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Image forming apparatus

Abstract

The controller moves a movable body along a moving direction. A recording head and a detector are mounted on the movable body. The detector detects a detection target fixed to an ink receiving unit. The ink receiving unit receives an ink jetted from the recording head at a time of a flushing. The controller obtains, based on a signal from an encoder, a position of the movable body in a case that the detection target is detected by the detector during movement of the movable body. The controller determines a start timing of the flushing based on the obtained position of the movable body.

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Background/Summary

REFERENCE TO RELATED APPLICATION

(1) This application claims priority from Japanese Patent Application No. 2022-093203 filed on Jun. 8, 2022. The entire content of the priority application is incorporated herein by reference.

BACKGROUND ART

(2) There is a conventionally known ink-jet recording apparatus which is capable of executing flushing of ink from a recording head. The ink flushing is performed so as to prevent any unsatisfactory jetting of the ink at a time of image recording. Further, the ink flushing is performed by conveying the recording head up to a maintenance and recovery mechanism provided on a non-printing area in a main scanning direction. A receiver for ink flushing is provided on the maintenance and recovery mechanism. The flushing receiver receives the ink flushed from the recording head.

DESCRIPTION

(3) In the above-described ink-jet recording apparatus, in a case that an actual position of the flushing receiver is deviated from a position specified by the design and/or an actual size of the flushing receiver is deviated from a size specified by the design, there is such a possibility that the ink might be jetted or flushed to outside of the flushing receiver.

(4) In view of the above-described situation, an object of the present disclosure is to provide a technique capable of performing the flushing of the ink from the recording head at an appropriate position.

(5) According to an aspect of the present disclosure, there is provided an image forming apparatus including: a motor, a movable body, a recording head, an ink receiving unit, a detection target, a

detector, an encoder, a position detecting section and a controller.
(6) The movable body is configured to be movable by the motor along a predetermined moving direction. The recording head is mounted on the movable body. The recording head is configured to jet ink onto a sheet while being moved together with the movable body so as to form an image on the sheet. The ink receiving unit is configured to receive the ink jetted from the recoding head at a time of executing a flushing and is fixed so as not to be moved together with a movement of the movable body. The detection target is directly or indirectly fixed to the ink receiving unit. The detector is mounted on the movable body. The detector is configured to detect the detection target. The encoder is configured to output a signal in accordance with a rotation amount of the motor or a moving amount of the movable body. The position detecting section is configured to detect a position of the movable body based on the signal from the encoder.
(7) The controller is configured to execute a moving processing, a position obtaining processing, a determining processing and a flushing processing. The moving processing is a processing of moving the movable body along a moving direction. The position obtaining processing is a processing of obtaining a position, of the movable body, from the position detecting section in a case that the detection target is detected by the detector during a period of time in which the movable body is being moved by the moving processing. The determining processing is a processing of determining a start timing of the flushing based on the position, of the movable body, obtained by the position obtaining processing. The flushing processing is a processing of starting the flushing in accordance with the start timing determined by the determining processing.
(8) In such an image forming apparatus, the actual position of the detection target which is directly or indirectly fixed to the ink receiving unit is obtained by the position obtaining processing. Further, the start timing of the flushing is determined based on the actual position which has been obtained. Accordingly, it is possible to start the flushing at an appropriate timing. Namely, it is possible to jet the ink appropriately to the ink receiving unit at the time of executing the flushing.

Description

(1) FIG. **1** is a block diagram depicting the configuration of an image forming system of an embodiment.
(2) FIG. **2** is a view for explaining the configuration of a carriage moving mechanism and the configuration of a sheet conveying mechanism.
(3) FIG. **3** is a view for explaining a problem which might occur during flushing.
(4) FIG. **4** is a view for explaining the overview of a procedure of correcting calculation (correcting arithmetic) of a flushing starting position.
(5) FIG. **5** is a flow chart of a print controlling processing.
(6) FIG. **6** is a view for explaining a first modification of the image forming system.
(7) FIG. **7** is a view for explaining a second modification of the image forming system.
(8) FIG. **8** is a view for explaining a third modification of the image forming system.
(9) In the following, an explanatory embodiment of the present disclosure will be explained with reference to the drawings.
1. EMBODIMENT
(10) (1) Configuration of Image Forming System
(11) An image forming system **1** depicted in FIG. **1** is configured as an ink-jet printer.
(12) The image forming system **1** is provided with a main controller **10**, a communication interface a print controller **20** and a conveyance controller **40**.
(13) The main controller **10** is provided with a CPU **11** and a memory **12**. The memory **12** is capable of storing a variety of kinds of programs, data, etc. The memory **12** is provided, for example, with a ROM and a RAM. The ROM stores a variety of kinds of programs. The CPU **11**

executes a processing in accordance with these programs. The RAM is used a work space in a case that the CPU **11** executes the processing. The memory **12** may further include a non-volatile storage medium of which storage content is electrically rewriteable (for example, NVRAM). The NVRAM stores data which is required to be stored (maintained) even at a time when the power source of the image forming system **1** is switched OFF. The NVRAM may store a program.
(14) The CPU **11** executes a processing in accordance with the program stored in the memory **12** to thereby control respective parts or components inside the image forming system **1** and to realize respective functions. In the following, a processing executed by the CPU **11** will be explained as a processing executed by the main controller **10**.
(15) The communication interface **15** is configured to be capable of performing data communication with an information processing apparatus **5** such as a personal computer, etc. The communication interface **15** may be capable of communicating with the information processing apparatus **5** in accordance, for example, with a communication system such as a USB communication, a Bluetooth communication (Bluetooth is a registered trade mark of Bluetooth SIG), a wired LAN or wireless LAN, etc.
(16) In a case that the main controller **10** obtains image data as an object of printing (printing object) from an external apparatus or device (for example, the image processing apparatus **5**) via the communication interface **15**, the main controller **15** inputs a variety of kinds of instructions to the print controller **20** and the conveyance controller **40** so that an image based on the image data is printed on a sheet (paper sheet, paper) Q (see FIG. **2**).
(17) The image forming system **1** is further provided with: a recording head **21**, an ink tank **22**, a head driving circuit **23**, a medium sensor **25**, a carriage moving mechanism **26**, a CR motor **31**, a first motor driving circuit **32**, a first encoder **33** and a first signal processing circuit **34**. The carriage moving mechanism **26** is provided with a carriage **30**, and causes the carriage to reciprocally move in a main scanning direction. The carriage **30** has the recording head **21** and the medium sensor **25** mounted thereon. In a case that the carriage **30** moves, the recording head **21** and the medium sensor **25** also move together with the carriage **30**. The recording head **21** jets an ink toward the sheet Q. The medium sensor **25** detects the sheet Q. In the present embodiment, the medium sensor **25** further detects a first detection target **56** and a second detection target **57** (see FIG. **2**, which will be described later on).
(18) The CR motor **31** is a driving source of the carriage **30**. The print controller **20** controls the CR motor **31** in accordance with an instruction from the main controller **10** to thereby control conveyance of the carriage **30** by the carriage moving mechanism **26**. The print controller **20** further controls a jetting operation of the ink by the recording head **21** in accordance with an instruction from the main controller **10**. By performing these controls, the print controller **20** forms the image on the sheet Q.
(19) The ink is filled in the ink tank **22**. The ink tank **22** in the present embodiment is not mounted on the carriage **30**; rather, the ink tank **22** is arranged at a predetermined position in the image forming system **1**. The recording head **21** is connected to the ink tank **22** via a tube (not depicted in the drawings). The ink is supplied from the ink tank **22** to the recording head **21** via the tube. The recording head **21** jets the ink supplied from the ink tank **22**.
(20) The head driving circuit **23** drives the recording head **21** in accordance with a control signal from the print controller **20**. The carriage moving mechanism **26** transmits a rotational force generated by the CR motor **31** to the carriage **30**. The carriage **30** is reciprocally moved along the main scanning direction by the CR motor **31** and the carriage moving mechanism **26**. The main scanning direction is orthogonal to a sub-scanning direction. The sub-scanning direction is the conveyance direction of the sheet Q by a sheet conveying mechanism **41** which will be described later on.
(21) The CR motor **31** is, for example, an aspect of a direct current motor. The first motor driving circuit **32** supplies a driving electricity, corresponding to an operation amount inputted from the

print controller **20**, to the CR motor **31**, thereby driving the CR motor **31**.

(22) The first motor driving circuit **32** may, for example, apply a voltage or an electric current corresponding to the operation amount to the CR motor **31** to thereby drive the CR motor **31**. Further, for example, the first motor driving circuit **32** may drive the CR motor **31** by a PWM (Pulse Width Modulation) control.

(23) The first encoder **33** outputs a signal corresponding to a displacement of the carriage **30** in the main scanning direction (hereinafter referred to as a "first encoder signal"). The first encoder **33** of the present embodiment is an aspect of a rotary encoder. The first signal processing circuit **34** detects a position Px and a velocity Vx in the main scanning direction of the carriage **30** based on the first encoder signal inputted from the first encoder **33**, as will be described later on. The position Px and the velocity Vx of the carriage **30** detected by the first signal processing circuit **34** are inputted to the print controller **20** and the main controller **10**. Note that the position Px of the carriage **30** may literally be a position of the carriage **30** itself, or a position indirectly indicating the position of the carriage **30** itself. Specifically, the position Px of the carriage **30** may be a position of a specific member mounted on the carriage **30** (for example, a nozzle from which the ink is jetted).

