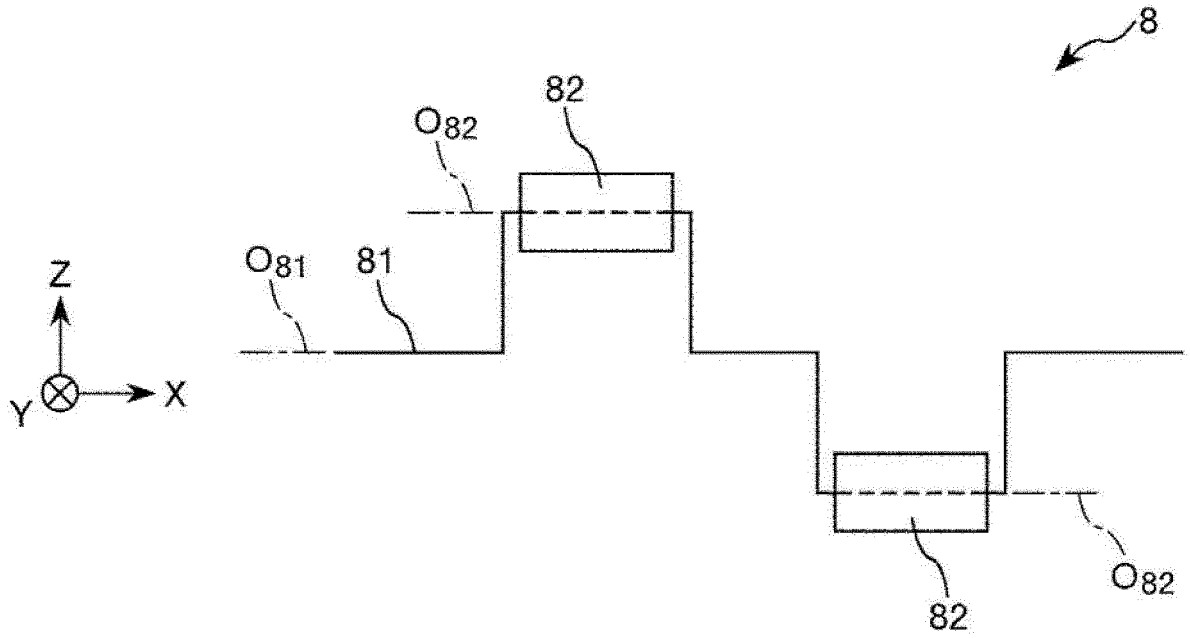


FIG. 15

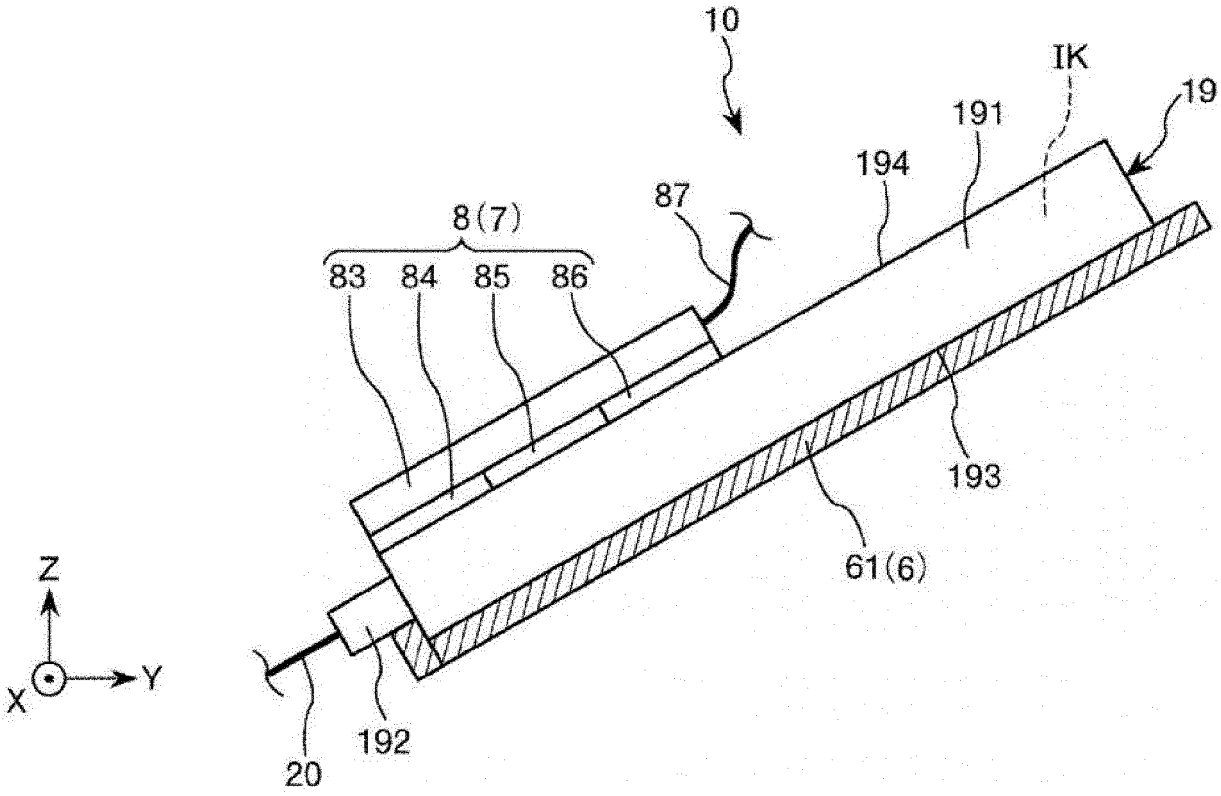


