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Output device, output system, and output method

Abstract

An output device communicably connected with a post-processing apparatus for executing post-processing on an output product output from the output device, the output device includes circuitry to receive a processing setting pattern that is determined in accordance with an output condition of the output product and corresponding to an operation to be performed by the post-processing apparatus, the output condition, and image data of an image to be formed on the output product and control output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
6088568	12/1999	Ohtani	399/408	G03G 15/6582
6185010	12/2000	Watanabe	361/600	H04N 1/00384
6718378	12/2003	Machida	709/224	H04L 43/00
2006/0029435	12/2005	Kasai et al.	N/A	N/A
2007/0057426	12/2006	Tao	270/58.09	G03G 15/6582
2007/0253720	12/2006	Kasai	N/A	N/A
2009/0074439	12/2008	Kasai	N/A	N/A
2010/0028053	12/2009	Kasai	N/A	N/A
2010/0254724	12/2009	Kasai	N/A	N/A
2012/0063819	12/2011	Kasai et al.	N/A	N/A
2013/0101303	12/2012	Kasai et al.	N/A	N/A
2015/0050033	12/2014	Kasai et al.	N/A	N/A
2015/0205237	12/2014	Kasai et al.	N/A	N/A
2016/0139537	12/2015	Kasai et al.	N/A	N/A
2016/0313668	12/2015	Kasai et al.	N/A	N/A
2024/0173968	12/2023	Kasai	N/A	G06F 3/1208

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
H10-236720	12/1997	JP	N/A

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This patent application is based on and claims priority pursuant to 35 U.S.C. § 119(a) to Japanese Patent Application No. 2022-189545, filed on Nov. 28, 2022, in the Japan Patent Office, the entire disclosure of which is hereby incorporated by reference herein.

BACKGROUND

Technical Field

(2) Embodiments of the present disclosure relate to an output device, an output system, and an

output method.

Related Art

(3) Some output devices that output output products such as sheets of paper on which images are printed based on image data are equipped with a post-processing apparatus such as a stapler that binds the output products. Since the stapler involves various mechanical operations, the stapler is designed to satisfy a certain degree of durability. However, for example, when an operator instructs the stapler to staple output products whose number exceeds a specified number of sheets, the durability in design may be reduced.

(4) For this reason, some techniques of restricting the use of the stapler in ways that affect the durability of the stapler are known. For example, a technique for canceling the setting of the stapling when the number of printed sheets of a print job set for the stapling exceeds the specified number of sheets.

SUMMARY

(5) In one aspect, an output device communicably connected with a post-processing apparatus for executing post-processing on an output product output from the output device, the output device includes circuitry to receive a processing setting pattern that is determined in accordance with an output condition of the output product and corresponding to an operation to be performed by the post-processing apparatus, the output condition, and image data of an image to be formed on the output product and control output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition.

(6) In another aspect, an output system includes a communication terminal including first circuitry, an output device communicably connected with the post-processing apparatus, the output device including second circuitry to output an output product having an image that is formed based on image data received from the communication terminal, and a post-processing apparatus to execute post-processing on the output product. The first circuitry of the communication terminal is to execute a printer driver to receive an output condition of the output product via a screen, determine a processing setting pattern corresponding to an operation to be performed by the post-processing apparatus according to the output condition, and transmit the processing setting pattern, the output condition, and the image data to be output to the output device. The second circuitry of the output device is to receive the processing setting pattern, the output condition, and the image data of the image to be formed on the output product and control output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition.

(7) In another aspect, an output method performed by a communication terminal that executes a printer driver includes receiving an output condition of an output product via a screen, determining a processing setting pattern corresponding to an operation to be performed on the output product by a post-processing apparatus according to the output condition, and transmitting, to an output device, the processing setting pattern, the output condition, and image data of an image to be formed on the output product.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) A more complete appreciation of embodiments of the present disclosure and many of the attendant advantages and features thereof can be readily obtained and understood from the following detailed description with reference to the accompanying drawings, wherein:

(2) FIG. **1**A is an external view of an image forming system according to an embodiment of the present disclosure;

(3) FIG. **1**B is a schematic diagram illustrating a configuration of an image forming apparatus according to an embodiment of the present disclosure;

(4) FIG. **2** is a schematic diagram illustrating the internal structure of a post-processing apparatus that is a part of an image forming system and the structure around the post-processing apparatus, according to an embodiment of the present disclosure;
(5) FIGS. **3**A to **3**D are diagrams each illustrating the processing to receive and align sheets in a staple mode of a post-processing apparatus according to an embodiment of the present disclosure;
(6) FIG. **4** is a diagram illustrating moving devices for moving a stapler that serves as a binding device of a post-processing apparatus according to an embodiment of the present disclosure;
(7) FIG. **5** is a block diagram illustrating a hardware configuration of a control system for controlling the movement of a stapler of a post-processing apparatus according to an embodiment of the present disclosure;
(8) FIG. **6**A to **6**G are diagrams each illustrating behaviors of a stapler when the stapler is moved to a binding position at a stapling position moving speed V1 and a reference speed V2, according to an embodiment of the present disclosure;
(9) FIG. **7** is a block diagram illustrating a configuration of an output system according to an embodiment of the present disclosure;
(10) FIG. **8** is a block diagram illustrating a hardware configuration of a communication terminal according to an embodiment of the present disclosure;
(11) FIG. **9** is a block diagram illustrating a hardware configuration of a control section of an image forming apparatus according to an embodiment of the present disclosure;
(12) FIG. **10** is a block diagram illustrating functional configurations of a printer driver and an output device, according to an embodiment of the present disclosure;
(13) FIG. **11**A is a diagram illustrating a table of processing setting patterns stored in a processing setting pattern storage unit according to an embodiment of the present disclosure;
(14) FIG. **11**B is a diagram illustrating another table of processing setting patterns stored in a processing setting pattern storage unit according to an embodiment of the present disclosure;
(15) FIG. **12** is a diagram illustrating a table of minimum amounts of operation stored in a minimum amount-of-operation storage unit according to an embodiment of the present disclosure;
(16) FIG. **13** is a diagram illustrating a table of print job information stored in a print job storage unit according to an embodiment of the present disclosure;
(17) FIG. **14** is a diagram illustrating a print setting screen displayed by a printer driver according to an embodiment of the present disclosure;
(18) FIG. **15** is a sequence chart illustrating the processing of a print job performed by a communication terminal and an output device communicating with each other, according to an embodiment of the present disclosure;
(19) FIG. **16** is a diagram illustrating a processing setting pattern in the case of a long-edge feed of a sheet feeding direction and staple positions at upper right and lower left, according to an embodiment of the present disclosure;
(20) FIG. **17** is a diagram illustrating a processing setting pattern in the case of a short-edge feed of a sheet feeding direction and staple positions at an upper right and at a lower left, according to an embodiment of the present disclosure;
(21) FIG. **18**A is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **16**, according to an embodiment of the present disclosure;
(22) FIG. **18**B is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **17**, according to an embodiment of the present disclosure;
(23) FIG. **19**A is a diagram illustrating a processing setting pattern in the case of a long-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper right, and short-edge biding, according to an embodiment of the present disclosure;
(24) FIG. **19**B is a diagram illustrating a processing setting pattern in the case of a long-edge feed

of a sheet feeding direction, double-sided printing, a staple position at an upper right, and long-edge biding, according to an embodiment of the present disclosure;

(25) FIG. **20**A is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **19**A, according to an embodiment of the present disclosure;

(26) FIG. **20**B is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **19**B, according to an embodiment of the present disclosure;

(27) FIG. **21**A is a diagram illustrating a processing setting pattern in the case of a long-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper left, and short-edge biding, according to an embodiment of the present disclosure;

(28) FIG. **21**B is a diagram illustrating a processing setting pattern in the case of a long-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper left, and long-edge biding, according to an embodiment of the present disclosure;

(29) FIG. **22**A is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **21**A, according to an embodiment of the present disclosure;

(30) FIG. **22**B is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **21**B, according to an embodiment of the present disclosure;

(31) FIG. **23**A is a diagram illustrating a processing setting pattern in the case of a short-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper left, and long-edge biding, according to an embodiment of the present disclosure;

(32) FIG. **23**B is a diagram illustrating a processing setting pattern in the case of a short-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper left, and short-edge biding, according to an embodiment of the present disclosure;

(33) FIG. **24**A is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **23**A, according to an embodiment of the present disclosure;

(34) FIG. **24**B is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **23**B, according to an embodiment of the present disclosure;

(35) FIG. **25**A is a diagram illustrating a processing setting pattern in the case of a short-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper right, and long-edge biding, according to an embodiment of the present disclosure;

(36) FIG. **25**B is a diagram illustrating a processing setting pattern in the case of a short-edge feed of a sheet feeding direction, double-sided printing, a staple position at an upper right, and short-edge biding, according to an embodiment of the present disclosure;

(37) FIG. **26**A is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **25**A, according to an embodiment of the present disclosure;

(38) FIG. **26**B is a flowchart of the processing in which a setting change unit changes a print setting according to the processing setting pattern of FIG. **25**B, according to an embodiment of the present disclosure;

(39) FIG. **27** is a diagram illustrating a durability prediction screen on which the correspondence between the operation status of a stapler and the durability, according to an embodiment of the present disclosure;

(40) FIG. **28** is a diagram illustrating an amount-of-operation comparison screen on which an amount of operation for the number of print jobs when the setting of a “stapler operation minimum mode” is turned on and an actual amount of operation for the number of print jobs are compared,

according to an embodiment of the present disclosure;
(41) FIG. **29** is a sequence chart illustrating the processing in which a communication terminal displays a durability prediction screen or an amount-of-operation comparison screen, according to an embodiment of the present disclosure;
(42) FIG. **30** is a schematic diagram illustrating a configuration of a network system in which an output device and a server apparatus are connected with each other via a network, according to an embodiment of the present disclosure; and
(43) FIG. **31** is a sequence chart illustrating the processing in which an administrator terminal sets the setting of a "stapler operation minimum mode" to be turned on as an initial setting of an output device, according to an embodiment of the present disclosure.
(44) The accompanying drawings are intended to depict embodiments of the present disclosure and should not be interpreted to limit the scope thereof. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted. Also, identical or similar reference numerals designate identical or similar components throughout the several views.

DETAILED DESCRIPTION

(45) In describing embodiments illustrated in the drawings, specific terminology is employed for the sake of clarity. However, the disclosure of this specification is not intended to be limited to the specific terminology so selected and it is to be understood that each specific element includes all technical equivalents that have a similar function, operate in a similar manner, and achieve a similar result.
(46) Referring now to the drawings, embodiments of the present disclosure are described below. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.
(47) An output device and an output method performed by the output device according to embodiments of the present disclosure are described below with reference to the drawings.
(48) From a global perspective, there are various ways in which operators use the output device. Those operators sometimes operate the output device to staple sheets having a thickness exceeding the original specification of the output device or output products whose number exceeds the specified number of sheets. Those operators often operate the output device to execute the stapling at positions that cause the amount of operation of a stapler to be increased. Such improper use of the output device may reduce the durability of the stapler. In other words, although the output device can execute such somewhat unreasonable stapling beyond the original specification of the output device, the durability of the output device is adversely affected. Even when a failure occurs earlier than expected because of the reduction of the durability caused by improper use by the operators, such a failure may lead to, for example, dissatisfaction with the output device.
(49) For this reason, for example, the following measures are considered to deal with such operators who use the output device improperly. A. To increase the durability of the stapler. B. To provide warning guidance at the time of use (or prior to use). C. To set a limit for improper use.
(50) However, the measure "A" leads to a cost increase, and the majority of operators do not expect that level of specification. The measures "B" and "C" are to impose uniform restrictions, even if the restrictions are temporarily set. Accordingly, the measures "B" and "C" are not preferable for the operators who are caused to use the output device in such ways only several times a year or once a few years.
(51) According to the present embodiment, the current durability of the output device is not necessarily to be changed significantly. For example, a printer driver automatically changes a print setting so that the load on the stapler is minimized. In other words, the printer driver changes the print setting for changing the orientation (upward or downward) of the front face of a sheet at the time of sheet ejection or rotating image data so that the moving range of the stapler is minimized. Thus, the load on the stapler is reduced when the output device performs a print job that involves stapling to be executed by the stapler. In this way, the durability of the stapler is prevented from