(24) The print controller **20** determines the operation amount with respect to the CR motor **31** based on the position Px and the velocity Vx of the carriage **30** inputted from the first signal processing circuit **34** and controls the CR motor **31**. With this, the print controller **20** realizes conveyance control of the carriage **30** in accordance with the instruction from the main controller **10**.

(25) The print controller **20** further inputs, to the head driving circuit **23**, a control signal for realizing jetting control of the ink in accordance with the instruction from the main controller based on the position Px of the carriage **30** inputted from the first signal processing circuit **34**. With this, an ink for forming the image as the print object is jetted from the recording head **21** onto the sheet Q.

(26) The image forming system **1** is further provided with a sheet conveying mechanism **41**, a PF motor **43**, a second motor driving circuit **44**, a second encoder **45** and a second signal processing circuit **46**. The conveyance controller **40** controls the PF motor **43** in accordance with the instruction from the main controller **10** to thereby control the conveyance of the sheet Q.

(27) As depicted in FIGS. **1** and **2**, the sheet conveying mechanism **41** is provided with a conveying roller **42**. The conveying roller **42** extends in the main scanning direction on the upstream side, in the sub-scanning direction, with respect to the recording head **21**. The conveying roller **42** rotates by receiving a rotational force from the PF motor **43** to thereby convey the sheet Q which is being conveyed from further upstream side toward a downstream side in the sub-scanning direction. The sheet Q is conveyed in the sub-scanning direction according to the operation of the recording head **21**, namely, while an image is being formed thereon by the recording head **21**.

(28) The PF motor **43** is, for example, an aspect of a direct current motor. The second motor driving current **44** applies the driving electric power in accordance with an operation amount inputted from the conveyance controller **40** to the PF motor **43** to thereby drive the PF motor **43**. The second encoder **45** in the present embodiment is an aspect of a rotary encoder. The second encoder **45** is arranged, for example, in a rotational shaft of the PF motor **43** or a rotation shaft of the conveying roller **42**. The second encoder **45** outputs a signal in accordance with the rotation of the rotational shaft in which the second encoder **45** is arranged (hereinafter referred to as a "second encoder signal").

(29) The second signal processing circuit **46** detects a rotational amount and a rotational velocity of the conveying roller **42** based on the second encoder signal inputted from the second encoder **45**. The rotational amount and the rotational velocity of the conveying roller **42** correspond to a conveying amount and a conveying velocity of the sheet Q conveyed by the rotation of the conveying roller **42**.

(30) The rotational amount and the rotational velocity detected by the second signal processing circuit **46** is inputted to the conveyance controller **40**. The conveyance controller **40** determines an operation amount with respect to the PF motor **43** based on the rotational amount and the rotational velocity inputted from the second signal processing circuit **46**, and controls the PF motor **43**. By doing so, the conveyance controller **40** controls the conveyance of the sheet Q by the conveying roller **42**.
(31) The specific configuration of the carriage moving mechanism **26** will be explained with reference to FIG. **2**. The carriage moving mechanism **26** is provided with the carriage **30**, a belt mechanism **27**, a first guide rail **28** and a second guide rail **29**. The belt mechanism **27** is provided with a driving puller **27***a*, a driven pulley **27***b* and a belt **27***c*. The driving pulley **27***a* and the driven pulley **27***b* are arranged along the main scanning direction. The belt **27***c* is wound around the driving pulley **27***a* and the driven pulley **27***b*.
(32) The carriage **30** is fixed to the belt **27***c*. In the belt mechanism **27**, the driving pulley **27***a* rotates by receiving a driving force from the CR motor **31**. Accompanying with and following the rotation of the driving pulley **27***a*, the belt **27***c* and the driven pulley **27***b* are rotated.
(33) The first and second guide rails **28** and **29** extend along the main scanning direction. The first and second guide rails **28** and **29** are arranged to be separated from each other in the sub-scanning direction. The belt mechanism **27** is arranged, for example, in the first guide rail **28**. A projected wall (not depicted in the drawings) which extends along the main scanning direction is formed in the first and second guide rails **28** and **29**. This wall regulates a moving direction in which the carriage **30** moves to the main scanning direction.
(34) The carriage **30** moves along the main scanning direction on the first and second guide rails **28** and **29** while being linked with the rotation of the belt **27***c*, and while the moving direction of the carriage **30** is regulated by the first and second guide rails **28** and **29**. The recording head **21** and the medium sensor **25** move integrally with the carriage **30** along the main scanning direction, in accompanying with the movement of the carriage **30**.
(35) As depicted in FIG. **2**, the image forming system **1** is further provided with a platen **50**. The platen **50** supports the sheet Q conveyed by the sheet conveying mechanism **41**. Namely, the sheet Q is conveyed on the platen **50**. A length in the main scanning direction of the platen **50** is longer than a length in the main scanning direction of the sheet Q.
(36) The platen **50** is formed and arranged so that a landing position of the ink on the sheet Q, in a case that the ink jetted from the recording head **21** lands on the sheet Q, is present on the platen **50**. In the present embodiment, the platen **50** extends, in the sub-scanning direction, from a back side of the first guide rail **28** up to a back side of the second guide rail **29**, as depicted in FIG. **2** as an example.
(37) The first encoder **33** is arranged on a detection target-rotary body. The detection target-rotary body may be any rotary body which is configured so that the rotation of the detection target-rotary body and the movement of the carriage **30** are synchronized or follow each other. Namely, the carriage **30** moves together with the rotation of the detection target-rotary body. The detection target-rotary body may be the CR motor **31** (specifically, a rotational shaft of the CR motor **31**), the driving pulley **27***a* or the driven pulley **27***b*. In the present embodiment, the detection target-rotary body is, for example, the CR motor **31**; as depicted in FIG. **2**, the first encoder **33** is provided on the CR motor **31**.
(38) The first encoder **33** is, more specifically, provided with a disc-shaped scale (not depicted in the drawings) and an optical sensor (not depicted in the drawings). The scale is fixed to the detection target-rotary body so that the center of the scale is arranged on the rotational shaft of the detection target-rotary body. Namely, the scale rotates integrally with the detection target-rotary body.
(39) The scale is provided with a slit array (not depicted in the drawings). The slit array includes a plurality of slits which are arranged in the entire circumference of the disc-shaped scale and at

equal intervals therebetween along the circumferential direction of the scale. The optical sensor is fixed and arranged in the inside of a casing of the image forming system **1** so that the optical sensor faces (is opposite to) the slit array. The optical sensor has a detection position at which the optical sensor detects presence or absence of a slit. Each of the plurality of slits passes the detection position in a case that the scale is rotated. The optical sensor outputs the first encoder signal in accordance with a displacement of the carriage **30** in the main scanning direction. The first encoder signal includes a pulse which is outputted every time a slit (each of the plurality of slits) passes the detection position of the optical sensor.
(40) The optical sensor of the present embodiment outputs a high level signal in a case that a slit (each of the plurality of slits) is passing the detection position, and outputs a low level signal in a case that the slit is not present in the detection position. With this, the first encoder signal which is a pulse signal in accordance with the occurrence of a phenomenon that the slit passes the optical sensor is outputted. The first encoder signal is an analog signal. The first encoder signal is inputted to the first signal processing circuit **34**.
(41) Note that the image forming system **1** may be provided with two optical sensors. In this case, the two optical sensors are referred to, respectively, as an A-phase sensor and a B-phase sensor. Further, a detection position of the A-phase sensor is referred to as an A-phase detection position and a detection position of the B-phase sensor is referred to as a B-phase detection position. Furthermore, the first encoder signal from the A-phase sensor is referred to as an A-phase encoder signal and the first encoder signal from the B-phase sensor is referred to as a B-phase encoder signal. The A-phase sensor and the B-phase sensor are arranged to be separated from each other along an arrangement direction of the plurality of slits (namely, along the circumferential direction of the scale). Namely, the A-phase detection position and the B-phase detection position are separated from each other along the circumferential direction of the scale. Accordingly, the phase of the A-phase signal and the phase of the B-phase signal are different from each other by $\pi/2$. The A-phase encoder signal and the B-phase encoder signal are inputted to the first signal processing circuit **34**. In the present embodiment, as an example, the explanation will be given provided that the first encoder **33** is provided with the A-phase sensor and the B-phase sensor.
(42) The first signal processing circuit **34** detects a pulse edge of each of the A-phase encoder signal and the B-phase encoder signal. The pulse edge includes a rising edge at which the low level is changed to the high level, and a falling edge at which the high level is changed to the low level.
(43) The first signal processing circuit **34** performs counting of the pulse edge every time the pulse edge of either one of the A-phase encoder signal and the B-phase encoder signal is detected. Specifically, every time the pulse edge of either one of the A-phase encoder signal and the B-phase encoder signal is detected, the first signal processing circuit **34** performs count-up (increments) or performs count-down (decrements) a count value of the pulse edge, in accordance with a signal level of the other of the A-phase encoder signal and the B-phase encoder signal at the time of the detection. For example, it is allowable that the count value is counted up every time the pulse edge is detected in a case that the carriage **30** is moving in the main scanning direction, and that the count value is counted down every time the pulse edge is detected in a case that the carriage **30** is moving in a direction opposite to the main scanning direction (hereinafter referred to as a “home direction”). The count value may be cleared to be an initial value (for example, 0 (zero)) in a case that a predetermined clear condition is established. The predetermined clear condition may include, for example, such a situation that the carriage **30** is moved to a home position, as will be described later on.
(44) The first signal processing circuit **34** detects the position Px of the carriage **30** (hereinafter referred to a “detection position Px”) based on the count value, and outputs the detection position Px to the print controller **20**. The first signal processing circuit **34** further detects the velocity Vx of the carriage **30** (hereinafter referred to as a “detection velocity Vx”), based on a time interval at which the pulse edge of the A-phase encoder signal is detected or a time interval at which the pulse