FIG. 16

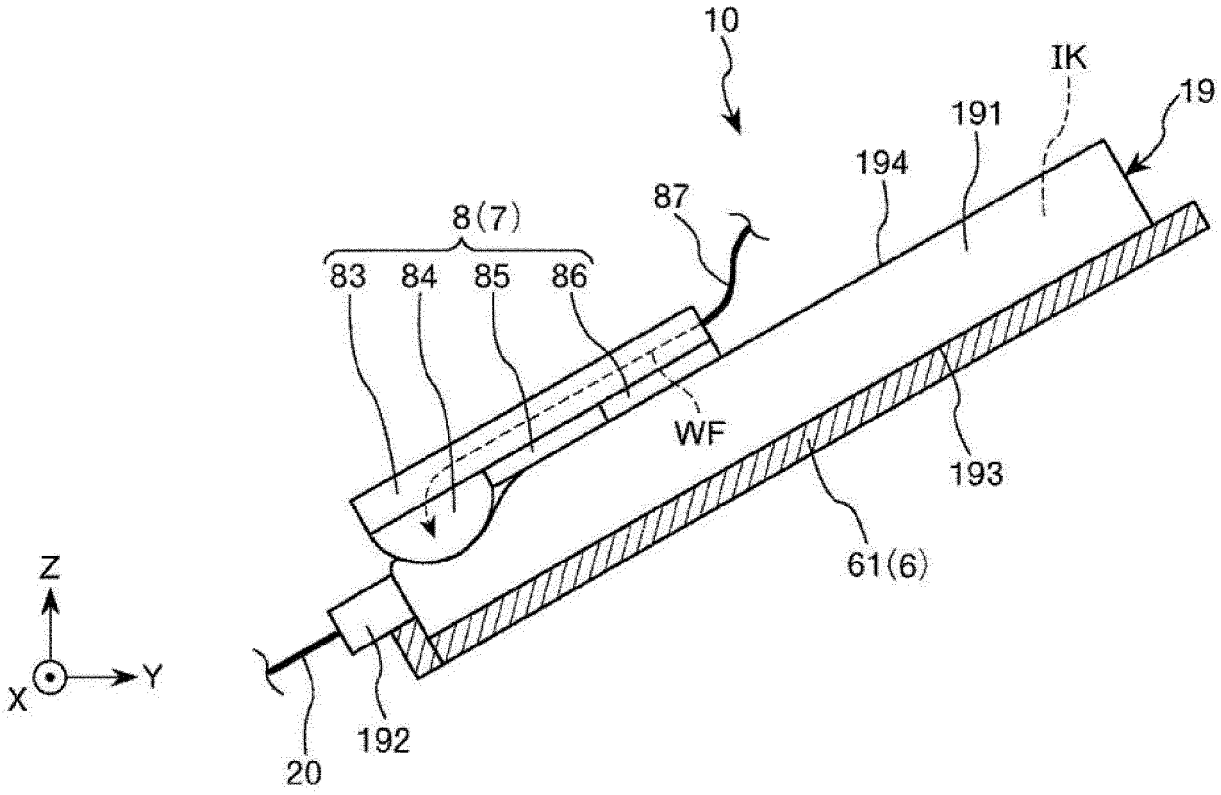