being decreased without imposing uniform restrictions on the operators.
(52) The output product is a medium output by the output device. In the present embodiment, the output product is a sheet material such as a sheet of paper or a sheet of film. In a case where the output device is an image forming apparatus such as a printer, an image representing image data is printed on the output product.
(53) A post-processing apparatus is an apparatus that executes some sort of post-processing on the output product. The post-processing includes, for example, stapling, punching, and bookbinding.
(54) The amount of operation of a processing apparatus is the amount of movement of the post-processing apparatus to exhibit the functions of the post-processing apparatus. Accordingly, the amount of operation may include any one or more of parallel movement, rotation, the number of times of processing, and the load during a single operation. The amount of operation of the processing apparatus described above affects the durability of the post-processing apparatus that executes, for example, the stapling. As the amount of operation increases, the number of factors that cause a failure or require a replacement of the post-processing apparatus increases. In other words, as the amount of operation increases, the time between failures or replacements becomes shorter, or the occurrence ratio of a failure or a replacement increases.
(55) An output condition is a setting that determines how the output product is to be output. The output condition may be set by an operator or the initial values of the output condition may be predetermined. The output condition is referred to as a print setting in the case of a printing apparatus. In the present embodiment, the output condition includes items for determining a processing setting pattern.
(56) The processing setting pattern is a print setting that allows the amount of operation of the post-processing apparatus to be reduced. The processing setting pattern is determined in accordance with the output condition. The expression “corresponding to the operation of the post-processing apparatus” means that the post-processing apparatus operates in accordance with a particular setting set in the processing setting pattern.
(57) First, the structure of the stapler is described below with reference to FIGS. **1**A to **6**.
(58) FIG. **1**A is an external view of an image forming system according to an embodiment of the present disclosure.
(59) In FIG. **1**A, the portion surrounded by a frame line **99** is a post-processing apparatus **9**, and the portion surrounded by a frame line **98** is an image forming apparatus **8**. The image forming apparatus **8** and the post-processing apparatus **9** are described in detail below. The drawings described below are merely given by way of example for the sake of description of a stapler.
(60) FIG. **1**B is a schematic diagram illustrating a configuration of the image forming apparatus **8** according to an embodiment of the present disclosure.
(61) The image forming apparatus **8** is a tandem color image forming apparatus employing an indirect transfer method using an intermediate transferor. An image forming device **110** that serves as a toner image forming device is arranged substantially at the center of the image forming apparatus **8**. The image forming device **110** includes image forming stations **111**Y, **111**M, **111**C, and **111**K (suffixes Y, M, C, and K are omitted as appropriate in the following description) for four colors (Y: yellow, M: magenta, C: cyan, and K: black) arranged in a predetermined direction. The image forming apparatus **8** includes a sheet feeder **120** and a sheet conveyance path (vertical conveyance path) **130**. The sheet feeder **120** is disposed below the image forming device **110** and serves as a recording medium feed device. The sheet conveyance path **130** conveys a sheet as a recording medium picked up by the sheet feeder **120** to a secondary transfer device **140** and a fixing device **150**. Further, the image forming apparatus **8** includes a branch sheet ejection path **160** and a duplex sheet conveyance path **170**. The branch sheet ejection path **160** conveys the sheet on which an image (toner image) is fixed toward the post-processing apparatus **9**. The duplex sheet conveyance path **170** inverts the sheet whose first face (front face) the image is formed on so that another image is formed on the second face (back face).

(62) The image forming device **110** includes photoconductor drums that serve as image bearers for the respective colors Y, M, C, and K of the image forming stations **111**. The image forming device **110** includes a charging unit, a developing unit, a primary transfer unit, a cleaning unit, and an electric-charge removing unit along the outer periphery of each of the photoconductor drums. The charging unit serves as a charging device. The developing unit serves as a developing device. The electric-charge removing unit serves as an electric-charge removing unit. The image forming device **110** includes optical writing units that serve as exposure devices and an intermediate transfer belt **112** that serves as an intermediate transferor. The optical writing units are disposed below the image forming stations **111**, and form electrostatic latent images by irradiating the photoconductor drums with light for each color based on image data. The intermediate transfer belt **112** is disposed above the image forming stations **111**, and the image (toner image) formed on each photoconductor drum is transferred by the primary transfer unit.
(63) The intermediate transfer belt **112** is rotatably supported by support rollers. A support roller **114** that is one of the support rollers faces a secondary transfer roller **115** via the intermediate transfer belt **112** in the secondary transfer device **140**. In the secondary transfer device **140**, the image (toner image) on the intermediate transfer belt **112** is secondarily transferred onto a sheet. Above the intermediate transfer belt **112**, replaceable toner containers **116** are disposed.
(64) The image forming process performed by the image forming apparatus configured as described above (such as the tandem color image forming apparatus employing an indirect transfer method) is known and is not related to the gist of the present disclosure directly. Accordingly, a detailed description thereof is omitted.
(65) The sheet on which the fixing processing is executed in the fixing device **150** is conveyed by a conveyance roller **162**, and the conveyance direction of the sheet is switched by the conveyance path switching section **161**. Thus, the sheet on which the fixing processing is executed is conveyed to the branch sheet ejection path **160** or the duplex sheet conveyance path **170**.
(66) FIG. **2** is a schematic diagram illustrating the internal structure of the post-processing apparatus **9** that is a part of the image forming system and the structure around the post-processing apparatus **9**, according to an embodiment of the present disclosure. The post-processing apparatus **9** includes, in order from the upstream side in the sheet conveyance direction, an entrance roller pair **201**, a sheet ejection conveyance path **202**, a shift sheet ejection roller pair **204**, and a staple tray **219**. Further, the post-processing apparatus **9** includes, in order toward the downstream side in the sheet conveyance direction, a tapping roller **211**, a trailing end reference fence **220**, jogger fences **212**, a sheet ejection roller **206**, a sheet ejection guide plate **205**, and a sheet ejection tray **203**. In other words, the sheet receiving section of the post-processing apparatus **9** is provided with the entrance roller pair **201** that receives a sheet conveyed from the branch sheet ejection path **160** of the image forming apparatus **8**. The sheet received by the entrance roller pair **201** is conveyed toward the shift sheet ejection roller pair **204** via the sheet ejection conveyance path **202**. The shift sheet ejection roller pair **204** has a function of shifting a sheet to the sheet ejection tray **203** for ejection. The entrance roller pair **201** and the shift sheet ejection roller pair **204** are rotationally driven by an entrance motor **216** that is a stepping motor as a driving source. Thus, the sheet is conveyed along the sheet ejection conveyance path **202**.
(67) The sheet ejection conveyance path **202** is provided with an entrance sensor **207** that serves as a sheet detecting device. The entrance sensor **207** detects the leading end and the trailing end of the sheet conveyed along the sheet ejection conveyance path **202**. The timing of the sheet processing is controlled by the detection timing of the end edge and the trailing end of the sheet and the number of driving steps of the entrance motor **216** that is a stepping motor and a sheet ejection motor **217** to be described later.
(68) At the end of the staple tray **219** near the sheet ejection roller **206**, a jam sensor **210** is disposed. The jam sensor **210** that serves as a sheet jam detecting device detects a sheet jam. At the other end of the staple tray **219** near the trailing end reference fence **220**, a sheet sensor **213** is

disposed. The sheet sensor **213** detects a sheet on which the sheet processing is to be executed. Between the staple tray **219** and the trailing end reference fence **220**, return rollers **214** are disposed. The return rollers **214** maintain a correct alignment of the sheet on which the sheet processing is to be executed in the conveyance direction of the sheet.

(69) The tapping roller **211** is provided to be movable up and down between a position indicated by a solid line and a position indicated by a broken line in FIG. **2**. The tapping rollers **211** are rotationally driven at a predetermined timing by the driving force of the sheet ejection motor **217** as a driving source.

(70) The sheet ejection tray **203** includes a stationary portion **208***a* on the downstream side in the sheet ejection direction and a movable portion **208***b* near the main body of the post-processing apparatus **9**. The movable portion **208***b* is coupled to a cam **221** that is rotationally driven by a direct current (DC) motor **221***a* as a drive source, and is controllable to swing around a swing shaft **221***c*. For example, when sheet bundles whose sheets are bound at the trailing end portions in the sheet ejection direction (the right end portion of the sheet ejection tray **203** in FIG. **2**) are ejected, the trailing end portions of the sheet bundles in the sheet ejection direction may be bulky and warp upward. In this case, the DC motor **221***a* is driven to swing the movable portion **208***b* in the clockwise direction around the swing shaft **221***c* so as to lower the end of the movable portion **208***b* near the main body of the post-processing apparatus **9**. Thus, even when the sheet bundles whose sheets are bound at the trailing end portions in the sheet ejection direction are ejected, the uppermost sheet of each of the sheet bundles is prevented from warping upward. The trailing end portions of the sheet bundles in the sheet ejection direction, which are ejected onto the movable portion **208***b* and placed near the main body of the post-processing apparatus **9**, are kept being pressed with the leading end of a pressing lever **209** which is swung by a solenoid **218**.

(71) The post-processing apparatus **9** configured as described above executes predetermined processing such as binding processing on the sheets based on the sheet conveyance mode notified from the controller of the main body of the image forming apparatus **8**, and ejects the sheets onto the sheet ejection tray **203**. The “sheet conveyance mode” in the present embodiment includes a shift mode and a staple mode. In the shift mode, sheets are shifted to different positions in a direction orthogonal to the sheet conveyance direction to be sorted, and then ejected. In the staple mode, sheets are bound, and then ejected as a sheet bundle. However, the sheet conveyance mode is not limited thereto.

(72) FIGS. **3**A to **3**D are diagrams each illustrating the processing to receive and align sheets in the staple mode of the post-processing apparatus **9** according to an embodiment of the present disclosure.

(73) With reference to FIG. **3**A, the staple tray **219**, a stapler **263**, and the main components around the staple tray **219** and the stapler **263** used in the staple mode, and the processing to receive and align sheets are described. In the present embodiment, the “staple mode” is a mode in which sheets are bound by the stapler **263** that serves as a binding processing device that binds sheets for each certain number of sheets at the time of sheet ejection, and the bundles of the bound sheets are ejected.

(74) The tapping roller **211** is disposed between the shift sheet ejection roller pair **204** disposed at the most downstream of the sheet ejection conveyance path **202** illustrated in FIG. **2** and the sheet ejection guide plate disposed at the position immediately before the sheet is ejected onto the sheet ejection tray **203**. The tapping roller **211** is driven in the vertical direction by the sheet ejection motor **217** that is, for example, a stepping motor. More specifically, the tapping roller **211** includes a lever portion and a roller portion. The lever portion moves up and down. The roller portion is rotationally driven by the sheet ejection motor **217** so as to convey the sheet in the direction opposite to the sheet conveyance direction (that is the left direction in FIG. **2**).

(75) At the time of sheet reception, as illustrated in FIG. **3**B, the stapler **263** is moved to the standby position in advance and the jogger fences **212** are retracted to the sheet receiving positions.

Then, a sheet P is received from the image forming apparatus **8**. When the trailing end of the sheet P passes the shift sheet ejection roller pair **204**, the tapping roller **211** is lowered, and the sheet P is pressed against the staple tray **219** by the roller portion of the tapping roller **211**. Further, the roller portion of the tapping roller **211** is rotated to switch back the sheet P until an edge e1 at the trailing end of the sheet P contacts the trailing end reference fence **220**. At this point, the roller portion of the tapping roller **211** is rotationally driven by the sheet ejection motor **217**, and is driven together with the sheet ejection roller **206**.

(76) The jogger fences **212** are in a standby status at positions where the jogger fences **212** do not contact the sheet P being conveyed or the sheet P being switched back until the sheet P is completely switched back. When the sheet P is completely switched back, the tapping roller **211** is moved up, and the jogger fences **212** are moved in the sheet width direction as illustrated in FIG. **3**C. Thus, the side faces of the jogger fences **212** contact edges e2 and e3 of the sheet P, and the sheet P is aligned with the reference position.

(77) Each of the return rollers **214** is a sponge roller in which a sponge material **214***b* is provided on the outer periphery of a roller shaft **214***a*. The return rollers **214** are driven to rotate by the entrance motor **216** and come into contact with the sheet P stacked on the staple tray **219**. By applying a conveyance force to the sheet P toward the trailing end reference fences **220**, the return rollers **214** maintain a correct alignment of the sheet P in the sheet conveyance direction.