edge of the B-phase encoder signal is detected. The first signal processing circuit **34** outputs the detection velocity Vx which is detected to the print controller **20**.
(45) As depicted in FIG. **2**, the image forming system **1** is further provided with a flushing guide **55**, a support frame **58**, a first detection target **56** and a second detection target **57**. In the present embodiment, flushing is performed in some cases. The term "flushing" corresponds to an operation of jetting the ink to a predetermined area, in the recording head **21**, which is different from the sheet Q. One of the objects of the flushing is to discharge or exhaust a dried ink adhered to the nozzle from which the ink is jetted in the recording head **21**.
(46) In the present embodiment, the flushing guide **55** is arranged, for example, on the downstream side in the main scanning direction with respect to an area, in a conveyance path of the carriage **30**, in which the sheet Q is conveyed. More specifically, the flushing guide **55** of the present embodiment is arrange on the downstream side in the main scanning direction, in the conveyance path of the carriage **30**, with respect to the platen **50**. The support frame **58** is fixed, for example to a part of the casing in the image forming system. Alternatively, the support frame **58** itself may be the part of the casing. The support frame **58** fixes and supports the flushing guide **55**.
(47) The flushing guide **55** functions as a receptacle which receives the ink jetted from the recording head **21** at the time of the flushing. More specifically, an ink absorbing member **59** is provided on the flushing guide **55** of the present embodiment. The ink jetted at the time of the flushing lands (namely, adheres), more specifically, on (to) the ink absorbing member **59**. The ink absorbing member **59** may have any shape, size and/or material capable of absorbing or attracting the ink jetted at the time of the flushing. The ink absorbing member **59** may have, for example, a sponge-like material. The flushing guide **55** supports the ink absorbing member **59**. The flushing guide **55** further suppress occurrence of such a situation that the ink jetted at the time of the flushing and/or the ink absorbed by the ink absorbing member **59** leaks to the surrounding of the flushing guide **55**. In order to realize such a function, the flushing guide **55** may have, for example, a plate-like (dish-like) shape having a predetermined depth.
(48) In the image forming system **1** of the present embodiment, even in such a case that the ink jetted at the time of the flushing misses the ink absorbing member **59**, it is allowable that the missed ink is in the inside of the flushing guide **55**. Accordingly, in the present embodiment, a variety of kinds of correcting calculations is performed (to be described later on) such that the ink jetted at the time of the flushing does not miss the flushing guide **55**.
(49) Further, in the present embodiment, the entirety of the flushing guide **55** including the ink absorbing member **59** corresponds to a part of the ink receiving unit in the present disclosure. Note, however, that the ink receiving unit in the present disclosure may be realized by any aspect or form. For example, the ink absorbing member **59** may be detachably attachable with respect to the flushing guide **55**. Alternatively, the ink absorbing member **59** may be integrally provided on the flushing guide **55**. For example, a part of the flushing guide **55** may be configured to function as the ink absorbing member **59**. Alternatively, as will be explained later with reference to FIGS. **7** and **8**, the ink absorbing member **59** may be provided singly (namely, without accompanying with the flushing guide **55**). In such a case, the ink absorbing member **59** functions as an example of the ink receiving unit of the present disclosure.
(50) In the present embodiment, in a case that the flushing is performed, the carriage **30** is moved in the main scanning direction. Further, in a case that the carriage **30** reaches a predetermined flushing starting position, the flushing is started.
(51) The flushing may be performed in any way, and an ending timing of the flushing may be determined in any way. For example, the flushing may be performed until the carriage **30** moves from the flushing starting position in the main scanning direction by a predetermined distance, or the flushing may be performed, while making the carriage **30** to move from the flushing starting position in the main scanning direction, until a predetermined time elapses. Further, the jetting of the ink in the flushing may be performed continuously or intermittently. In the flushing of the

present embodiment, as an example, the ink is jetted from the recording head **21** in a predetermined cycle (hereinafter referred to as a "flushing cycle") while making the carriage **30** to move in the main scanning direction (for example, to move at a constant velocity), by a number of jetting times (hereinafter referred to as a "jetting number of times").

(52) The first and second detection targets **56** and **57** are provided, respectively, on both ends in the main scanning direction of the flushing guide **55**. Specifically, the first detection target **56** is provided on an end part on the upstream side in the main scanning direction in the flushing guide **55** and the second detection target **57** is provided on an end part on the downstream side in the main scanning direction in the flushing guide **55**. The first and second detection targets **56** and **57** are detected by the medium sensor **25**, as described above. The first and second detection targets **56** and **57** may be directly fixed to the flushing guide **55**, or may be indirectly fixed to the flushing guide **55**.

(53) The first and second detection targets **56** and **57** are provided to detect an actual position (specifically, positions of the both ends) in the main scanning direction of the flushing guide **55**. The first and second detection targets **56** and **57** are detected by the main controller **10** based on a detection signal (to be described later on) inputted from the medium sensor **25** to the main controller **10**.

(54) The medium sensor **25** is provided to face the platen **50**, at a lower surface of the carriage **30** (a surface facing the platen **50**). The medium sensor **25** detects an object to be detected (detection-object) such as the sheet Q, the first and second detection targets **56** and **57**, etc. The medium sensor **25** is provided with a light-emitting part (not depicted in the drawings) and a light-receiving part (not depicted in the drawings). The light-emitting part includes, for example, a light-emitting element such as a light-emitting diode, etc. The light-receiving part receives a light and outputs a detection signal indicating a light-receiving amount (of the received light).

(55) The main controller **10** outputs a light-emitting instruction to the light-emitting part during a period of time in which the detection object is to be detected. The light-emitting instruction includes a light-emitting amount. In a case that the light-emitting part receives the light-emitting instruction from the main controller **10**, the light-emitting part emits the light of an instructed light-emitting amount in a predetermined light-emitting direction. The light-emitting direction is, for example, a direction which is orthogonal or substantially orthogonal to the sheet Q on the platen **50** and is a direction toward the platen **50**.

(56) A light irradiated from the light-emitting part is reflected off on an object such as the platen **50**, the sheet Q supported by the platen **50**, etc., and a reflected light thereof is received by the light-receiving part. In the present embodiment, the irradiated light may be irradiated also onto the first and second detection targets **56** and **57** and may be reflected off by the first and second detection targets **56** and **57**.

(57) A light receiving amount by the light-receiving part is different depending on a distance from the light-emitting part to the detection-object and/or a physical property such as a shape, material, color, etc., of the detection-object, etc. The medium sensor **25** outputs, to the main controller **10**, the detection signal indicating the light-receiving amount of the light-receiving part. For example, the medium sensor **25** outputs, to the main controller **10**, such a detection signal that the voltage becomes higher as the light-receiving amount is greater.

(58) The main controller **10** detects the detection-object based on the detection signal inputted from the medium sensor **25**. The main controller **10** may detect the detection object (detection target) based on the detection signal in any method. For example, it is allowable that a range of the light-receiving amount is set with respect to each of detection-objects. Further, it is allowable that the main controller **10** distinguish a detection-object from another detection-object based on whether or not the light-receiving amount indicated by the detection-object is included in the range of the light-receiving amount of which detection-object among the detection-objects. Alternatively, it is also allowable, for example, that a range of a change amount of the light-receiving amount is set

with respect to each of the detection-objects. Further, for example, it is allowable that the main controller **10** detects a certain detection-object, among the detection-objects, in a case that there is a change in the light-receiving amount which is included in the range of the change amount of the light-receiving amount of the certain detection-object among the detection-objects.

(59) In a case that the sheet Q is being conveyed on the plate **50**, the main controller **10** detects presence and a width (namely, a length in the main scanning direction) of the sheet Q, based on the detection signal from the medium sensor **25**. Before executing the flushing, the main controller **10** further detects the first and second detection targets **56** and **57**, based on the detection signal from the medium sensor **25**.