FIG. 17

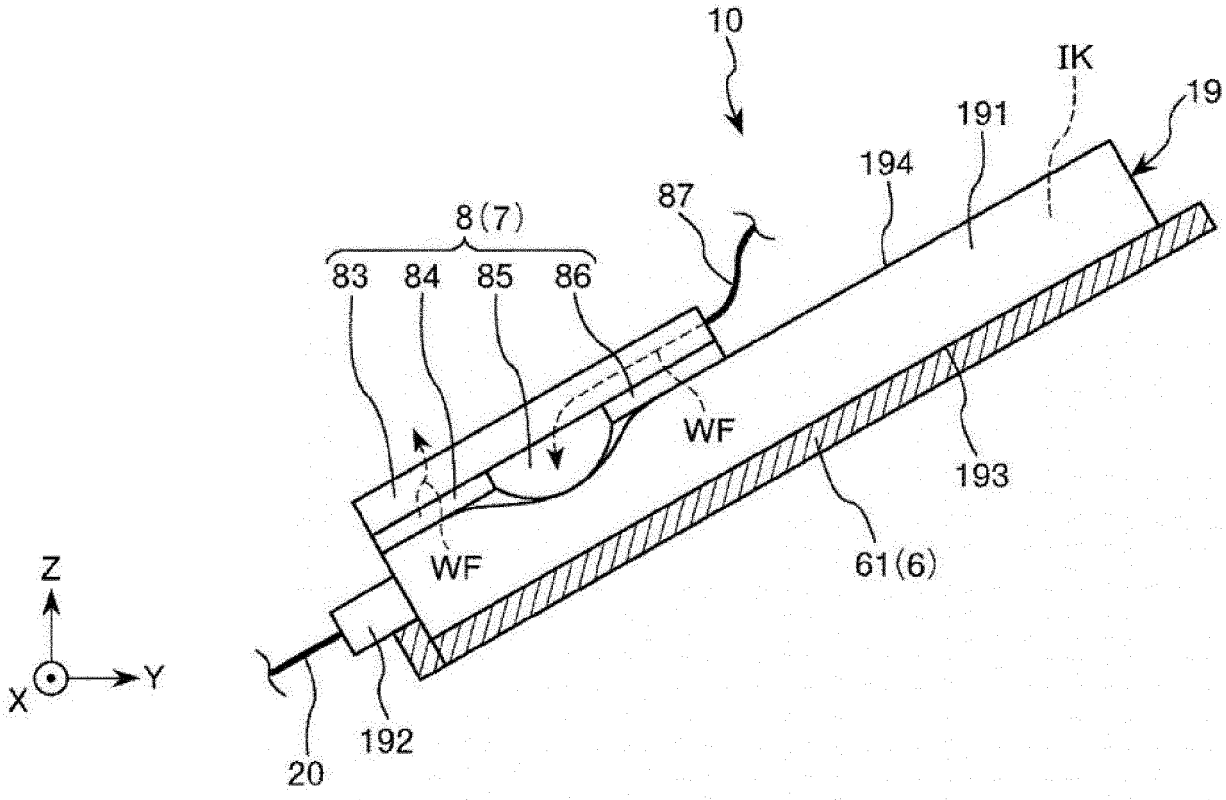


FIG. 18