(78) When the sheet P is completely aligned, as illustrated in FIG. **3**D, the jogger fences **212** are retracted to positions where the jogger fences **212** do not contact the sheet P in preparation for receiving the next sheet.

(79) Thereafter, the alignment and retraction are repeated. After the conveyance operation, the switchback operation, and the alignment processing of the designated number of sheets are completed, the sheets are bound by the stapler **263**.

(80) FIG. **4** is a diagram illustrating moving devices for moving the stapler **263** that serves as a binding device of the post-processing apparatus **9** according to an embodiment of the present disclosure.

(81) The stapler **263** is driven, via a timing belt **272**, by a stapler moving motor **271** that rotates in both forward and reverse directions. By the stapler moving motor **271** driving the stapler **263**, the stapler **263** is configured to be movable in the sheet width direction along the guide shaft **275** in order to bind one or more positions (typically two positions) at the edge e1 of the sheet P. The stapler moving motor **271** and the timing belt **272** function as moving devices for the stapler **263**, and the stapler **263** is movable over at least the entire width of the edge e1 supported by the trailing end reference fence **220**. In the present embodiment, a guided portion **263**B included in a part of the stapler **263** is configured to slide, for example, along the guide shaft **275**. A driven portion **263**A disposed at one end near the timing belt **272** of both ends of the stapler **263** with the guided portion **263**B therebetween is fixed to the timing belt **272**. A sensor feeler **274** as a detected portion, which will be described later, is disposed at the other end of the stapler **263**.

(82) A stapler home position sensor **273** (referred to as a “stapler HP sensor **273**” in the following description) that serves as a standby position detection device that detects the standby position (home position) of the stapler **263** is disposed at one end (on the left side in FIG. **4**) of the moving range of the stapler **263**. The stapler **263** is provided with the sensor feeler **274** as a portion to be detected by the stapler HP sensor **273**. When the stapler HP sensor **273** detects the sensor feeler **274** of the stapler **263**, the standby position (home position) of the stapler **263** is detected. The control of moving the stapler **263** to a predetermined binding position in the width direction of the sheet P is performed based on the time point when the sensor feeler **274** passes through the detection portion of the stapler HP sensor **273**. In other words, the detection is performed based on the time point when the sensor feeler **274** of the stapler **263** is no longer detected by the stapler HP sensor **273** after the stapler **263** starts moving. The stapler **263** is controlled to move by a predetermined target amount of movement after the sensor feeler **274** passes through the detection portion of the

stapler HP sensor **273**. In other words, after the stapler **263** starts moving and the sensor feeler **274** of the stapler **263** is no longer detected by the stapler HP sensor **273**, the stapler **263** is controlled to move by the predetermined target amount of movement. As the movement of the stapler **263** is controlled as described above, the stapler **263** at the standby position is moved to the predetermined binding position in the width direction of the sheet P.

(83) FIG. **5** is a block diagram illustrating a hardware configuration of a control system for controlling the movement of the stapler **263** of the post-processing apparatus **9** according to an embodiment of the present disclosure.

(84) The post-processing apparatus **9** includes a controller **400** that serves as a controller. The controller **400** includes, for example, a central processing unit (CPU) **401**, a read-only memory (ROM) **402**, a random access memory (RAM) **403**, and a serial interface (I/F) **404** as control devices. The program codes for the control are stored in the ROM **402**. The CPU **401** loads the program codes onto the RAM **403**, stores data used for the control in the RAM **403**, and executes the control defined by the program codes using the RAM **403** as a work area. Thus, the movement of the stapler **263** is controlled.

(85) The image forming apparatus **8** and the post-processing apparatus **9** are controlled so as to communicate with each other via the serial I/F **404**. By this communication control, commands used for sheet processing such as sheet size information of a sheet to be passed through from the image forming apparatus **8** and an operation completion notification of the post-processing apparatus **9** are exchanged.

(86) In the present embodiment, the RAM **403**, for example, is used as a first memory that stores the amount of movement of the stapler **263** when the stapler **263** is moved at a predetermined moving speed (referred to as a “stapling position moving speed” in the following description) V1 for executing the binding processing. The RAM **403**, for example, is also used as a second memory that stores the amount of movement of the stapler **263** when the stapler **263** is moved at a reference speed V2 to be described later, which is lower than the stapling position moving speed V1. In other words, the amount of movement of the stapler **263** when the stapler **263** is moved at the stapling position moving speed V1 and the amount of movement of the stapler **263** when the stapler **263** is moved at a reference speed V2 are stored in the storage areas set in the RAM **403**. As a memory for storing the above-amounts of movement, in addition to the RAM **403**, another built-in memory included in the controller **400**, an external recording medium such as a detachable memory card or a universal serial bus (USB), or an external storage device such as a magnetic disk or an optical disk may be used. The CPU **401** also functions as a comparison device that compares the amounts of movement stored in the first memory and the second memory such as the RAM **403**.

(87) FIG. **6**A to **6**G are diagrams each illustrating behaviors of the stapler **263** when the stapler **263** is moved to a binding position at the stapling position moving speed V1 and the reference speed V2, according to an embodiment of the present disclosure.

(88) First, the stapler moving motor **271** rotates in a direction in which the stapler **263** is moved out of the home position (HP) that is a standby position and drives the timing belt **272** to rotate. Then, the driven portion **263**A, which is the attachment portion of the timing belt **272** illustrated in FIG. **6**A, is moved, and the stapler **263** starts moving.

(89) In the present embodiment, in order to increase the productivity of the post-processing apparatus **9**, the controller **400** moves the stapler **263** at the stapling position moving speed V1 that is a high speed. When moving at such a high speed, the stapler **263** as an entirety cannot follow the movement of the attachment portion (driven portion) **263**A of the timing belt **272** due to the inertia force applied to the stapler **263**. As a result, as illustrated in FIG. **6**B, the stapler **263** moves in a state in which the stapler **263** is inclined.

(90) When the stapler **263** starts moving in the state in which the stapler **263** is inclined, an OFF timing at which the stapler HP sensor **273** does not detect the stapler **263** is delayed compared with the case where the stapler **263** starts moving in the state in which the stapler **263** is not inclined.

This inclination is eliminated when the movement of the stapler **263** is stopped. Accordingly, when the stapler **263** is moved by a predetermined target amount-of-movement D1 for correction (see FIG. **6**C) and stops moving after the OFF timing of the stapler HP sensor **273** (that is, after the stapler HP sensor **273** no longer detects the stapler **263**), the stapler **263** is in a status of excessive movement. In other words, an excessive amount of movement D1x corresponding to the time period caused by the delay of the OFF timing of the stapler HP sensor **273** due to the inclination of the stapler **263** occurs (see FIG. **6**D).

(91) For this reason, in order to obtain the above-described excessive amount of movement D1x, the controller **400** starts moving the stapler **263** at the reference speed V2, which is set to be lower than the stapling position moving speed V1 so as not to cause the stapler **263** to incline, from the position to which the stapler **263** is moved by the predetermined target amount of movement D1 for correction at the stapling position moving speed V1. An amount of movement D1A (see FIG. **6**E) from the start of the movement to the time when the stapler HP sensor **273** detects the stapler **263** and returns to the standby position (home position) is obtained.

(92) In the present embodiment, the "reference speed" V2 is the moving speed of the stapler **263** set to be low so as not to cause inclination of the stapler **263** at the time of starting the movement of the stapler **263**. In other words, the "reference speed" V2 is a moving speed set to be low so that a delay time from the start of the movement of the stapler **263** to the time point at which the stapler **263** is no longer detected by the stapler HP sensor **273** does not occur. When the stapler **263** is moved at the reference speed V2, the actual amount of movement of the stapler **263** (i.e., the amount of movement D1A in the case of FIG. **6**E) is obtained from, for example, the product of the moving time of the stapler **263** and the reference speed V2.

(93) Subsequently, in order to obtain a reference amount of movement used to calculate the excessive amount of movement D1x caused by the delay of the sensing timing, the controller **400** operates to move the stapler **263** at the reference speed V2 by the predetermined target amount-of-movement D1 for correction from the position of the OFF timing of the stapler HP sensor **273** (see FIG. **6**F). The controller **400** obtains the amount of movement when the stapler **263** is returned to the home position at the reference speed V2 from the position to which the stapler **263** moves at the reference speed V2 by the predetermined target amount-of-movement D1 for correction. The controller **400** determines the amount of movement calculated in the above method to be a reference movement amount D1B (FIG. **6**G).

(94) FIG. **7** is a block diagram illustrating a configuration of an output system **100** according to an embodiment of the present disclosure.

(95) The output system **100** includes communication terminals **30** and output devices **10** that are connected to each other via a network N. The communication terminals **30** can use the output devices **10** on the network N to execute printing. In FIG. **7**, only one communication terminal **30** and one output device **10** are illustrated. The other communication terminals **30** and output devices **10** are omitted.

(96) The communication terminal **30** includes a controller **14** that is implemented by a microcomputer including, for example, a CPU, a ROM, a RAM, and a hard disk drive (HDD) illustrated in FIG. **8**. To the controller **14**, an input device **12** and a display device **13** are connected. While the input device **12** and the display device **13** are illustrated as separate devices in FIG. **7**, the input device **12** and the display device **13** may be incorporated into the communication terminal **30** as illustrated in FIG. **8**.

(97) The controller **14** is implemented by the CPU executing various control programs stored in the ROM or the HDD, and controls the entire operation of the communication terminal **30**. Similarly, the functional units are implemented by the CPU executing a printer driver **11** stored in the ROM or the HDD, and control the printing executed by the output device **10**. More specific example structure of the controller **14** is described below referring to FIG. **8**.

(98) The input device **12** is implemented by, for example, a keyboard and a mouse, and is a device

with which the operator inputs various operation information (for example, a print setting) to the communication terminal **30**. The operation information input with the input device **12** is transmitted to the controller **14**. The controller **14** executes various processing based on the various operation information.

(99) The display device **13** is, for example, a display **506** illustrated in FIG. **8**, and displays various operation screens and various information to the operator. The display is performed by the controller **14** executing the control processing.

(100) The output device **10** is a printing device that performs a print job transmitted from the communication terminal **30** based on a print setting instructed by the communication terminal **30**. The output device **10** may be a monochrome printer or a color printer. Any of various printing methods including an ink jet system and an electrophotographic method is employed as a printing method of the output device **10**. In the present embodiment, the output device **10** may be any device that has a printing function. The output device **10** is applicable to any device including a facsimile machine, a copying machine, or a multifunction peripheral as long as the device has a printing function. The communication terminal **30** may store the print job in a print server, and the output device **10** may acquire the print job from the print server and perform the print job. As described above, examples of the output device **10** include the image forming apparatus **8**, which is communicably connected with the post-processing apparatus **9**.

(101) The network N is any of various communication networks including the Internet and a local area network, and may be wired or wireless. The network N may include a mobile phone network such as the third generation (3G), the fourth generation (4G), the fifth generation (5G), or the sixth generation (6G).

(102) Some hardware configurations of the communication terminal **30** and the image forming apparatus **8** according to the present embodiment are described below with reference to FIGS. **8** and **9**.

(103) FIG. **8** is a block diagram illustrating a hardware configuration of the communication terminal **30** according to an embodiment of the present disclosure.

(104) As illustrated in FIG. **8**, the communication terminal **30** is implemented by a computer **500**. The computer **500** includes a CPU **501**, a ROM **502**, a RAM **503**, a hard disk (HD) **504**, an HDD controller **505**, the display **506**, an external device interface (I/F) **508**, a network interface (I/F) **509**, a bus line **510**, a keyboard **511**, a pointing device **512**, a digital versatile disc rewritable (DVD-RW) drive **514**, and a medium interface (I/F) **516**.

(105) The CPU **501** controls the entire operation of the communication terminal **30**. The ROM **502** stores a program such as an initial program loader (IPL) to boot the CPU **501**. The RAM **503** is used as a work area for the CPU **501**. The HD **504** stores various data such as a control program. The HDD controller **505** controls the reading and writing of various data from and to the HD **504** under the control of the CPU **501**. The display **506** displays various information such as a cursor, a menu, a window, characters, and images. The external device I/F **508** is an interface for connection with various external devices. Examples of the external devices include, but are not limited to, a USB memory and a printer. The network I/F **509** is an interface for data communication through the communication network N. The bus line **510** is, for example, an address bus or a data bus, which electrically connects the components or elements such as the CPU **501** illustrated in FIG. **8** to each other.