(60) The main controller **10** detects a first end position and a second end position of the flushing guide **55**, based on a first detection position Px**1** which is the detection position Px in a case that the first detection target **56** is detected and a second detection position Px**2** which is the detection position Px in a case that the second detection target **57** is detected. The first end position corresponds to a position of the end part on the upstream end in the main scanning direction in the flushing guide **55**, and the second end position corresponds to a position of the end part on the downstream end in the main scanning direction in the flushing guide **55**. In the following, the first end position and the second end position which are detected based on the detection position Px are referred to, respectively, as a "first end detection position Pa" and a "second end detection position Pb".

(61) The first end detection position Pa and the second end detection position Pb may be detected in any way. For example, the first detection position Px**1** may be detected (namely handled), as it is, as the first end detection position Pa; and the second detection position Px**2** may be detected (namely handled), as it is, as the second end detection position Pb.

(62) In particular, in a case that the first detection target **56** is provided at a position same as or substantially same as the first end of the flushing guide **55**, the first detection position Px**1** may be detected, as it is, as the first end detection position Pa. Alternatively, also in a case that the first detection target **56** is configured such that the first detection position Px**1** and an actual first end detection position Pa are coincident or substantially coincident with each other, the first detection position Px**1** may be detected, as it is, as the first end detection position Pa. This is applicable similarly also to the second end detection position Pb; in a case that the second detection target **57** is provided at a position same as or substantially same as the second end of the flushing guide **55**, the second detection position Px**2** may be detected, as it is, as the second end detection position Pb. Alternatively, also in a case that the second detection target **57** is configured such that the second detection position Px**2** and an actual second end detection position Pb are coincident or substantially coincident with each other, the second detection position Px**2** may be detected, as it is, as the second end detection position Pb.

(63) Alternatively, it is also allowable that the first end detection position Pa and the second end detection position Pb are detected, considering that the detection object by the medium sensor **25** is not the both end themselves of the flushing guide **55**, but the first and second detection targets **56** and **57** provided, respectively, on the both ends of the flushing guide **55**. For example, a position obtained by shifting the first detection position Px**1** in the main scanning direction by a first predetermined distance is detected as the first end detection position Pa; and a position obtained by shifting the second detection position Px**2** in the home direction by a second predetermined distance is detected as the second end detection position Pb. The first predetermined distance may be determined based on a difference between the first detection position Px**1** and the actual first end detection position Pa. The second predetermined distance may be determined based on a difference between the second detection position Px**2** and the actual second end detection position Pb.

(64) In the following, the explanation will be given provided that the first detection position Px**1** and the second detection position Px**2** are, respectively, the first end detection position Pa and the second end detection position Pb, as they are, for the purpose of simplifying the explanation.

(65) As depicted in FIG. **2**, the image forming system **1** is further provided with a capping mechanism **60**. The capping mechanism **60** is arranged on the upstream side, in the main scanning direction in the conveyance path of the carriage **30**, with respect to the area in which the sheet Q is conveyed. More specifically, the capping mechanism **60** of the present embodiment is arranged on the upstream side, in the main scanning direction in the conveyance path of the carriage **30**, with respect to the platen **50**.
(66) The capping mechanism **60** is provided with a cap **61**, a lever **62**, a hole **63** and a driving mechanism (which is omitted in the drawings). The hole **63** is formed so as to penetrate a part of the second guide rail **29**. An end of the lever **62** projects upward from the hole **63**. The other end of the lever **29** is mechanically connected to the driving mechanism. The lever **62** is urged in the main scanning direction by an elastic body (not depicted in the drawings).
(67) In a case that the image formation on the sheet Q is ended, the carriage **30** is moved toward the capping mechanism **60** (namely, in the home direction). The carriage **30** which is being moved in the home direction makes contact with the lever **62** and moves the lever **62** in the home direction. With this, the driving mechanism lifts the cap **61** upward. Specifically, by the lever **62** moving in the home direction together with the carriage **30**, the cap **61** is gradually lifted upward. Then, in a case that the entirety of the recording head **21** reaches the predetermined home position on the cap **61**, the carriage **30** is stopped and the recording head **21** is subjected to capping (capped) by the cap **61**, namely, is closed by the cap **61**. Specifically, at least the nozzle from which the ink is jetted in the recording head **21** is capped. Note that the capping mechanism **60** may have any configuration such as a configuration capable of capping the recording head **21** by the cap **61** at the home position, etc.
(68) During a period of time in which the printing on the sheet Q is not required, the image forming system **1** basically causes the carriage **30** to stand by at the home position. Then, in a case that a timing at which the carriage **30** is to be moved from the home position in the main scanning direction, such as the image formation on the sheet Q, or other occasion, etc., arrives, the image forming system **1** causes the carriage **30** to move from the home position in the main scanning direction. In a case that the carriage **30** starts to move from the home position in the main scanning direction, the lever **62** also starts to move by an urging force in the main scanning direction, accompanying with the above-described movement of the carriage **30**. With this, the cap **61** is moved downward, thereby cancelling the capping of the recording head **21** by the cap **61**.
(69) (2) Correction of Flushing Parameter
(70) (2-1) Outline
(71) An explanation will be given about correction of a flushing parameter which is one of the most characteristic techniques in the present disclosure. The term “flushing parameter” is a general term for the above-described flushing starting position, the flushing cycle and the jetting number of times. In the present embodiment, in a case that the flushing is performed, a correcting calculation of correcting at least one piece of the flushing parameter is performed. Further, the flushing is performed based on a corrected flushing parameter corrected by the correcting calculation.
(72) (2-2) Object of Correcting Calculation
(73) Before explaining the specific content of the correcting calculation, an object of the correcting calculation will be briefly explained. In a case that a timing at which the flushing is to be executed arrives, the main controller **10** outputs a flushing instruction including the flushing parameter to the print controller **20**. In a case that the print controller **20** receives the flushing instruction from the main controller **10**, the print controller **20** executes the flushing based on the flushing parameter.
(74) Here, in the present embodiment, the rotary encoder is used as the first encoder **33**. Further, the carriage **30** is moved by the belt **27***c*. Accordingly, any variation in the pitch of the belt **27***c* and/or any variation in the intervals between the plurality of slits of the first encoder **33**, the detection position Px calculated based on the count value of the first encoder signal in the first signal processing circuit **34** and an actual position of the carriage **30** might be different.

(75) For example, in a case that the entire length of the belt **27***c* is longer than a theoretical value, a moving distance of the carriage **30** per one rotation of the CR motor **31** becomes shorter than a theoretical moving distance of the carriage **30**. In such a case, the actual position of the carriage **30** is consequently deviated to the upstream side in the moving direction of the carriage **30** with respect to the detection position Px. Accordingly, for example, it is presumed that, even in a case that the carriage **30** is moved until the detection position Px is coincident with the flushing starting position, the carriage **30** has not actually reached the flushing starting position. In a case that the flushing is started in such a state, there is such a possibility that the ink might be jetted at a location outside of the flushing guide **55** (specifically, on the upstream side with respect to the flushing guide **55**).

(76) Further, in a case for example that the number (quantity) of the plurality of slits of the first encoder **33** is smaller than a prescribed value and that the interval between the plurality of slits becomes to be greater than a prescribed interval, a moving distance, of the carriage **30**, per one count becomes to be longer than a theoretical moving distance. In such a case, the actual position of the carriage **30** is consequently deviated to the downstream side in the moving direction of the carriage **30** with respect to the detection position Px. Accordingly, for example, it is presumed that, in a case that the carriage **30** is moved until the detection position Px is coincident with the flushing starting position, the carriage **30** has actually advanced past (farther than) the flushing starting position. In a case that the flushing is started in such a state, there is such a possibility that the carriage **30** might pass the flushing guide **55** before the flushing is completed and that the ink might be jetted at a location outside of the flushing guide **55** (specifically, on the downstream side with respect to the flushing guide **55**).

(77) Such a deviation between the detection position Px and the actual position of the carriage **30** becomes to be greater as the movement of the carriage **30** advances further (namely, as the count value is increased further). Further, under a condition that the belt **27***c* and the first encoder **33** are theoretically produced (as in the designed values thereof, respectively), although any deviation between the detection position Px and the actual position of the carriage **30** does not occur, there is a possibility that the ink might be jetted at the location outside the flushing guide **55** by any other factor. For example, there is such a possibility that the flushing guide **55** is attached while being deviated from a designed regular (normal) position. Alternatively, there is also such a possibility that the size of the flushing guide **55** itself might be deviated from a designed size. Specifically, there is such a possibility that the size in the main scanning direction of the flushing guide **55** might be shorter than the design size. In such a case, there is such a possibility that the ink might be jetted at a location outside of the flushing guide **55** at the time of the flushing.