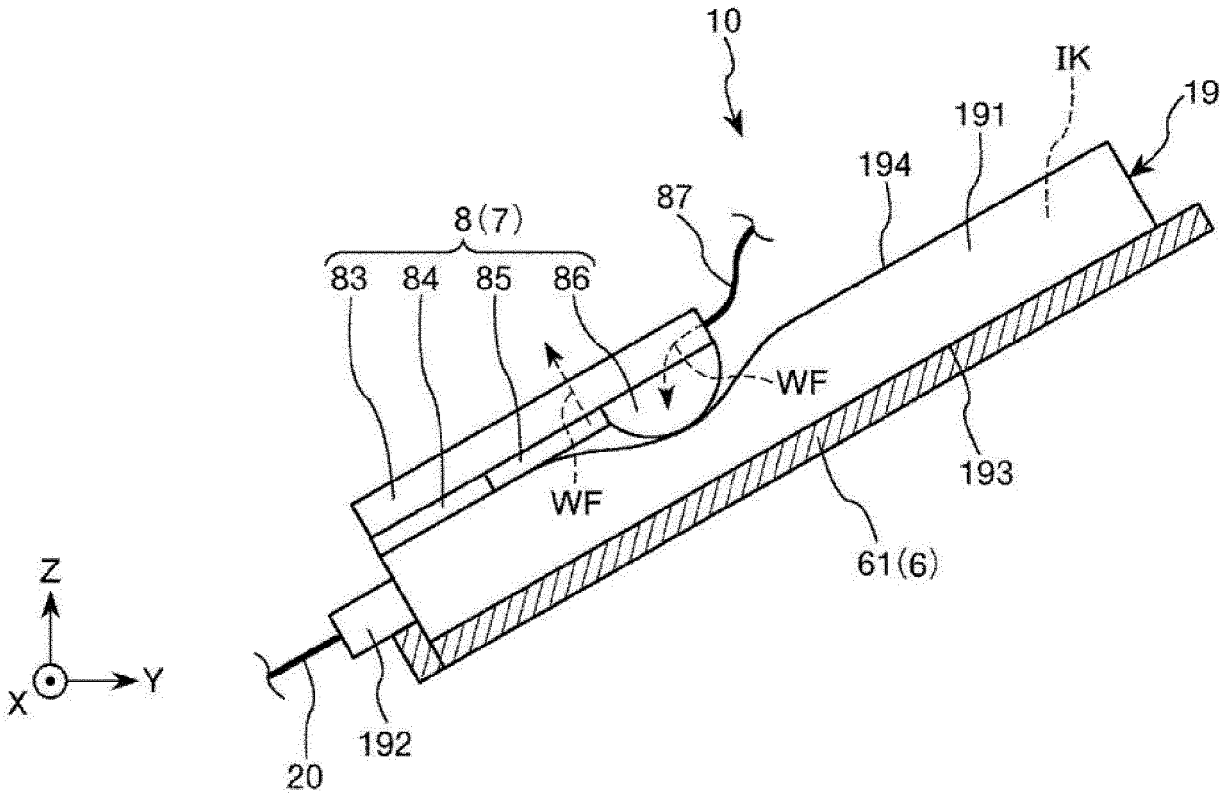
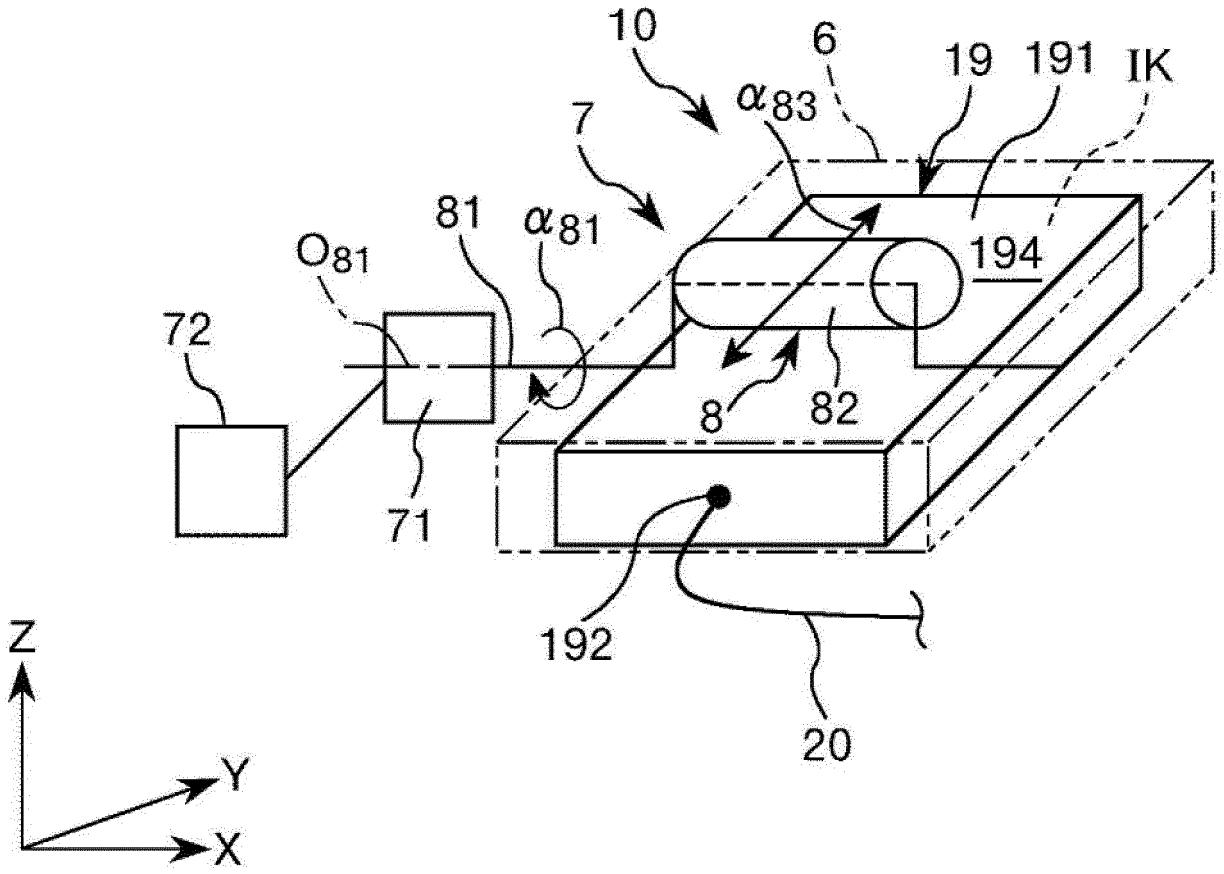