(106) The keyboard **511** serves as an input device (for example, the input device **12**) provided with a plurality of keys used for, for example, inputting characters, numerical values, and various instructions. The pointing device **512** serves as an input device (for example, the input device **12**) used for, for example, selecting or executing various instructions, selecting an object to be processed, and moving a cursor being displayed. The DVD-RW drive **514** controls the reading and writing of various data from and to a DVD-RW **513**, which serves as a removable storage medium according to the present embodiment. The removable recording medium is not limited to the DVD-

RW. For example, the removable recording medium may be a digital versatile disc recordable (DVD-R). The medium I/F **516** controls the reading and writing (storing) of data from and to a recording medium **515** such as a flash memory.
(107) FIG. **9** is a block diagram illustrating a hardware configuration of a control section of the image forming apparatus **8** according to an embodiment of the present disclosure.
(108) As illustrated in FIG. **9**, the image forming apparatus **8** includes a controller **910**, a short-range communication circuit **920**, an engine controller **930**, an operation panel **940**, and a network I/F **950**.
(109) The controller **910** includes a CPU **901** as a processor of a computer, a system memory **902**, a north bridge (NB) **903**, a south bridge (SB) **904**, an application-specific integrated circuit (ASIC) **906**, a local memory **907** as a storage area, an HDD controller **908**, and an HD **909** as a storage area. In the controller **910**, the NB **903** and the ASIC **906** are connected via an Accelerated Graphics Port (AGP) bus **921**.
(110) The CPU **901** is a processor that controls the entire operation of the image forming apparatus **8**. The NB **903** is a bridge that connects the CPU **901** to the system memory **902**, the SB **904**, and the AGP bus **921**. The NB **903** includes a memory controller to control the reading from and writing to the system memory **902**, a peripheral component interconnect (PCI) master, and an AGP target.
(111) The system memory **902** includes a ROM **902***a* and a RAM **902***b*. The ROM **902***a* stores programs and data for implementing various functions of the controller **910**. The RAM **902***b* is used to load the programs and the data. The RAM **902***b* is used as, for example, a drawing memory to store drawing data for printing. The programs stored in the ROM **902***a* may be stored in any computer-readable recording medium, such as a compact disc read-only memory (CD-ROM), a compact disc-recordable (CD-R), or a digital versatile disc (DVD), in an installable or executable file format and provided as a computer program product.
(112) The SB **904** is a bridge that connects the NB **903** to a PCI device and a peripheral device. The ASIC **906** is an integrated circuit (IC) dedicated to image processing and includes hardware elements for image processing. The ASIC **906** serves as a bridge that connects the AGP bus **921**, a PCI bus **922**, the HDD controller **908**, and the local memory **907** to each other. The ASIC **906** includes a PCI target, an AGP master, an arbiter (ARB) as a central processor of the ASIC **906**, a memory controller to control the local memory **907**, a plurality of direct memory access controllers (DMACs), and a PCI unit. For example, the DMACs convert coordinates of image data with hardware logic to rotate an image based on the image data. The PCI unit transfers data between a scanner engine **931**, a printer engine **932**, and a facsimile engine **933** through the PCI bus **922**. The ASIC **906** may be configured to connect to a USB interface, the Institute of Electrical and Electronics Engineers **1394** (IEEE 1394) interface, or both.
(113) The local memory **907** is a memory used as a buffer for image data to be copied or a code buffer. The HD **909** is a storage that stores image data, font data for printing, and form data. The HDD controller **908** controls the reading and writing of data from and to the HD **909** under the control of the CPU **901**. The AGP bus **921** is a bus interface for a graphics accelerator card, which has been proposed to accelerate graphics processing. The AGP bus **921** directly accesses the system memory **902** with high throughput to accelerate the graphics accelerator card.
(114) The short-range communication circuit **920** is provided with a short-range communication circuit antenna **920***a*. The short-range communication circuit **920** is a communication circuit in compliance with, for example, the near field communication (NFC) or BLUETOOTH.
(115) The engine controller **930** includes the scanner engine **931**, the printer engine **932**, and the facsimile engine **933**. The operation panel **940** includes a display panel **940***a* and a hard keypad **940***b*. The display panel **940***a* is, for example, a touch panel that displays current settings or a selection screen and receives user input. The hard keypad **940***b* includes, for example, a numeric keypad and a start key. The numeric keypad receives assigned values of image forming parameters

such as an image density parameter. The start key receives an instruction to start copying, for example. The controller **910** controls the entire operation of the image forming apparatus **8**. For example, the controller **910** controls, for example, drawing, communication, and input through the operation panel **940**. The scanner engine **931** or the printer engine **932** includes an image processor to perform, for example, error diffusion and gamma conversion.

(116) The image forming apparatus **8** may sequentially switch to select a document server function, a copying function, a printing function, and a facsimile communication function by an application switching key of the operation panel **940**. When the document server function is selected, an operation mode switches to a document box mode. With the selection of the copying function, the operation mode switches to a copy mode. With the selection of the printing function, the operation mode switches to a printer mode. With the selection of the facsimile communication function, the operation mode switches to a facsimile mode.

(117) The network I/F **950** is an interface for data communication through the communication network N. The short-range communication circuit **920** and the network I/F **950** are electrically connected to the ASIC **906** via the PCI bus **922**.

(118) FIG. **10** is a block diagram illustrating functional configurations of the printer driver **11** and the output device **10** illustrated in FIG. **7**, according to an embodiment of the present disclosure.

(119) The printer driver **11** includes a communication unit **22**, a setting reception unit **20**, and a drawing module **25**. These units and module are implemented by the CPU of the controller **14** executing programs stored in the ROM or the HDD of the controller **14**.

(120) The setting reception unit **20** performs the functions of a UI display unit **21**, a setting change unit **23**, a durability prediction unit **24**, a processing setting pattern storage unit **26**, and a minimum amount-of-operation storage unit **27**, which are implemented by the CPU executing programs. The UI display unit **21** displays, for example, a print setting screen on the display device **13** of the communication terminal **30**, and receives the changes in the print setting operated by the operator through the print setting screen. In the present embodiment, the UI display unit **21** receives a setting of a “stapler operation minimum mode” to be described later.

(121) When the setting change unit **23** is notified by the UI display unit **21** that the setting of the “stapler operation minimum mode” is turned on, the setting change unit **23** changes the print setting based on the processing setting pattern, which is associated with the print setting, stored in the processing setting pattern storage unit **26**. The processing setting pattern is a setting for controlling image processing such as the determination of the orientation of the front face of a sheet and the rotation of image data so that the moving range of the stapler **263** is minimized. Accordingly, the load on the stapler **263** is minimized as well. The term “minimum” is not strictly used in the present embodiment. The term “minimum” can be used for an operation in which the load on the stapler **263** is controlled to be less than the load on the stapler **263** in the output device **10** based on the normal setting in the actual operation. The term “the setting is turned on” indicates a setting in which the “stapler operation minimum mode” is performed according to the present embodiment. In other words, the term “the setting is turned on” may be referred to in various ways, such as “the setting is not set to be turned off,” “the setting is valid (or is not invalid),” or “the setting to execute is selected (the setting not to execute is not selected).”

(122) The durability prediction unit **24** predicts the durability based on the actual amount of operation of the stapler **263** acquired from the output device **10** and a minimum amount of operation set in advance. For this reason, the durability prediction unit **24** refers to the minimum amount-of-operation storage unit **27**. The durability prediction unit **24**, for example, determines whether the current amount of operation approaches a reference amount of operation for replacement, or compares the actual amount of operation of the stapler **263** with the amount of operation in the case where the setting of the “stapler operation minimum mode” is to be turned on.

(123) The drawing module **25** draws the print data based on the print setting. Since this is a known technique, a detailed description thereof is omitted.

(124) The communication unit **22** transmits a print setting (including a processing setting pattern) that the setting reception unit **20** receives and the setting change unit **23** changes and a print job (i.e., the image data drawn by the drawing module) to the output device **10**. The communication unit **22** serves as a first communication device.
(125) FIGS. **11**A and **11**B are diagrams each illustrating a table of processing setting patterns stored in the processing setting pattern storage unit **26**, according to an embodiment of the present disclosure.
(126) A process setting pattern is a part of a print setting that allows the load on the stapler **263** to be minimized. The processing setting pattern is associated with a print setting relating to the stapler **263**. In other words, the processing setting pattern is also a part of the print setting. As illustrated in FIG. **11**, as parts of the print setting that affect the amount of operation of the stapler **263**, the sheet feeding direction, single-sided printing or double-sided printing (whether an image is printed on a single face or both faces of a sheet), the staple position (an upper left or an upper right), and the binding direction of the stapler **263** (long-edge binding or short-edge binding) are considered. The processing setting patterns associated with the individual print settings are processing setting patterns that allow the amount of operation of the stapler **263** to be minimized. The process setting pattern is a pattern of a print setting in which the amount of operation of the stapler **263** is reduced when the setting of the "stapler operation minimum mode" is turned on in the print condition, compared with a case where the setting of the "stapler operation minimum mode" is turned off. This is the case where the setting is not set. A detail of the processing setting pattern will be described later.
(127) The sheet feeding direction refers to the landscape direction (long-edge feed (LEF)) and the portrait direction (short-edge feed (SEF)). In the present embodiment, the sheet feeding direction means a direction of image data based on which an image is printed in each sheet feeding direction (the orientation of the image printed based on the image data).
(128) FIG. **12** is a diagram illustrating a table of minimum amounts of operation stored in the minimum amount-of-operation storage unit **27** according to an embodiment of the present disclosure.
(129) The minimum amount of operation is an amount of operation when the stapling is executed in a certain print setting regarding the stapler **263** under the setting of the "stapler operation minimum mode" being turned on. In other words, the minimum amount of operation is an amount of operation when the stapling is executed according to the processing setting pattern that allows the decrease in durability of the stapler to be minimized, as in the present embodiment. Accordingly, the minimum amount of operation may be measured or estimated in advance by the person in charge and stored in the minimum amount-of-operation storage unit **27**.
(130) Referring back to FIG. **10**, the description continues. The output device **10** includes a communication unit **31**, an output control unit **32**, an amount of operation monitoring unit **33**, and a print job storage unit **34**. These functional units that the output device **10** has are functions implemented by the CPU **901** illustrated in FIG. **9** executing instructions included in one or more programs installed on the output device **10** in cooperation with the operations and the control performed by the hardware components illustrated in FIG. **9**. The print job storage unit **34** is implemented by, for example, the HD **909** or the RAM **902***b* illustrated in FIG. **9**.
(131) The communication unit **31** receives a print request with the designation of the print setting and the print job from the communication terminal **30**, and stores the print setting and the print job in the print job storage unit **34**. The communication unit **31** serves as a second communication device. The communication unit **31** associates the print job with, for example, a job identification (ID) and a date and time. The job ID is the identification information of the job.
(132) The output control unit **32** performs the print jobs stored in the print job storage unit **34** in the order in which the print jobs are stored (in the order in which the print jobs are registered). In other words, the output control unit **32** controls the output of image data based on the processing setting

pattern and the output condition that are changed by the printer driver **11**. The output control unit **32** performs the print job in the print setting that allows the decrease in durability of the stapler **263** to be minimized. The print job refers to the printing of image data and stapling where printed matters are bound.

(133) The amount of operation monitoring unit **33** monitors the amount of operation of the stapler **263**. The amount of operation refers to at least one of the number of times of stapling and the amount of movement of the stapler **263**. The amount of movement of the stapler **263** is the amount by which the stapler **263** is driven along the timing belt **272** by the stapler moving motor **271**. The amount of movement may be an actual measurement value or an amount driven by the stapler moving motor **271**.

(134) The number of times of stapling is the sum of the number of binding positions in each print job. In the present embodiment, since stapling involves movement of the stapler **263**, only the number of times of stapling is considered as the amount of operation in the description. In other words, the amount of operation may be at least one of the number of times of stapling and the amount of movement of the stapler **263**.