(78) A specific aspect in which there is a possibility that the ink might be jetted at the location outside the flushing guide **55** will be explained with reference to FIG. **3**. The memory **12** of the main controller **10** stores the above-described flushing parameter, namely, the flushing starting position, the flushing cycle and the jetting number of times. Among those as described above, the flushing starting position stored in the memory **12**, namely a design (theoretical) flushing starting position is hereinafter referred to as an “ideal FLS starting position Pst**0**) (see an upper part of FIG. **3**). The memory **12** further stores a design first end position and a design second end position of the flushing guide **55**. In the following explanation, the design first end position is referred to as a “first end ideal position Pa**0**” (see the upper part of FIG. **3**) and the design second end position is referred to as a “second end ideal position Pb**0**” (see the upper part of FIG. **3**). Note that a size in the main scanning direction of the flushing guide **55** is Lg**0** in design as indicated, as an example, in the upper part of FIG. **3**. Further, in design, at the time of the flushing, the ink is jetted in a predetermined design landing range **55***a* with the ideal FLS starting position Pst**0** as the starting position. Note that this design landing range **55***a* may be coincident with a range in which the ink absorbing member **59** is present, or may be partially shifted from the range in which the ink absorbing member **59** is present.

(79) In view of this, in the actual image forming system **1**, it is presumed that the length of the belt **27***c* or the interval between the plurality of slits of the first encoder **33** is different from the design value. For example, it is presumed that the actual position is advanced with respect to the detection position Px. Further, as depicted in a lower part of FIG. **3** as an example, an actual attachment position of the flushing guide **55** is deviated in the home position with respect to the design attachment position and that the actual size Lg of the flushing guide **55** becomes shorter than the design size Lg**0** of the flushing guide **55**.
(80) In this case, as depicted in the lower part of FIG. **3** as an example, in a case that the detection position Px, of the carriage **30**, recognized by the main controller **10** reaches the ideal FLS starting position Pst**0**, there is such a possibility that the actual position of the carriage **30** is advanced further than the ideal FLS starting position Pst**0**. Accordingly, the starting position of the flushing is deviated toward the downstream side in the main scanning direction than the design position. Further, as described above, the actual size Lg of the flushing guide **55** is shorter than the design size Lg**0**. Due to this, the actual landing range **55***b* at the time of the flushing extends from the flushing guide **55**, as depicted in the lower part of FIG. **3** as an example.
(81) Moreover, in the present embodiment, the print controller **20** controls the movement of the carriage **30** by, for example, a velocity feedback control. The velocity feedback control is a control method in which the detection velocity Vx is periodically obtained and an electrified amount to the CR motor **31** is controlled such that the detection velocity Vx coincides with a velocity profile instructed by the main controller **10**. The detection velocity Vx used in the velocity feedback control is detected based on the count value of the first encoder signal, as described above.
(82) Accordingly, such a case might occur that the detection velocity Vx and the actual velocity do not coincide with each other due to the variation in the interval between the plurality of slits of the first encoder **33**, etc. In the present embodiment, in view of the above situation, the flushing cycle and the jetting number of times in one time of the flushing are instructed by the main controller **10**. Thus, in a case for example that the actual velocity is faster than the detection velocity Vx, the carriage **30** passes the flushing guide **55** before the jetting of the ink of the jetting number of times is finished, which in turn might lead to such a possibility that the ink is jetted to the location outside the flushing guide **55** (specifically, on the downstream side with respect to the flushing guide **55**).
(83) In view of the above situation, in the present embodiment, the flushing parameter is corrected by the above-described correcting calculation, before the flushing is executed.
(84) (2-3) Specific Content of Correcting Calculation
(85) The specific content of the correcting calculation will be explained, with reference to FIG. **4**. Also in FIG. **4**, it is presumed, completely same as in FIG. **3**, that the actual attachment position and the actual size of the flushing guide **55** are deviated (vary) from the design position and the design size of the flushing guide **55**, and that the actual position of the carriage **30** is advanced with respect to the detection position Px.
(86) Prior to the correcting calculation, the main controller **10** first detects the both ends of the flushing guide **55**. Specifically, at a time of executing a pre-scan (to be described later on), the main controller **10** moves the carriage **30** from the home position in the main scanning direction. Then, the main controller **10** obtains (detects) the first end detection position Pa in accordance with the detection of the first end of the flushing guide **55** by the medium sensor **25**. Further, the main controller **10** obtains the second end detection position Pb in accordance with the detection of the second end of the flushing guide **55** by the medium sensor **25**.
(87) A middle part of FIG. **4** depicts an example of each of the first end detection position Pa and the second end detection position Pb which are obtained. Namely, in this example, the first end detection position Pa recognized by the main controller **10** in a case that the first end is detected is deviated in the home position with respect to the actual position of the first end. Similarly, the second end detection position Pb recognized by the main controller **10** in a case that the second end

is detected is deviated in the home position with respect to the actual position of the second end. Further, an amount of deviation (deviation amount) is greater than a deviation amount between the actual position of the first end and the first end detection position Pa.
(88) Furthermore, in the example of FIG. **4**, the first end detection position Pa is deviated from the first end ideal position Pa**0** in the home position by Δa, and the second end detection position Pb is deviated from the second end ideal position Pb**0** in the home position by Δb.
(89) The main controller **10** uses the first end detection position Pa and the second end detection position Pb which are obtained, the first end ideal position Pa**0** and the second end ideal position Pb**0**, and the ideal FLS starting position Pst**0** so as to calculate a correction amount ΔP.
(90) The correction amount ΔP indicates a difference between the ideal FLS starting position and an actual FLS starting position Pst as the detection position Px at which the flushing is actually to be started, as depicted in the lower part of FIG. **4**. Namely, by correcting the ideal FLS starting position Pst**0** by the correction amount ΔP, the actual FLS starting position Pst is calculated.
(91) In the present embodiment, as indicated by a formula (1) as follows, deduction of correction amount ΔP is made with respect to the ideal FLS starting position Pst**0** (namely, the ideal FLS starting position is shifted in the home direction), thereby calculating the actual FLS starting position Pst. Further, the correction amount ΔP is expressed by a formula (2) indicated below, as depicted in the lower part of FIG. **4**.
(92) [Formulas]
(93) $\mathrm{Pst} = \mathrm{Pst0} - \Delta P$ (1) $\Delta P = \frac{\Delta b - \Delta a}{\mathrm{Pb} - \mathrm{Pa}}$ .Math. $(\mathrm{Pst} - \alpha) + \beta$ (2) note that Δa=Pa**0**−Pa, Δb=Pb**0**−Pb α=Pa, β=Δa or α=Pb, β=Δb Pst: Actual FLS starting position Pst**0**: Ideal FLS starting position Pa: First end detection position Pb: Second end detection position Pa**0**: First end ideal position Pb**0**: Second end ideal position
(94) As appreciated from Formula (2) indicated above, there are two kinds of combination of α and β. The correction value ΔP may be expressed by using either one of these two combinations. The lower part of FIG. **4** depicts, as an example, a correction value ΔP in a case that α=Pa and β=Δa.
(95) A flushing parameter which is to be ultimately obtained by using the above-described formula (2) is, actually, the actual FLS starting position Pst. In either one of the formulas (1) and (2), a term including the actual FLS starting position Pst is present. Accordingly, the main controller **10** calculates, actually, the actual FLS starting position Pst by using an arithmetic formula of the actual FLS starting position Pst which is obtained, for example, by synthesizing the formulas (1) and (2). In this arithmetic formula, the left side thereof is Pst, and Pst is not present in the right side thereof.
(96) After the main controller **10** calculates the actual FLS starting position Pst in such a manner, the main controller **10** actually executes the flushing. Namely, the main controller **10** causes the carriage **30** to move from the home position in the main scanning direction, and starts the flushing in response to that the detection position Px coincides with the actual FLS starting position Pst. With this, as depicted in the lower part of FIG. **4** as an example, even in a case that the actual attachment position and/or the actual size of the flushing guide **55** are (is) different from the ideal attachment position and/or the ideal size, it is possible to start the flushing from an appropriate position in the flushing guide **55** and to suppress the occurrence of such a situation that the ink is jetted to a location outside of the flushing guide **55**.
(97) Here, the flushing parameter which is to be corrected is not limited to or restricted by the flushing starting position. It is allowable to correct the flushing cycle and/or the jetting number of times, in addition to or instead of the flushing starting position. For example, in the examples depicted in FIGS. **3** and **4**, an actual velocity is faster than the detection velocity Vx detected based on the count value.
(98) In this case, accordingly, it is allowable for example to shorten the flushing cycle and/or to lower the jetting number of times. More specifically, it is allowable for example to correct the flushing cycle such that as the difference between a and R is greater, the flushing cycle becomes

shorter. Alternatively, for example, it is allowable to correct the jetting number of times such that as the difference between a and R is greater, the jetting number of times becomes smaller. The reason for performing the correction in such a manner is that it is expected that as the difference between a and R is greater, the actual velocity is faster than the detection velocity Vx.

(99) Note that contrary to the above-described situation, the possibility that the actual position of the carriage **30** might pass the flushing guide **55** during the execution of the flushing is low in a case that the actual velocity of the carriage **30** is slower than the detection velocity Vx detected based on the count value. Accordingly, in this case, it is allowable that the flushing cycle and the jetting number of times are not corrected. Note, however, that in this case also, it is allowable to correct the flushing cycle and/or the jetting number of times. For example, it is allowable to make the flushing cycle to be long and/or to increase the jetting number of times.