FIG. 19



Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 17 8160

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/052768 A1 (OHASHI TETSUYA [JP] ET AL) 8 March 2007 (2007-03-08) * paragraphs [0047], [0055] - [0058]; figures 5, 6, 7b, 7c, 8a-8d *	1-11	INV. B41J2/175
X	US 8 287 064 B2 (AKATSUKA YASUSHI [JP]; KIMURA HITOTOSHI [JP]; SEIKO EPSON CORP [JP]) 16 October 2012 (2012-10-16) * column 17, lines 16-35; figure 17 *	1-11	
X,D	JP 2013 237219 A (SEIKO EPSON CORP) 28 November 2013 (2013-11-28) * paragraphs [0041], [0042]; figures 3, 6 *	1-11	
X	EP 1 764 223 A2 (CANON KK [JP]) 21 March 2007 (2007-03-21) * paragraphs [0077] - [0084]; figures 5a, 5b, 6a, 6b *	1-11	
X	US 2010/053280 A1 (OHASHI TETSUYA [JP] ET AL) 4 March 2010 (2010-03-04) * the whole document *	1	TECHNICAL FIELDS SEARCHED (IPC) B41J
X	US 2016/082739 A1 (TAKAGIWA YUTAKA [JP]) 24 March 2016 (2016-03-24) * paragraphs [0044] - [0048], [0050], [0052]; figures 7, 9 *	1	
X	US 2014/078226 A1 (SATOH MITSURU [JP] ET AL) 20 March 2014 (2014-03-20) * paragraphs [0042] - [0050]; figures 1, 2 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 October 2017	Adam, Emmanuel

CATEGORY OF CITED DOCUMENTS

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