(135) The amount of operation monitoring unit **33** may weigh the number of times of stapling thin sheets or a small number of sheets and the number of times of stapling thick sheets or a large number of sheets to calculate the amount of operation. The amount of operation monitoring unit **33** may weigh the number of times of the execution of the stapling (the number of times of stapling) by 1.2 times to calculate the amount of operation when the stapler **263** staple thick sheets that causes a greater mechanical load on the stapler **263** compared to, for example, thin sheets. In other words, when the stapling is executed under a condition that a mechanical load on the stapler **263** is large, the amount of operation monitoring unit **33** calculates the amount of operation by multiplying the actual number of times of stapling by a weighting coefficient exceeding one. The amount of operation monitoring unit **33** stores the amount of operation in association with the print job.

(136) FIG. **13** is a diagram illustrating a table of print job information stored in the print job storage unit **34** according to an embodiment of the present disclosure.

(137) With reference to FIG. **13**, the print setting related to the stapler **263** is described, and other information is omitted. As illustrated in FIG. **13**, the print job information includes, as data items, a file name, a date and time, a print setting, and an amount of operation of a stapler (stapler amount of operation), which are associated with a job ID. In the data item of the print setting, parts of the print setting associated with the processing setting pattern are indicated among all parts of the print setting set by the operator. In the data item of the amount of operation of a stapler, the amount of operation of the stapler **263** monitored by the amount of operation monitoring unit **33** is indicated. The amount of operation in the table may be, for example, the amount of movement of the stapler, the number of times of stapling, or the amount of movement of the stapler weighted by the number of times of stapling.

(138) FIG. **14** is a diagram illustrating a print setting screen **300** displayed by the printer driver **11** according to an embodiment of the present disclosure.

(139) The print setting screen **300** includes various settings related to printing. With reference to FIG. **14**, primary items of a print setting are described. The print setting screen **300** includes a staple setting field **302**. When the staple setting field **302** is set to “ON,” the stapling is set for the print job. When the stapling is set to “ON”, the operator can designate the staple position and the binding direction.

(140) When the staple setting field **302** is set to “ON”, the operator can set a check box **303** for the “stapler operation minimum mode.” Before the staple setting field **302** is set to “ON”, the check box **303** for the “stapler operation minimum mode” is not displayed or is grayed out. When the check box **303** is checked, the setting of the “stapler operation minimum mode” is turned on.

(141) In FIG. **14**, a document orientation **301** is a print setting that can be changed depending on a

processing setting pattern. In this way, the print setting (document orientation **301**, 180 degree rotation, front face up) that can be changed depending on the processing setting pattern is grayed out (a mode in which the setting of the output condition cannot be received) so as not to be set, for example, by the operator when the setting of the "stapler operation minimum mode" is turned on. It is assumed that the print setting that the operator can change in the processing setting pattern is already set. In this case, when the setting of the "stapler operation minimum mode" is turned on, the printer driver **11** disregards the print setting set by the operator.

(142) FIG. **15** is a sequence chart illustrating the processing of a print job performed by the communication terminal **30** and the output device **10** communicating with each other, according to an embodiment of the present disclosure. S**101**: The operator configures a print setting on the print setting screen **300**. The setting reception unit **20** receives the print setting. S**102**: The staple setting field **302** is set to "ON", and the check box **303** for the "stapler operation minimum mode" is checked. In this case, the setting change unit **23** changes parts of the print setting according to the processing setting pattern associated with the print setting in the processing setting pattern storage unit **26**. S**103**: The communication unit **22** transmits a print request together with the print setting and the print job to the output device **10**. S**104**: The communication unit **31** of the output device **10** receives the print request together with the print setting and the print job, and stores the print setting and the print job in the print job storage unit **34**. The output control unit **32** controls the output of image data or performs the print job based on the processing setting pattern and the print setting. In other words, the output control unit **32** prints pieces of image data corresponding to the number of pages of the original document on sheets, and staples the sheets.

(143) The processing of step S**102** is described below in detail.

(144) The processing setting pattern is described in detail with reference to FIGS. **16** to **26**. FIG. **16** is a diagram illustrating a processing setting pattern in the case of the long-edge feed of the sheet feeding direction and the staple positions at the upper right and at the lower left, according to an embodiment of the present disclosure.

(145) In FIG. **16**, the finishing in the case where the staple position is at an upper right **335** or an upper left **336** is described from the bottom to the top. In FIG. **16**, a plan view (top view) and a front view of the output device **10** are illustrated to indicate the moving direction of a sheet and the position of the stapler **263**. A setting **338** for "180 degree rotation" and a setting **337** for "eject a sheet with the front face up" in, for example, FIG. **16** are parts of a processing setting pattern corresponding to a print setting illustrated in FIG. **11**.

(146) A description is given below in the case where the sheet feeding direction is set to the long-edge feed and a setting **332** for the staple position is set to an upper right. (1) The setting change unit **23** turns on the setting **338** for "180 degree rotation." When the setting **338** for "180 degree rotation" is turned off in the initial setting or by an operation by the operator, the setting is discarded. (2) Accordingly, the output device **10** rotates image data **331** to be printed on a sheet by 180 degrees. (3) The setting change unit **23** turns on the setting **337** for "eject a sheet with the front face up." When the setting **337** for "eject a sheet with the front face up" is turned off in the initial setting or by an operation by the operator, the setting is discarded. (4) The sheet is ejected from the side face of the output device **10**.

(147) Since the setting **338** for "180 degree rotation" and the setting **337** for "eject a sheet with the front face up" are turned on, the stapler **263** can execute the stapling at the upper right **335** of the sheet with a small amount of movement. In other words, assuming that the setting **338** for "180 degree rotation" or the setting **337** for "eject a sheet with the front face up" is turned off, since the home position of the stapler **263** is at the left end in the plan view, the amount of movement of the stapler **263** increases by the height of the sheet for the stapler **263** to execute the stapling at the upper right **335** of the sheet.

(148) A description is given below in the case where the sheet feeding direction is set to the long-edge feed and the setting **333** for the staple position is set to an upper left. (1) The setting change

unit **23** turns on the setting **338** for "180 degree rotation." When the setting **338** for "180 degree rotation" is turned off in the initial setting or by an operation by the operator, the setting is discarded. (2) Accordingly, the output device **10** rotates image data **331** to be printed on a sheet by 180 degrees. (5) The setting change unit **23** leaves the setting **337** for "eject a sheet with the front face up" to be turned off. When the setting **337** for "eject a sheet with the front face up" is turned on in the initial setting or by an operation by the operator, the setting is discarded. (6) The sheet is ejected from the side face of the output device **10**.

(149) Since the setting **338** for "180 degree rotation" is turned on and the setting **337** for "eject a sheet with the front face up" is turned off, the stapler **263** can staple the sheets at the upper left **336** of the sheets with a small amount of movement. In other words, assuming that the setting **338** for "180 degree rotation" is turned off and the setting **337** for "eject a sheet with the front face up" is turned on, since the home position of the stapler **263** is at the left end in the plan view, the amount of movement of the stapler **263** increases by the height of the sheet for the stapler **263** to execute the stapling at the upper left **336** of the sheet.

(150) In FIG. **16**, since the position of the stapler **263** is at the left end in the plan view, the processing setting patterns described above are effective. If the position of the stapler **263** is at the right end of the plan view, the processing setting pattern is set so as to allow the amount of operation to be minimized for the stapler **263** whose position is at the right end of the plan view accordingly. The same applies to the case where the position of the stapler **263** is at another place, such as the center in the plan view.

(151) FIG. **17** is a diagram illustrating a processing setting pattern in the case of the short-edge feed of the sheet feeding direction and the staple positions at the upper right and at the lower left, according to an embodiment of the present disclosure.

(152) In FIG. **17**, the finishing in the case where the staple position is set to an upper right **341** or an upper left **342** is described from the bottom to the top. In FIG. **17**, the plan view (top view) and the front view of the output device **10** are illustrated to indicate the moving direction of a sheet and the position of the stapler **263**. Like reference signs are given to elements in FIG. **17** similar to those illustrated in FIG. **16** as those elements operate similarly and provide the same or similar effects, and redundant descriptions may be omitted in the following description.

(153) A description is given below in the case where the sheet feeding direction is set to the short-edge feed and the setting **333** for the staple position is set to an upper left. (11) The setting change unit **23** sets a setting **339** for "document orientation" to the landscape. When the setting **339** for "document orientation" is set to the portrait in the initial setting or by an operation by the operator, the setting is discarded. The setting **339** for "document orientation" being set to the landscape or the portrait means that the image data is to be rotated by 90 degrees in a predetermined direction (not the processing to rotate the sheet to be fed). (12) Accordingly, the output device **10** rotates the orientation of the image data by 90 degrees (in the present embodiment, the rotation direction is counterclockwise). (13) The setting change unit **23** turns on the setting **337** for "eject a sheet with the front face up." When the setting **337** for "eject a sheet with the front face up" is turned off in the initial setting or by an operation by the operator, the setting is discarded. (14) The sheet is ejected from the side face of the output device **10**.

(154) Since the setting **339** for "document orientation" is set to the landscape and the setting **337** for "eject a sheet with the front face up" is turned on, the stapler **263** can execute the stapling at the upper left **342** of the sheet with a small amount of movement.

(155) A description is given below in the case where the sheet feeding direction is set to the short-edge feed and the setting **332** for the staple position is set to an upper right. (11) The setting change unit **23** sets the setting **339** for "document orientation" to the landscape. When the setting **339** for "document orientation" is set to the portrait in the initial setting or by an operation by the operator, the setting is discarded. (15) The setting change unit **23** leaves the setting **337** for "eject a sheet with the front face up" to be turned off. When the setting **337** for "eject a sheet with the front face

up” is turned on in the initial setting or by an operation by the operator, the setting is discarded.
(16) The sheet is ejected from the side face of the output device **10**.
(156) Since the setting **339** for “document orientation” is set to the landscape and the setting **337** for “eject a sheet with the front face up” is turned off, the stapler **263** can execute the stapling at the upper right **341** of the sheet with a small amount of movement.
(157) FIGS. **18**A and **18**B are flowcharts of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **16** or **17**, according to an embodiment of the present disclosure.
(158) The setting change unit **23** determines a processing setting pattern associated with a print setting stored in the processing setting pattern storage unit **26** as follows.
(159) First, the processing is described below with reference to FIG. **18**A. The setting reception unit **20** receives an input of a print job that involves the execution of the stapling (S**1**).
(160) The setting change unit **23** determines whether the setting of the “stapler operation minimum mode” is turned on by the operator (S**2**).
(161) When the result of the determination in step S**2** is Yes, the setting change unit **23** determines whether the print setting is set to the single-sided printing (S**3**). When the result of the determination in step S**3** is No, the processing proceeds to the circle “A” in FIG. **20**A.
(162) When the result of the determination in step S**3** is Yes, the setting change unit **23** determines whether the sheet feeding direction is set to the long-edge feed (S**4**). When the result of the determination in step S**4** is No, the processing proceeds to the circle “B” in FIG. **18**B.
(163) When the result of the determination in step S**4** is Yes, the setting change unit **23** turns on the setting **338** for “180 degree rotation” (S**5**).
(164) The setting change unit **23** determines whether the staple position is set to an upper right or an upper left (S**6**). When the staple position is set to the upper right, the setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up” (S**7**).
(165) When the staple position is set to the upper left, the setting change unit **23** turns off the setting **337** for “eject a sheet with the front face up” (S**8**).
(166) The processing in the case where the print setting is the single-sided printing and the short-edge feed of the sheet feeding direction is described below with reference to FIG. **18**B.
(167) First, the setting change unit **23** sets the setting **339** for “document orientation” to the landscape (S**9**).
(168) The setting change unit **23** determines whether the staple position is set to an upper right or an upper left (S**10**). When the staple position is set to the upper right, the setting change unit **23** turns off the setting **337** for “eject a sheet with the front face up” (S**11**).
(169) When the staple position is set to the upper left, the setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up” (S**12**).
(170) FIGS. **19**A and **19**B are diagrams each illustrating a processing setting pattern in the case of the long-edge feed of the sheet feeding direction, double-sided printing, the staple position at the upper right, and the short-edge biding or the long-edge biding, according to an embodiment of the present disclosure.
(171) An upper right **345** in FIG. **19**A in the case of the short-edge binding and an upper right **346** in FIG. **19**B in the case of the long-edge binding are at the upper right when the “top and bottom” of the first face of the image data to be printed is viewed from the front.
(172) A description is given below in the case of the long-edge feed of the sheet feeding direction, the double-sided printing, the setting **332** for the staple position set to an upper right, and a short-edge binding **343**. (21) The setting change unit **23** turns on the setting **338** for “180 degree rotation” for an image data **331***a* of the first face and an image data **331***b* of the second face. When the setting **338** for “180 degree rotation” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (22) Accordingly, the output device **10** rotates each piece of image data of both faces to be printed on a sheet by 180 degrees. (23) The setting change unit **23**