(100) (3) Print Controlling Processing

(101) A print controlling processing executed by the main controller **10** will be explained, with reference to FIG. **5**. In a case that a such a timing at which the image is to be formed on the sheet Q arrives and which is, for example, such a timing that a print instruction is received from the information processing apparatus **5**, the main controller **10** reads and then executes a program of the print controlling processing from the memory **12**.

(102) In a case that the main controller **10** starts the print controlling processing, the main controller **10** starts a pre-scan processing in step S**110**. The pre-scan processing is performed for a specified object which is different from the image formation. The specified object may include not less than one object including, for example: determining presence or absence of the sheet Q on the platen **50**, determining the width (length in the main scanning direction) of the sheet Q on the platen **50**, determining as to whether or not there is provided a state that the carriage **30** can be appropriately moved in a reciprocal manner along the main scanning direction, determining as to whether or not the state of the first encoder **31** (for example, a state of the slit array in the scale) is normal, etc.

(103) In the pre-scan processing, the main controller **10** instructs the print controller **20** so as to cause the carriage **30** to make a reciprocal movement one time from the home position in the main scanning direction. Further, during the one reciprocal movement, the main controller detects the detection object based on the detection signal from the medium sensor **25** and/or monitors the position and/or the velocity during the movement to thereby collect information necessary for the specified object. Furthermore, the main controller **10** performs a variety of kinds of processings for the specified object, based on the collected information.

(104) Moreover, in the present embodiment, the main controller **10** obtains the first end detection position Pa and the second end detection position Pb of the flushing guide **55** based on the detection signal from the medium sensor **25**, during the movement of the carriage **30** in the main scanning direction for the pre-scan processing.

(105) Namely, the main controller **10** determines, in step S**120**, as to whether or not the first end of the flushing guide **55** is detected by the medium sensor **25**. The main controller **10** repeats the determining processing of step S**120** until the first end is detected. In a case that the first end is detected, the main controller **10** obtains the first end detection position Pa in step S**130**.

(106) Next, in step S**140**, the main controller **10** determines as to whether or not the second end of the flushing guide **55** is detected by the medium sensor **25**. The main controller **10** repeats the determining processing of step S**140** until the second end is detected. In a case that the second end is detected, the main controller **10** obtains the second end detection position Pb in step S**150**.

(107) In step S**160**, the main controller **10** executes a correcting processing. Specifically, the main controller **10** corrects the flushing parameter by using the first end detection position Pa and the second end detection position Pb which have been obtained. In the present embodiment, the main controller **10** performs at least the correction of the flushing starting position. Specifically, the man controller **10** calculates the actual FLS starting position Pst, based on the formulas (1) and (2) as

described above.
(108) It is allowable that the main controller **10** further performs correction of the flushing cycle and/or the jetting number of times in step S**160**. Further, as described above, it is allowable that in the correcting processing, the main controller **10** performs corrections of the flushing cycle and/or the jetting number of times, rather than performing the correction of the flushing starting position (namely, the calculation of the actual FLS starting position Pst).
(109) After ending the correcting processing, the main control **10** executes the flushing processing in step S**170**. Note that although the details of the pre-scan processing is omitted in FIG. **5**, the pre-scan processing is basically completed before the execution of the processing of step S**170**. In a case that the main controller **10** causes the carriage **30** to make one reciprocal movement for the pre-scan processing, the main controller **10** returns the carriage **30** again to the home position, via the instruction to the print controller **20**.
(110) In step S**170**, the main controller **10** causes the carriage **30** to make one-way movement from the home position in the main scanning direction, by the instruction to the print controller **20**. Further, in a case that the carriage **30** reaches the actual FLS starting position Pst (namely, in a case that the detection position Px coincides with the actual FLS starting position Pst), the main controller **10** starts the flushing. Namely, by giving the instruction to the print controller **20**, the main controller **10** causes the recording head **21** to jet the ink therefrom in the flushing cycle and by the jetting number of times, while causing the carriage **30** to move in the main scanning direction (for example, to move at the constant velocity) from the actual FLS starting position Pst.
(111) After the ending of the flushing, the main controller **10** causes the carriage **30** to stop once. Then, in step S**180**, the main controller **10** executes a printing processing. Namely, the main controller **10** instructs the print controller **20** and the conveyance controller **40** so as to form, on the sheet Q, an image based on the image data. With this, an image as the object of printing is formed on the sheet Q while the sheet Q is being conveyed in the sub-scanning direction and the carriage is reciprocally being moved in the main scanning direction.
(112) (4) Effect of Embodiment and Corresponding Relationship Among Terms
(113) In the image forming system **1** of the present embodiment as explained above, the actual positions of the first and second detection targets **56** and **57** which are fixed to the flushing guide **55** are obtained, and the first end detection position Pa and the second end detection position Pb are obtained based on the actual positions of the first and second detection targets **56** and **57**. Further, the actual FLS starting position Pst is determined based on the first end detection position Pa and the second end detection position Pb which have been obtained. Accordingly, it is possible to start the flushing at an appropriate position in accordance with the actual position of the flushing guide **55**. Namely, it is possible to jet the ink appropriately to the flushing guide **55** at the time of executing the flushing.
(114) Further, in the present embodiment, the ideal FLS staring position Pst**0** is corrected and calculated, thereby calculating the actual FLS starting position Pst. Specifically, the actual FLS starting position Pst is calculated based on the formulas (1) and (2) as described above. Accordingly, it is possible to calculate the actual FLS starting position Pst by a simple linear arithmetic.
(115) Furthermore, in the present embodiment, the first end detection position Pa and the second end detection position Pb used to calculate the actual FLS starting position Pst are obtained in a case that the carriage **30** is moved in the pre-scan processing. Namely, the carriage **30** is not moved separately from the pre-scan so as to obtain the first end detection position Pa and the second end detection position Pb. Accordingly, it is possible to efficiently obtain the first end detection position Pa and the second end detection position Pb.
(116) Moreover, in the present embodiment, the flushing cycle and/or the jetting number of times may be corrected in addition to or instead of calculating the actual FLS starting position Pst. For example, by further correcting the flushing cycle and/or the jetting number of times in addition to

calculating the actual FLS starting position Pst, it is possible to cause the ink to be jetted to the inside of the flushing guide **55** in a more ensured manner at the time of the flushing.

(117) Here, the corresponding relationship among the terms will be clarified. In the present embodiment, the image forming system **1** corresponds to an example of an “image forming apparatus” in the present disclosure. The CR motor **31** corresponds to an example of a “motor” in the present disclosure. The carriage **30** corresponds to an example of a “movable body” in the present disclosure. The support frame **58** corresponds to an example of a “supporting part” in the present disclosure. Each of the first and second detection targets **56** and **57** corresponds to an example of a “detection target” in the present disclosure. The medium sensor **25** corresponds to an example of a “detector” in the present disclosure. The first encoder **33** corresponds to an example of an “encoder” in the present disclosure. The first signal processing circuit **34** corresponds to an example of a “position detecting section” in the present disclosure. The main controller **10** corresponds to an example of a “controller” in the present disclosure. The first end detection position Pa corresponds to an example of a “first detection position” in the present disclosure. The second end detection position Pb corresponds to an example of a “second detection position” in the present disclosure. Each of the “Δa” and “Δb” in the formula (2) corresponds to an example of a “positional deviation” in the present disclosure. More specifically, the “Δa” corresponds to an example of a “first positional deviation” in the present disclosure, and the “Δb” corresponds to an example of a “second positional deviation” in the present disclosure. The ideal FLS starting position Pst**0** corresponds to an example of a “theoretic starting position” in the present disclosure. The sheet Q corresponds to an example of a “sheet” in the present disclosure. The flushing cycle corresponds to an example of a “predetermined cycle” in the present disclosure. The jetting number of times corresponds to an example of a “predetermined number of times” in the present disclosure.

(118) The processing of step S**110** corresponds to an example of a “pre-processing” in the present disclosure. Causing the carriage **30** to move in step S**110** corresponds to an example of a “moving processing” (in particular, a “first moving processing”) in the present disclosure. Each of the processings of step S**130** and step S**150** corresponds to an example of a “position obtaining processing” in the present disclosure. The processing of step S**160** corresponds to an example of a “determining processing” in the present disclosure. The processing of step S**170** corresponds to an example of a “flushing processing” in the present disclosure. Further, causing the carriage **30** to move in the processing of step S**170** corresponds to an example of a “second moving processing” in the present disclosure.

2. OTHER EMBODIMENTS

(119) In the foregoing, the embodiment of the present disclosure has been explained. It is allowable, however, that the present disclosure is not limited to or restricted by the above-described embodiment, and the present disclosure may be modified in a variety of kinds of way. (1) In the above-described embodiment, the first detection target **56** is fixed to be adjacent to the outer side of the first end of the flushing guide **55**, and the second detection target **57** is fixed to be adjacent to the outer side of the second end of the flushing guide **55**. It is allowable, however, that the first and second detection targets **56** and **57** are arranged to the flushing guide **55** in any way, or are fixed to any positions, respectively.