turns on the setting **337** for “eject a sheet with the front face up.” When the setting **337** for “eject a sheet with the front face up” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (24) The sheet is ejected from the side face of the output device **10**.
(173) Since the “top and bottom” of the first face and the “top and bottom” of the second face are in the same orientation, the sheet is prepared for the short-edge binding. Since the setting **338** for “180 degree rotation” is turned on for both face and the setting **337** for “eject a sheet with the front face up” is turned on, the stapler **263** can execute the stapling at the upper right **345** of the sheet with a small amount of movement.
(174) A description is given below in the case of the long-edge feed of the sheet feeding direction, the double-sided printing, the setting **332** for the staple position set to an upper right, and a long-edge binding **344**. (25) The setting change unit **23** turns on the setting **338** for “180 degree rotation” only for the image data **331***a* of the first face. When the setting **338** for “180 degree rotation” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (26) Accordingly, the output device **10** rotates the image data **331***a* of the first face to be printed on a sheet by 180 degrees and does not rotate the image data **331***b* of the second face. (27) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up.” When the setting **337** for “eject a sheet with the front face up” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (28) The sheet is ejected from the side face of the output device **10**.
(175) Since the “top and bottom” of the first face and the “top and bottom” of the second face are reversed in the vertical direction, the sheet is prepared for the long-edge binding. Since the setting **338** for “180 degree rotation” is turned on only for a single face and the setting **337** for “eject a sheet with the front face up” is turned on, the stapler **263** can execute the stapling at the upper right **346** of the sheet with a small amount of movement.
(176) FIG. **20**A is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **19**A, according to an embodiment of the present disclosure.
(177) First, subsequent to the result of the determination of “No” in step S**3** in FIG. **18**A, the setting reception unit **20** determines whether the sheet feeding direction is set to the long-edge feed (S**21**). In the case of the short-edge feed, the processing proceeds to the circle “C” in FIG. **24**A.
(178) In the case of the long-edge feed, the setting change unit **23** determines whether the staple position is set to an upper right or an upper left (S**22**). When the staple position is set to the upper left, the process proceeds to the circle “D” in FIG. **22**A.
(179) When the staple position is set to the upper right, the setting change unit **23** determines whether the short-edge binding is set (S**23**). In the case of the long-edge binding, the processing proceeds to the circle “E” in FIG. **20**B.
(180) In the case of the short-edge binding, the setting change unit **23** turns on the setting **338** for “180 degree rotation” for the first face and the second face (S**24** and S**25**).
(181) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up” (S**26** and S**27**). Since the setting **337** for “eject a sheet with the front face up” is a setting for one sheet, the settings for the first face and the second face are common.
(182) The processing is described below with reference to FIG. **20**B.
(183) FIG. **20**B is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **19**B, according to an embodiment of the present disclosure.
(184) The processing in the case where the print setting is set to the double-sided printing, the sheet feeding direction is set to the long-edge feed, the staple position is set to an upper right, and the long-edge binding is set is described below with reference to FIG. **20**B.
(185) The setting change unit **23** turns on the setting **338** for “180 degree rotation” only for the first face (S**28**).

(186) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up” (S**29** and S**30**).
(187) FIGS. **21**A and **21**B are diagrams each illustrating a processing setting pattern in the case of the long-edge feed of the sheet feeding direction, double-sided printing, the staple position at the upper left, and the short-edge biding or the long-edge binding, according to an embodiment of the present disclosure.
(188) An upper left **347** in FIG. **21**A in the case of the short-edge binding and an upper left **348** in FIG. **21**B in the case of the long-edge binding are at the upper right when the “top and bottom” of the first face of the image data to be printed is viewed from the front.
(189) A description is given below in the case of the long-edge feed of the sheet feeding direction, the double-sided printing, the setting **333** for the staple position set to an upper left, and the short-edge binding **343**. (31) The setting change unit **23** turns on the setting **338** for “180 degree rotation” for the image data **331***a* of the first face and the image data **331***b* of the second face. When the setting **338** for “180 degree rotation” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (32) Accordingly, the output device **10** rotates each piece of image data of both faces to be printed on a sheet by 180 degrees. (33) The setting change unit **23** leaves the setting **337** for “eject a sheet with the front face up” to be turned off. When the setting **337** for “eject a sheet with the front face up” is turned on in the initial setting or by an operation by the operator, the setting is discarded. (34) The sheet is ejected from the side face of the output device **10**.
(190) Since the “top and bottom” of the first face and the “top and bottom” of the second face are in the same orientation, the sheet is prepared for the short-edge binding. Since the setting **338** for “180 degree rotation” is turned on for both faces and the setting **337** for “eject a sheet with the front face up” is turned off, the stapler **263** can execute the stapling at the upper left **347** of the sheet with a small amount of movement. In FIG. **21**A, the first face faces downward.
(191) A description is given below in the case of the long-edge feed of the sheet feeding direction, the double-sided printing, the setting **333** for the staple position set to an upper left, and the long-edge binding **344**. (35) The setting change unit **23** turns on the setting **338** for “180 degree rotation” only for the image data **331***a* of the first face. When the setting **338** for “180 degree rotation” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (36) Accordingly, the output device **10** rotates only the image data **331***a* of the first face to be printed on a sheet by 180 degrees. (37) The setting change unit **23** leaves the setting **337** for “eject a sheet with the front face up” to be turned off. When the setting **337** for “eject a sheet with the front face up” is turned on in the initial setting or by an operation by the operator, the setting is discarded. (38) The sheet is ejected from the side face of the output device **10**.
(192) Since the “top and bottom” of the first face and the “top and bottom” of the second face are reversed in the vertical direction, the sheet is prepared for the long-edge binding. Since the setting **338** for “180 degree rotation” is turned on only for a single face and the setting **337** for “eject a sheet with the front face up” is turned off, the stapler **263** can execute the stapling at the upper left **348** of the sheet with a small amount of movement. In FIG. **21**B, the first face faces downward.
(193) FIG. **22**A is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **21**A, according to an embodiment of the present disclosure.
(194) The processing in the case where the print setting is the double-sided printing, the long-edge feed of the sheet feeding direction, and the staple position at an upper left is described below with reference to FIG. **22**A.
(195) The setting change unit **23** determines whether the short-edge binding is set (S**31**). In the case of the long-edge binding, the processing proceeds to the circle “F” in FIG. **22**B.
(196) In the case of the short-edge binding, the setting change unit **23** turns on the setting **338** for “180 degree rotation” for the first face and the second face (S**32** and S**33**).

(197) The setting change unit **23** turns off the setting **337** for “eject a sheet with the front face up” (S**34** and S**35**). Accordingly, the sheet is ejected with the first face facing downward.
(198) FIG. **22**B is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **21**B, according to an embodiment of the present disclosure.
(199) The processing in the case where the print setting is the double-sided printing, the long-edge feed of the sheet feeding direction, the staple position at an upper left, and the long-edge binding is described below with reference to FIG. **22**B.
(200) In the case of the long-edge binding, the setting change unit **23** turns on the setting **338** for “180 degree rotation” only for the first face (S**36**).
(201) The setting change unit **23** turns off the setting **337** for “eject a sheet with the front face up” (S**37** and S**38**). Accordingly, the sheet is ejected with the first face facing downward.
(202) FIGS. **23**A and **23**B are diagrams each illustrating a processing setting pattern in the case of the short-edge feed of the sheet feeding direction, double-sided printing, the staple position at the upper left, and the short-edge biding or the long-edge binding, according to an embodiment of the present disclosure.
(203) An upper left **351** in FIG. **23**A in the case of the long-edge binding and an upper left **352** in FIG. **23**B in the case of the short-edge binding are at the upper right when the “top and bottom” of the first face of the image data to be printed is viewed from the front.
(204) A description is given below in the case of the short-edge feed of the sheet feeding direction, the double-sided printing, the setting **333** for the staple position set to an upper left, and the long-edge binding **344**. (41) The setting change unit **23** sets the setting **339** for “document orientation” to the landscape for the image data **331***a* of the first face and the image data **331***b* of the second face. When the setting **339** for “document orientation” is set to the portrait in the initial setting or by an operation by the operator, the setting is discarded. (42) Accordingly, the output device **10** rotates the orientation of each piece of image data by 90 degrees. (43) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up.” When the setting **337** for “eject a sheet with the front face up” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (44) The sheet is ejected from the side face of the output device **10**.
(205) Since the “top and bottom” of the first face and the “top and bottom” of the second face are in the same orientation, the sheet is prepared for the long-edge binding. Since the setting **339** for “document orientation” is set to the landscape and the setting **337** for “eject a sheet with the front face up” is turned on, the stapler **263** can execute the stapling at the upper left **351** of the sheet with a small amount of movement.
(206) A description is given below in the case of the short-edge feed of the sheet feeding direction, the double-sided printing, the setting **333** for the staple position set to upper left, and the short-edge binding **343**. (45) The setting change unit **23** sets the setting **339** for “document orientation” to the landscape for the image data **331***a* of the first face and the image data **331***b* of the second face. When the setting **339** for “document orientation” is set to the portrait in the initial setting or by an operation by the operator, the setting is discarded. (46) The setting change unit **23** turns on the setting **338** for “180 degree rotation” only for the image data **331***b* of the second face. When the setting **338** for “180 degree rotation” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (47) Accordingly, the output device **10** rotates the orientation of each piece of image data by 90 degrees, and further rotates only the image data **331***b* of the second face by 180 degrees. (48) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up.” When the setting **337** for “eject a sheet with the front face up” is turned off in the initial setting or by an operation by the operator, the setting is discarded. (49) The sheet is ejected from the side face of the output device **10**.
(207) Since the “top and bottom” of the first face and the “top and bottom” of the second face are reversed in the vertical direction, the sheet is prepared for the short-edge binding. Since the setting

339 for “document orientation” is set to the landscape and the setting **338** for “180 degree rotation” is turned on only for the image data **331***b* of the second face, and the setting **337** for “eject a sheet with the front face up” is turned on, the stapler **263** can execute the stapling at the upper left **352** of the sheet with a small amount of movement.

(208) FIG. **24**A is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **23**A, according to an embodiment of the present disclosure.

(209) The processing in the case where the print setting is the double-sided printing and the short-edge feed of the sheet feeding direction is described below with reference to FIG. **24**A.

(210) The setting change unit **23** determines whether the staple position is set to an upper right or an upper left (S**41**). When the staple position is set to the upper right, the process proceeds to the circle “G” in FIG. **26**A.

(211) When the staple position is set to the upper left, the setting change unit **23** determines whether the long-edge binding is set (S**42**). In the case of the short-edge binding, the processing proceeds to the circle “H” in FIG. **24**B.

(212) In the case of the long-edge binding, the setting change unit **23** sets the setting **339** for “document orientation” to the landscape for the first face and the second face (S**43** and S**44**).

(213) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up” (S**45** and S**46**). Accordingly, the sheet is ejected with the first face facing upward.

(214) FIG. **24**B is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **23**B, according to an embodiment of the present disclosure.

(215) The processing in the case where the print setting is the double-sided printing, the short-edge feed of the sheet feeding direction, the staple position at an upper left, and the short-edge binding is described below with reference to FIG. **24**B.

(216) In the case of the short-edge binding, the setting change unit **23** sets the setting **339** for “document orientation” to the landscape for the first face and the second face (S**47** and S**48**).

(217) The setting change unit **23** turns on the setting **338** for “180 degree rotation” only for the second face (S**49**).

(218) The setting change unit **23** turns on the setting **337** for “eject a sheet with the front face up” (S**50** and S**51**). Accordingly, the sheet is ejected with the first face facing upward.

(219) FIGS. **25**A and **25**B are diagrams each illustrating a processing setting pattern in the case of the short-edge feed of the sheet feeding direction, double-sided printing, the staple position at the upper right, and the short-edge biding or the long-edge binding, according to an embodiment of the present disclosure.

(220) An upper right **353** in FIG. **25**A in the case of the long-edge binding and an upper right **354** in FIG. **25**B in the case of the short-edge binding are at the upper right when the “top and bottom” of the first face of the image data to be printed is viewed from the front.