(120) For example, it is allowable that the first and second detection targets **56** and **57** are fixed to an inner wall of the flushing guide **55** having the dish (plate)-like shape. Specifically, the first detection target **56** may be, for example, fixed to an inner surface of a side wall corresponding to the first end of the flushing guide **55**, namely to a surface facing a space in which the ink is jetted. Similarly, the second detection target **57** may be, for example, fixed to an inner surface of a side wall corresponding to the second end of the flushing guide **55**.

(121) Alternatively, it is allowable, for example, that the first detection target **56** is fixed to an upper surface of the first end of the flushing guide **55**, and that the second detection target **57** is fixed to an upper surface of the second end of the flushing guide **55**. Namely, it is allowable to

provide such a state that the flushing guide **55** and each of the first and second detection targets **56** and **57** are stacked in the up-down direction.

(122) Still alternatively, it is allowable that each of the first and second detection targets **56** and **57** is fixed to the flushing guide **55** in a state that each of the first and second detection targets **56** and **57** is separated from the flushing guide **55** along the main scanning direction, as depicted in FIG. **6**. In an image forming system **100** depicted in FIG. **6**, first and second detection targets **56** and **57** are fixed to a support frame **58**. Further, each of the first and second detection targets **56** and **57** is arranged to be separated from the flushing guide **55** along the main scanning direction. In such an image forming system **100**, the main controller **10** is capable of calculating the actual FLS starting position Pst by performing the above-described correcting calculation while considering a distance between the first detection target **56** and the first end of the flushing guide **55** and a distance between the second detection target **57** and the second end of the flushing guide **55**, similarly to the above-described embodiment. For example, the main controller **10** is capable of obtaining, as the first end detection position Pa, a position which is advanced in the main scanning direction from the detection position Px in a case that the first detection target **56** is detected, by the distance between the first detection target **56** and the first end. Further, the main controller **10** is capable of obtaining, as the second end detection position Pb, a position which is returned in the home direction from the detection position Px in a case that the second detection target **57** is detected, by the distance between the second detection target **57** and the second end. (2) It is allowable that the flushing guide **55** and the first and second detection targets **56** and **57** are provided, respectively, on locations which are different from those in the above-described embodiment. Further, it is also allowable that the ink absorbing member **59** is arranged together with the first and second detection targets **56** and **57**, without having the flushing guide **55** accompanying therewith, as described above. For example, as depicted in FIG. **7** as an example, the ink absorbing member **59** and the first and second detection targets **56** and **57** are provided on the platen **50**. In an image forming system **110** depicted in FIG. **7** as an example, the ink absorbing member **59** and the first and second detection targets **56** and **57** are provided on the downstream side in the main scanning direction with respect to an area, on the platen **50**, in which the sheet Q is conveyed. Also in the image forming system **110**, it is possible to correct the flushing parameter by a same method as that is the above-described embodiment, by replacing, with the ink absorbing member **59**, the flushing guide **55** of the correcting method of the flushing parameter in the above-described embodiment. Specifically, an end on the side of the home direction in the ink absorbing member **59** is considered as the first end of the flushing guide **55** in the correcting method of the above-described embodiment, and an end on the side of the main scanning direction in the ink absorbing member **59** is considered as the second end of the flushing guide **55** in the correcting method of the above-described embodiment, thereby making it possible to correct the flushing parameter by the correcting method of the above-described embodiment. Note that in the image forming system **110**, the ink absorbing member **59** corresponds to an example of the “ink receiving unit” in the present disclosure.

(123) In the image forming system **110** of FIG. **7**, the ink absorbing member **59** and the first and second detection targets **56** and **57** may be fixed to the platen **50** in any way, and may be fixed, respectively, to any positions in the platen **50**. For example, the ink absorbing member **59** may be directly fixed to a part of a surface of the platen **50**.

(124) Alternatively, for example, the flushing guide **55** and the first and second detection targets **56** and **57** may be provided at a location on the home direction side with respect to the area in which the sheet Q is conveyed. Still alternatively, the ink absorbing member **59** may be provided, together with the first and second detection targets **56** and **57**, on the side of the home direction with respect to the area in which the sheet Q is conveyed, without having the flushing guide **55** accompanying therewith. Specifically, as depicted in FIG. **8** as an example, the ink absorbing member **59** and the first and second detection targets **56** and **57** may be provided, respectively, on predetermined

locations in the capping mechanism **60**.

(125) In an image forming system **120** as depicted in FIG. **8** as an example, the ink absorbing member **59** and the first and second detection targets **56** and **57** are provided on an upper surfaced of the cap **61**. Note that each of the ink absorbing member **59** and the first and second detection targets **56** and **57** may be fixed in any location and in any way, in the capping mechanism **60**. The first and second detection targets **56** and **57** may be adjacent to the ink absorbing member **59**, or the first and second detection targets **56** and **57** may be fixed to the cap **61** in a state that the first and second detection targets **56** and **57** are separated from the ink absorbing member **59** along the main scanning direction. Also in the image forming system **120**, it is possible to correct the flushing parameter by a same method as that is the above-described embodiment, by replacing, with the ink absorbing member **59**, the flushing guide **55** of the correcting method of the flushing parameter in the above-described embodiment. Specifically, an end on the side of the main scanning direction in the ink absorbing member **59** is considered as the first end of the flushing guide **55** in the correcting method of the above-described embodiment, and an end on the side of the home direction in the ink absorbing member **59** is considered as the second end of the flushing guide **55** in the correcting method of the above-described embodiment, thereby making it possible to correct the flushing parameter by the correcting method of the above-described embodiment. Note that in the image forming system **120**, the ink absorbing member **59** corresponds to an example of the “ink receiving unit” in the present disclosure.

(126) In the image forming system **120** depicted in FIG. **8** as an example, it is allowable, for example, that the first end detection position Pa and the second end detection position Pb are obtained at a time of ending of the reciprocal movement of the carriage **30** in the pre-scan, namely, at a time that the carriage **30** which has been moved from the home position in the main scanning direction returns again to the home position. (3) It is allowable that the recording head **21** is provided with a nozzle of which number (quantity) is arbitrary. In a case that the recording head **21** is provided with a plurality of nozzles, the plurality of nozzles may be arranged to be separated from each other along the main scanning direction. In this case, the main controller **10** may detect the detection position Px of the nozzle for each of the plurality of nozzles. Further, the main controller **10** may start the flushing, individually with respect to each of the plurality of nozzles, in a case that the detection position Px corresponding to each of the plurality of nozzles reaches the actual FLS starting position Pst.

(127) Further, in a case that the recording head **21** is provided with the plurality of nozzles, it is allowable to set not less than two mutually different kinds of actual FLS starting positions Pst. Further, it is allowable to make at least one nozzle, among the plurality of nozzles, to correspond to each of the not less than two kinds of actual FLS starting positions Pst. (4) In the above-described embodiment, although the main controller **10** calculates the actual FLS starting position Pst based on the first end detection position Pa and the second end detection position Pb, the main controller **10** may calculate the actual FLS starting position Pst by using either one of the first end detection position Pa and the second end detection position Pb (namely, without using the other of the first end detection position Pa and the second end detection position Pb). Namely, it is allowable that either one of the first and second detection targets **56** and **57** is not provided.

(128) For example, it is allowable that the second detection target **57** is not provided. In such a case, the main controller **10** may calculate the actual FLS starting position Pst by using the first end detection position Pa. For example, the main controller **10** may calculate, as the corrected value ΔP, the Δa as it is, or a value obtained by multiplying Δa with a predetermined coefficient. Further, the main controller **10** may determine a position which is located on the side in the home position, with respect to the ideal FLS starting position Pst**0**, by a distance corresponding to ΔP, to be the actual FLS starting position Pst.

(129) Further, it is allowable that the first detection target **56** is not provided. In such a case, the main controller **10** may use the second end detection position Pb so as to calculate the actual FLS

starting position Pst. For example, the main controller **10** may calculate, as the corrected value ΔP, the Δb as it is, or a value obtained by multiplying Δb with a predetermined coefficient. Further, the main controller **10** may determine a position which is located on the side in the home position, with respect to the ideal FLS starting position Pst**0**, by a distance corresponding to ΔP, to be the actual FLS starting position Pst.

(130) Furthermore, in a case that the actual FLS starting position Pst is calculated by using the first end detection position Pa, but without using the second end detection position Pb, it is allowable to execute a series of the processings from step S**120** to S**170** while the carriage **30** is being subjected to the one-way movement in the main scanning direction. Namely, in a case that the first end detection position Pa is obtained while the carriage **30** is being moved one way, the actual FLS starting position Pst is calculated based on the first end detection position Pa, while continuing the one-way movement of the carriage **30** (while allowing the carriage **30** to continuously move one way). Moreover, it is allowable to start the flushing in a case that the detection position Px reaches the actual FLS starting position Pst by the one-way movement of the carriage **30** which is being continued. Namely, for example, it is allowable to complete the calculation of the actual FLS starting position Pst and the flushing processing based on the calculated actual FLS starting position Pst, in a process that the carriage **30** moves in a forwarding direction (main scanning direction) in the reciprocal movement of the carriage **30** in the pre-scan. (5) In the above-described embodiment, the example in which the flushing starting position is corrected, as a specific method of correcting the start timing of the flushing, is indicated. It is allowable, however, to correct the start timing of the flushing by a method different from the method of correcting the flushing starting position.

(131) For example, in response to such a situation that the detection position Px of the carriage **30** reaches the ideal FLS start position Pst**0**, it is allowable to start the flushing (namely to start the jetting of the ink) after elapse of a prescribed time since a timing at which the detection position Px reaches the ideal FLS starting position Pst**0**. Then, the prescribed time may be corrected. The prescribed time may be set at any time which is not less than 0 (zero). The main controller **10** may be configured such that, for example, in a case that the actual position of the carriage **30** is advanced with respect to the detection position Px, the main controller **10** makes the prescribed time to be short, thereby starting the flushing at a timing which is faster after the detection position Px reaches the ideal FLS starting position Pst**0**. Conversely, the main controller **10** may be configured such that, for example, in a case that the actual position of the carriage **30** is deviated to the upstream side in the moving direction of the carriage **30** with respect to the detection position Px, the main controller **10** makes the prescribed time to be long, thereby starting the flushing at a timing which is later after the detection position Px reaches the ideal FLS starting position Pst**0**. (6) The technique of the present disclosure is also applicable to an image forming system in which a linear encoder is used as the first encoder **33**. Further, the technique of the present disclosure is also applicable to an image forming system in which a sensor which is different from both of the rotary encoder and the linear encoder is used as a sensor configured to detect the position of the carriage **30**. (7) In the above-described embodiment, although the correcting calculation (specifically, steps S**120** to S**160** of FIG. **5**) is performed by the main controller **10**, the correcting calculation may be performed at any location or part (component). It is allowable that a part or all of the correcting calculation is performed at a location or part (component) which is different from the main controller **10** (for example, in the print controller **20**). (8) It is allowable that a function possessed by one constituent component in the above-described embodiment is provided in a dividing manner in a plurality of constituent components. It is allowable that a function possessed by a plurality of constituent components is integrated in one constituent component. Further, it is also allowable that a part of the configuration of the above-described embodiment may be omitted. Furthermore, it is also allowable that at least a part of the configuration of the above-described embodiment is added to or replaced with respect to that of the configuration of the another embodiment as described

above. The embodiments of the present disclosure include various embodiments or aspects that are included in the technical ideas specified by the wordings of the following claims.

Claims

1. An image forming apparatus comprising: a motor; a movable body configured to be moved by the motor along a moving direction; a recording head mounted on the movable body and configured to jet ink onto a sheet while being moved together with the movable body to form an image on the sheet; an ink receiving unit configured to receive the ink jetted from the recoding head at a time of executing a flushing and fixed so as not to be moved together with a movement of the movable body; a detection target fixed directly or indirectly to the ink receiving unit; a detector mounted on the movable body and configured to detect the detection target; an encoder configured to output a signal in accordance with a rotation amount of the motor or a moving amount of the movable body; a position detecting section configured to detect a position of the movable body based on the signal outputted from the encoder; and a controller, wherein the controller is configured to execute: a moving processing for moving the movable body along the moving direction; a position obtaining processing for obtaining a position, of the movable body, from the position detecting section in a case that the detection target is detected by the detector during the movement of the movable body in the moving processing; a determining processing for determining a start timing of the flushing based on the position, of the movable body, obtained in the position obtaining processing; and a flushing processing for starting the flushing in accordance with the start timing determined in the determining processing.
2. The image forming apparatus according to claim 1, wherein in the determining processing, the controller is configured to determine, as the start timing, a flushing starting position which is a position, of the movable body, in a case that the flushing is started, and in the flushing processing, the controller is configured to start the flushing at the flushing starting position determined in the determining processing.
3. The image forming apparatus according to claim 2, wherein in the determining processing, the controller is configured to determine the flushing starting position based on a positional deviation as a difference between a position, of the movable body, obtained in the position obtaining processing and a design position, of the movable body, at which the detection target is to be detected by the detector.
4. The image forming apparatus according to claim 3, wherein in the determining processing, the controller is configured to determine the flushing starting position by correcting, based on the positional deviation, a theoretical starting position which is a design position of the movable body, which is previously determined and at which the flushing is to be started.
5. The image forming apparatus according to claim 3, wherein the moving processing includes: a first moving processing for moving the movable body in the moving direction so that the detection target is detected by the detector, and then moving the movable body in an opposite direction opposite to the moving direction toward an upstream, in the moving direction, with respect to the ink receiving unit; and a second moving processing for moving the movable body in the moving direction after executing the first moving processing so that the recording head passes the ink receiving unit, in the position obtaining processing, the controller is configured to obtain a position, of the movable body, from the position detecting section in a case that the detection target is detected by the detector during the movement of the movable body in the moving direction in the first moving processing, and in the flushing processing, the controller is configured to start the flushing during the movement of the movable body in the second moving processing.
6. The image forming apparatus according to claim 5, wherein in a case of forming the image on the sheet, the controller is configured to execute a pre-processing for performing reciprocal moving of the movable body in the moving direction prior to formation of the image, for a specified object

which is different from the formation of the image, and the first moving processing is included in the reciprocal moving of the movable body in the pre-processing.
7. The image forming apparatus according to claim 6, wherein the detector is configured to detect the sheet, and the specified object includes detection of presence or absence of the sheet and/or detection of a width in the moving direction of the sheet, based on a result of detection of the sheet by the detector.
8. The image forming apparatus according to claim 5, further comprising another detection target which is provided separately from the detection target and which is fixed directly or indirectly to the ink receiving unit.
9. The image forming apparatus according to claim 8, wherein the detection target is arranged on the upstream in the moving direction with respect to the ink receiving unit, and the another detection target is arranged on a downstream in the moving direction with respect to the ink receiving unit.
10. The image forming apparatus according to claim 8, wherein in the position obtaining processing, the controller is configured to obtain, from the position detecting section, a first detection position which is a position of the movable body in a case that the detection target is detected by the detector and a second detection position which is a position of the movable body in a case that the another detection target is detected by the detector, and in the determining processing, the controller is configured to determine the flushing starting position based on a first positional deviation and a second positional deviation, the first positional deviation being a difference between the first detection position and a design position, of the movable body, at which the detection target is to be detected by the detector, the second positional deviation being a difference between the second detection position and a design position, of the movable body, at which the another detection target is to be detected by the detector.
11. The image forming apparatus according to claim 10, wherein in the determining processing, the controller is configured to determine, based on a formula (1) and a formula (2), the flushing starting position satisfying the formula (1) and the formula (2): $Pst = Pst0 - \Delta P$ (1) $\Delta P = \frac{\Delta b - \Delta a}{Pb - Pa}$ .Math. $(Pst - \alpha) + \beta$ (2) note that $\Delta a = Pa\mathbf{0} - Pa$, $\Delta b = Pb\mathbf{0} - Pb$ $\alpha = Pa$, $\beta = \Delta a$ or $\alpha = Pb$, $\beta = \Delta b$ in the formulas (1) and (2), Pst: Actual FLS starting position Pst**0**: Ideal FLS starting position Pa: First end detection position Pb: Second end detection position Pa**0**: First end ideal position Pb**0**: Second end ideal position.
12. The image forming apparatus according to claim 10, wherein the flushing processing includes executing, from the flushing starting position, a jetting processing of jetting the ink from the recording head a predetermined number of times in a predetermined cycle, and the determining processing includes determining the predetermined cycle and/or the predetermined number of times based on the first positional deviation and the second positional deviation.
13. The image forming apparatus according to claim 1, wherein in the flushing processing, in response to reaching of the movable body to a reference position as a result of the movement of the movable body in the moving direction, the controller is configured to start the flushing after elapse of a prescribed time since a timing at which the movable body reaches the reference position, while the controller continues the movement of the movable body, and in the determining processing, the controller is configured to determine the prescribed time as the start timing.
14. The image forming apparatus according to claim 1, wherein the detection target is arranged on an upstream, in the moving direction, with respect to the ink receiving unit.
15. The image forming apparatus according to claim 14, wherein the moving processing includes moving the movable body one way in the moving direction, and the controller is configured to execute the position obtaining processing, the determining processing and the flushing processing while the movable body is being continuously moved one way in the moving direction in the moving processing.

16. The image forming apparatus according to claim 1, further comprising a supporting part configured to support the ink receiving unit, wherein the detection target is fixed to the supporting part.
17. The image forming apparatus according to claim 1, further comprising a platen extending along the moving direction and to face the recoding head, wherein the ink receiving unit and the detection target are fixed to the platen.
18. The image forming apparatus according to claim 1, further comprising a capping mechanism provided at a predetermined standby position at which the movable body is made to stand by during a period of time in which formation of image is not performed on the sheet, the capping mechanism being configured to cover the recording head, wherein the ink receiving unit is provided on the capping mechanism, and the detection target is fixed to the capping mechanism.