(221) A description is given below in the case of the short-edge feed of the sheet feeding direction, the setting **332** for the staple position set to an upper right, and the long-edge binding **344**. (51) The setting change unit **23** sets the setting **339** for “document orientation” to the landscape for the image data **331***a* of the first face and the image data **331***b* of the second face. (52) Accordingly, the output device **10** rotates the orientation of each piece of image data by 90 degrees. (53) The setting change unit **23** leaves the setting **337** for “eject a sheet with the front face up” to be turned off. When the setting **337** for “eject a sheet with the front face up” is turned on in the initial setting or by an operation by the operator, the setting is discarded. (54) The sheet is ejected from the side face of the output device **10**.

(222) Since the “top and bottom” of the first face and the “top and bottom” of the second face are in the same orientation, the sheet is prepared for the long-edge binding. Since the setting **339** for “document orientation” is set to the landscape and the setting **337** for “eject a sheet with the front

face up" is turned off, the stapler **263** can execute the stapling at the upper right **353** of the sheet with a small amount of movement.
(223) A description is given below in the case of the short-edge feed of the sheet feeding direction, the setting **332** for the staple position set to an upper right, and the short-edge binding **343**. (55) The setting change unit **23** sets the setting **339** for "document orientation" to the landscape for the image data **331***a* of the first face and the image data **331***b* of the second face. (56) The setting change unit **23** turns on the setting **338** for "180 degree rotation" only for the image data **331***b* of the second face. (57) Accordingly, the output device **10** rotates the orientation of each piece of image data by 90 degrees, and further rotates only the image data **331***b* of the second face by 180 degrees. (58) The setting change unit **23** leaves the setting **337** for "eject a sheet with the front face up" to be turned off. When the setting **337** for "eject a sheet with the front face up" is turned on in the initial setting or by an operation by the operator, the setting is discarded. (59) The sheet is ejected from the side face of the output device **10**.
(224) Since the "top and bottom" of the first face and the "top and bottom" of the second face are in the same orientation, the sheet is prepared for the short-edge binding. Since the setting **339** for "document orientation" is set to the landscape and the setting **338** for "180 degree rotation" is turned on only for the image data **331***b* of the second face, and the setting **337** for "eject a sheet with the front face up" is turned off, the stapler **263** can execute the stapling at the upper right **354** of the sheet with a small amount of movement.
(225) FIG. **26**A is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **25**A, according to an embodiment of the present disclosure.
(226) The processing in the case where the print setting is the double-sided printing, the short-edge feed of the sheet feeding direction, and the staple position at an upper right is described below with reference to FIG. **26**A.
(227) The setting change unit **23** determines whether the long-edge binding is set (S**61**). In the case of the short-edge binding, the processing proceeds to the circle "I" in FIG. **26**B.
(228) In the case of the long-edge binding, the setting change unit **23** sets the setting **339** for "document orientation" to the landscape for the first face and the second face (S**62** and S**63**).
(229) The setting change unit **23** turns off the setting **337** for "eject a sheet with the front face up" (S**64** and S**65**). Accordingly, the sheet is ejected with the first face facing downward.
(230) FIG. **26**B is a flowchart of the processing in which the setting change unit **23** changes a print setting according to the processing setting pattern of FIG. **25**B, according to an embodiment of the present disclosure.
(231) The processing in the case where the print setting is the double-sided printing, the short-edge feed of the sheet feeding direction, the staple position at an upper left, and the short-edge binding is described below with reference to FIG. **26**B.
(232) In the case of the short-edge binding, the setting change unit **23** sets the setting **339** for "document orientation" to the landscape for the first face and the second face (S**66** and S**67**).
(233) The setting change unit **23** turns on the setting **338** for "180 degree rotation" only for the second face (S**68**).
(234) The setting change unit **23** turns off the setting **337** for "eject a sheet with the front face up" (S**69** and S**70**). Accordingly, the sheet is ejected with the first face facing downward.
(235) When the operator desires stapling to be executed freely but knows that the durability of the stapler is to be reduced, the operator may desire to use the stapler with the "stapler operation minimum mode" of the present embodiment to be turned on. For example, by the printer driver **11** of the communication terminal **30** displaying a screen for visualizing the current operation status, the operator may manually turn on the setting of the "stapler operation minimum mode." Alternatively, it is assumed that the operator does not manually turn on the setting of the "stapler operation minimum mode." Even in such a case, when the maintenance (or replacement time) of

the stapler **263** is to be advanced, the printer driver **11** may set the setting of the "stapler operation minimum mode" to be turned on as the initial setting.
(236) FIG. **27** is a diagram illustrating a durability prediction screen **310** on which the correspondence between an operation status of the stapler **263** and the durability, according to an embodiment of the present disclosure.
(237) The durability prediction screen **310** is displayed by the printer driver of the communication terminal **30** communicating with the output device **10**. As a simple method for predicting the time to replace the stapler **263**, for example, a method based on the total number of times stapling is performed. When the total number of times of the execution exceeds a certain threshold value, the durability prediction unit **24** prompts the setting of the "stapler operation minimum mode" to be turned on, or sets the status in which the setting of the "stapler operation minimum mode" to be turned on as the initial setting. Alternatively, the durability prediction unit **24** may turn on the setting of the "stapler operation minimum mode" and restrict the setting from being changed to off.
(238) In FIG. **27**, the horizontal axis represents the number of print jobs involving stapling, and the vertical axis represents durability. The length from the maximum value to the replacement guideline on the vertical axis is the amount of operation of the stapler, at which a failure of the stapler is assumed not to occur in design. A history line **311** (that serves as a first line) indicates a decrease in durability due to the execution of print jobs in the past. The numerical value of the durability to be decreased is the sum of the amount of operation of the stapler stored in the print job storage unit **34**.
(239) A standard prediction line **312** (that serves as a second line) indicates the relationship between the number of print jobs involving stapling and durability, which is assumed at the time of design. The standard prediction line **312** is generated using a network in which a plurality of output devices **10** are connected to a monitoring server. The individual output device **10** has a function of notifying the monitoring server of, for example, the count value of the number of printed sheets and failure via the network N. Using this function, the individual output device **10** transmits the amount of operation of the stapler **263** to the monitoring server for each print job. The monitoring server aggregates the amount of operation in the past of the stapler (**263**) of the individual output device **10** connected to the network, and the durability prediction unit **24** generates the standard prediction line **312** based on the average of the amount of operation per one print job.
(240) Alternatively, the median value between the maximum and minimum values of the amount of movement of the stapler **263** in the design is regarded as the average amount of operation of the stapler **263** per one print job. Then, the durability prediction unit **24** may use the median value to generate the standard prediction line **312**.
(241) In FIG. **27**, the inclination of the history line **311** is approximately the same as that of the standard prediction lines **312** up to a certain number of print jobs. However, after a certain number of print jobs, the degree of the inclination of the history line **311** abruptly increases. The durability prediction unit **24** then determines that a difference **316** between the current durability and the replacement guideline (the remaining amount of operation that can be consumed without maintenance) is smaller than the threshold value. For this reason, the printer driver **11** displays a message **315** that indicates a recommendation to turn on the setting of the "stapler operation minimum mode." The operator can determine whether to turn on the setting of the "stapler operation minimum mode" by checking that the history line **311** approaches the replacement guideline or the message **315**.
(242) Instead of comparing the difference **316** between the current durability and the replacement guideline with the threshold value, the durability prediction unit **24** may compare a difference **317** with the threshold value. The difference **317** is the difference between the number of print jobs at which a straight line **313** extrapolated from the history line **311** intersects the reference amount of operation for replacement (i.e., the replacement guideline) and the current number of print jobs.
(243) In FIG. **27**, a prediction line after the mode setting **314** (that serves as a third line) is

presented. The prediction line after the mode setting **314** indicates the changes in durability with respect to the number of print jobs when the setting of the "stapler operation minimum mode" is turned on. The change in durability indicates the durability that decreases with the increase of the amount of operation of the stapler **263**. The amount of operation of the stapler **263** when the setting of the "stapler operation minimum mode" is turned on is the minimum amount of operation stored in the minimum amount-of-operation storage unit **27**. In other words, the prediction line after the mode setting **314** is the amount of operation obtained by accumulating the minimum amount of operation associated with the print setting in the print job.

(244) The operator can grasp the effect of the setting of the "stapler operation minimum mode" to be turned on from the prediction line after the mode setting **314** to determine whether to turn on the setting of the "stapler operation minimum mode."

(245) The durability prediction unit **24** may detect that the inclination of the history line **311** is larger than that of the standard prediction line **312** by another threshold value or more. Then, the UI display unit **21** may display the message **315**.

(246) In FIG. **27**, the horizontal axis on the durability prediction screen **310** is defined as the number of print jobs that involve stapling. Since the print jobs are associated with dates and times, the horizontal axis can be defined as the period of use.

(247) FIG. **28** is a diagram illustrating an amount-of-operation comparison screen **320** on which an amount of operation for the number of print jobs when the setting of the "stapler operation minimum mode" is turned on and an actual amount of operation for the number of print jobs are compared, according to an embodiment of the present disclosure.

(248) In FIG. **28**, the horizontal axis represents the number of print jobs, and the vertical axis represents the amount of operation. An actual amount of operation line **322** is an amount of operation obtained by accumulating the amount of operation of the stapler **263** stored in the print job storage unit **34**. The amount of operation of the stapler **263** is estimated based on the print setting stored in the print job storage unit **34** and the minimum amount of operation stored in the minimum amount of operation storage unit **27**, and an estimated amount-of-operation line **321** is an amount of operation obtained by accumulating the amounts of operation of the stapler **263**. In other words, the estimated amount-of-operation line **321** is the amount of operation obtained by accumulating the minimum amount of operation associated with the print setting in the print job.

(249) The operator can grasp the effect of the setting of the "stapler operation minimum mode" to be turned on the amount-of-operation comparison screen **320** to determine whether to turn on the setting of the "stapler operation minimum mode."

(250) FIG. **29** is a sequence chart illustrating the processing in which the communication terminal **30** displays the durability prediction screen **310** or the amount-of-operation comparison screen **320**, according to an embodiment of the present disclosure. S**201**: First, the operator inputs an operation for displaying the durability prediction screen **310** or the amount-of-operation comparison screen **320** to the communication terminal **30**. The setting reception unit **20** receives the input. S**202**: The communication unit **22** requests the output device **10** to supply the amount of operation of the stapler **263** needed for one of these screens to be displayed. S**203**: The communication unit **31** of the output device **10** receives the request and transmits the amount of operation of the stapler **263** stored in the print job storage unit **34** to the communication terminal **30**. S**204**: The communication unit **22** of the communication terminal **30** receives the amount of operation of the stapler **263**. The UI display unit **21** displays the durability prediction screen **310** or the amount-of-operation comparison screen **320** based on, for example, the amount of operation and the minimum amount of operation of the stapler **263**. The durability prediction unit **24** displays the message **315** when the difference between the current durability and the replacement guideline is smaller than the threshold value.

(251) In FIG. **29**, the printer driver **11** generates the durability prediction screen **310** or the amount-of-operation comparison screen **320**. Alternatively, the output device **10** may generate these

screens. In other words, in the case where the output device **10** has a function of a web server, the output device **10** generates the durability prediction screen **310** or the amount-of-operation comparison screen **320** in, for example, a hypertext markup language (HTML), and transmits the generated screen to the communication terminal **30**. The communication terminal **30** displays the durability prediction screen **310** or the amount-of-operation comparison screen **320** on a web browser.

(252) The "stapler operation minimum mode" is set by the operator in the printer driver **11**. In addition, the "stapler operation minimum mode" can be set by an administrator for the individual output devices **10** via a server apparatus **600**.

(253) FIG. **30** is a schematic diagram illustrating a configuration of a network system **1000** in which the output device **10** and the server apparatus **600** are connected with each other via the network N, according to an embodiment of the present disclosure.

(254) The network system **1000** includes an administrator terminal **601**, the server apparatus **600**, and the output device **10**. The server apparatus **600** and the output device **10**, and the server apparatus **600** and the administrator terminal **601** are communicably connected to each other, via the network N that is a wide area network such as the Internet.

(255) The server apparatus **600** can acquire the contents from the print job storage unit **34** of the output device **10** as needed. The server apparatus **600** includes the durability prediction unit **24** and the minimum amount-of-operation storage unit **27** described above. Accordingly, the server apparatus **600** can provide the administrator terminal **601** with web pages including the screens illustrated in FIGS. **27** and **28** in response to a request from the administrator terminal **601**.

(256) FIG. **31** is a sequence chart illustrating the processing in which the administrator terminal **601** sets the setting of the "stapler operation minimum mode" to be turned on as the initial setting of the output device **10**, according to an embodiment of the present disclosure. S**301**: The communication unit **31** of the output device **10** transmits the contents of the print job storage unit **34** to the server apparatus **600** as needed. S**302**: The administrator inputs an operation for displaying the durability prediction screen **310** or the amount-of-operation comparison screen **320** to the administrator terminal **601**. S**303**: The administrator terminal **601** requests one of these screens to be displayed from the server apparatus **600**. S**304**: The server apparatus **600** receives the request and generates the durability prediction screen **310** or the amount-of-operation comparison screen **320** using, for example, the contents of the print job storage unit **34** and the minimum amount of operation. The server apparatus **600** transmits the screen information of the durability prediction screen **310** or the amount-of-operation comparison screen **320** to the administrator terminal **601**. S**305**: The administrator terminal **601** receives the screen information of the durability prediction screen **310** or the amount-of-operation comparison screen **320**, and displays one of these screens represented by the screen information. By the administrator terminal **601** displaying the screens illustrated in FIGS. **27** and **28**, the administrator can determine that the setting of the "stapler operation minimum mode" should be turned on. The administrator operates the administrator terminal **601** to display the print setting screen **300** for the administrator. The administrator further operates the administrator terminal **601** to designate an individual output device **10** and turn on the setting of the "stapler operation minimum mode." S**306**: The administrator terminal **601** transmits a request to turn on the setting of the "stapler operation minimum mode" to the server apparatus **600**. S**307**: The server apparatus **600** transmits, to the output device **10**, a request for setting the status in which the setting of the "stapler operation minimum mode" is turned on as the initial setting. S**308**: In response to the request from the server apparatus **600**, the output device **10** sets the setting of the "stapler operation minimum mode" to be turned on as the initial setting.

(257) As a result, when the communication terminal **30** communicates with the output device **10**, the printer driver **11** displays the print setting screen **300** on which the setting of the "stapler operation minimum mode" is turned on.

(258) As described above, in the present embodiment, the printer driver automatically changes a print setting so that the load on the stapler is minimized. In other words, the printer driver changes the print setting for changing the orientation (upward or downward) of the front face of a sheet at the time of sheet ejection or rotating image data so that the moving range of the stapler is minimized. Thus, the load on the stapler is reduced when the output device performs a print job that involves stapling to be executed by the stapler. In this way, the durability of the stapler is prevented from being decreased without imposing uniform restrictions on the operator or taking measures on the hardware.
(259) The above-described embodiments are illustrative and do not limit the present disclosure. Thus, numerous additional modifications and variations are possible in light of the above teachings. For example, elements and/or features of different illustrative embodiments may be combined with each other and/or substituted for each other within the scope of the present disclosure. Any one of the above-described operations may be performed in various other ways, for example, in an order different from the one described above.
(260) For example, in the present embodiment, the stapler **263** is described by way of example of the post-processing apparatus **9**. Alternatively, the post-processing apparatus **9** may be a punching apparatus. The processing setting pattern of the present embodiment is applicable to post-processing apparatuses other than the post-processing apparatus **9**.
(261) In the present embodiment, the processing for reducing the amount of operation of the stapler in the output device **10** when the communication terminal **30** requests the output device **10** to perform printing is described. Alternatively, the processing may be applied to a case where the output device **10** is used as a copying machine.
(262) In the present embodiment, the printer driver **11** determines the processing setting pattern associated with the print setting. Alternatively, the output device **10** may determine the processing setting pattern. In this case, the output device **10** includes the setting change unit **23** and the processing setting pattern storage unit **26**. The output device **10** determines the processing setting pattern associated with the print setting received from the printer driver **11** from the process setting pattern storage unit **26**.
(263) Still, alternatively, the web server may determine the processing setting pattern. In this case, the printer driver **11** transmits the print setting to the web server, and the web server returns the processing setting pattern associated with the print setting to the printer driver **11**.
(264) The processing setting pattern of the present embodiment is also applicable to a case where the operator operates the operation panel of the output device **10** to perform a print job stored in the output device **10**. A mode in which the operator transmits a print job to the output device **10** in advance and the operator operates the operation panel of the output device **10** to perform the print job stored in the output device **10** is referred to as pull printing. The operator can change the print setting of the print job using the operation panel. When changing the print setting, the operator can set the stapling and turn on the setting of the “stapler operation minimum mode.” When the setting of the “stapler operation minimum mode” is turned on, the output device **10** determines a processing setting pattern associated with the print setting from the processing setting pattern storage unit **26**.
(265) In the present embodiment, the sheet ejection direction of the output product is the long-edge feed. When the output device **10** supports the sheet ejection directions of the long-edge feed and the short-edge feed, the sheet ejection direction of the output product may be further included in the processing setting pattern.
(266) In the present embodiment, the setting of the document orientation to be portrait or landscape corresponds to the rotation by 90 degrees of the image data. However, the rotation by 90 degrees may be processed as a rotation by 270 degrees depending on the rotation direction. When the output device performs both 90 degree and 180 degree rotations, both rotations may be processed as a 270 degree rotation.

(267) For example, the functional configurations according to the present embodiment illustrated in FIG. **10** are divided according to functions in order to facilitate understanding of the processing executed by the communication terminal **30** and the output device **10**. No limitation to the scope of the present disclosure is intended by how the processing units are divided or by the names of the processing units. The processing units executed by the communication terminal **30** and the output device **10** may be divided into a greater number of processing units in accordance with the contents of the processing units. In addition, a single processing unit can be divided to include a greater number of processing units.
(268) Each function of the embodiments of the present disclosure described above may be implemented by one processing circuit or a plurality of processing circuits. The "processing circuit or circuitry" herein includes a programmed processor to execute functions by software, such as a processor implemented by an electronic circuit, and devices, such as an application specific integrated circuit (ASIC), a digital signal processor (DSP), a field programmable gate array (FPGA), and circuit modules known in the art arranged to perform the recited functions.
(269) Embodiments of the present disclosure can provide significant enhancements in computer capability and functionality. These enhancements allow the operators to take advantage of computers that provide more efficient and robust interaction with tables, which is a way to store and present information on information processing apparatuses. In addition, the embodiments of the present disclosure can provide a better operator experience through the use of a more efficient, powerful, and robust user interface. Such a user interface provides a better interaction between a human and a machine.
(270) Aspect 1
(271) An output device including a post-processing apparatus that executes post-processing on an output product includes a communication unit and an output control unit. The communication unit that receives a processing setting pattern, which is determined in accordance with an output condition of the output product, corresponding to an operation of the post-processing apparatus, the output condition, and image data to be output. The output control unit controls the output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition.
(272) Aspect 2
(273) In the output device according to Aspect 1, when an amount of operation of the post-processing apparatus to be reduced is set in the output condition, the processing setting pattern is a print setting pattern in which the amount of operation of the post-processing apparatus is reduced as compared with a case where the amount of operation to be reduced is not set, or when the amount of operation of the post-processing apparatus not to be reduced is not set in the output condition, the processing setting pattern is a print setting pattern in which the amount of operation of the post-processing apparatus is reduced as compared with a case where the amount of operation not to be reduced is set.
(274) In other words, in a case the output condition indicates to reduce an amount of operation of the post-processing apparatus, the processing setting pattern is determined to be a print setting pattern in which the amount of operation of the post-processing apparatus is reduced as compared with a case where the output condition indicates not to reduce the amount of operation.
(275) Aspect 3
(276) In the output device according to Aspect 1 or 2, the processing setting pattern includes a rotation of the image data to be output, determination of whether a front face of a sheet faces upward at a time of ejection of the sheet, or determination of whether a document orientation is landscape or portrait.
(277) Aspect 4 In the output device according to any one of Aspects 1 to 3, the output condition includes a sheet feeding direction, determination of whether to print on both faces or one face of the sheet, or a position where the post-processing apparatus executes processing on the output

product.
Aspect 5
(278) In the output device according to Aspect 4, the post-processing apparatus is a stapler, and the output condition includes determination of whether a long edge is bound or a short edge is bound by the stapler.
(279) Aspect 6
(280) In the output device according to Aspect 5, according to whether the output condition includes the sheet feeding direction, determination of whether to print on both faces or the one face of the sheet, and determination of whether the long edge is bound or the short edge is bound by the stapler, the rotation of the image data to be output, whether the front face of the sheet faces upward at the time of ejection of the sheet, and whether the document orientation is landscape or portrait included in the processing setting pattern are determined.
(281) Aspect 7
(282) In the output device according to Aspect 5, in a case that the output condition includes a long-edge feed as the sheet feeding direction, determination of printing on the one face of the sheet, and a staple position set to upper right, the processing setting pattern includes a rotation by 180 degrees of the image data to be output and the front face of the sheet facing upward at the time of ejection of the sheet.
(283) Aspect 8
(284) In the output device according to Aspect 5, in a case that the output condition includes a long-edge feed as the sheet feeding direction, determination of printing on both faces of the sheet, the staple position set to upper right, and determination that the short edge is bound by the stapler, the processing setting pattern includes a rotation by 180 degrees of the image data to be output and the front face of the sheet facing upward at the time of ejection of the sheet.
(285) Aspect 9
(286) An output system includes a communication terminal that executes a printer driver and an output device that outputs image data received from the printer driver. The printer driver causes the communication terminal to function as a setting reception unit that receives an output condition of an output product on a particular screen, a setting change unit that determines a processing setting pattern corresponding to an operation of a post-processing apparatus according to the output condition, and a first communication unit that transmits the processing setting pattern, the output condition, and the image data to be output to the output device. The output device includes the post-processing apparatus that executes post-processing on the output product, a second communication unit that receives the processing setting pattern, the output condition, and the image data to be output, and an output control unit that controls the output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition.
(287) Aspect 10
(288) In the output system according to Aspect 9, the post-processing apparatus is a stapler, and in a case that the output condition includes stapling, the setting change unit determines the processing setting pattern.
(289) Aspect 11
(290) In the output system according to Aspect 10, in a case that the output condition includes a setting to reduce an amount of operation of the post-processing apparatus or in a case that the output condition does not include a setting not to reduce the amount of operation of the post-processing apparatus, the setting change unit determines the processing setting pattern.
(291) Aspect 12
(292) In the output system according to any one of Aspects 9 to 11, in a case that the setting reception unit receives the setting to reduce the amount of operation of the post-processing apparatus on the particular screen or in a case that the setting reception unit does not receive the setting not to reduce the amount of operation of the post-processing apparatus on the particular

screen, the output condition is displayed on the particular screen in a mode in which the setting of the output condition included in the processing setting pattern is not received.

(293) Aspect 13

(294) In the output system according to any one of Aspects 9 to 12, the output device stores the amount of operation of the post-processing apparatus in association with the output condition. The printer driver causes the communication terminal to function as a durability prediction unit that estimates the amount of operation of the post-processing apparatus in a case that the amount of operation of the post-processing apparatus to be reduced is set or in a case that the amount of operation of the post-processing apparatus not to be reduced is not set, using the amount of operation of the post-processing apparatus in a case that the amount of operation of the post-processing apparatus associated with the output condition to be reduced is set or in a case that the amount of operation of the post-processing apparatus associated with the output condition not to be reduced is not set and a display device that displays the amount of operation of the post-processing apparatus acquired from the output device and the amount of operation of the post-processing apparatus estimated by the durability prediction unit.

(295) Aspect 14

(296) In the output system according to any one of Aspects 9 to 12, the output device stores the amount of operation of the post-processing apparatus in association with the output condition. The printer driver causes the communication terminal to function as a display device that displays, in association with a number of jobs in which the image data is output, a first line representing accumulation of the amount of operation of the post-processing apparatus in a past acquired from the output device, a second line representing a standard relationship between the number of jobs and a change in the amount of operation of the post-processing apparatus, and a third line representing a relationship between the number of jobs and the change in the amount of operation of the post-processing apparatus, which is predicted in the case that the amount of operation of the post-processing apparatus to be reduced is set or in the case that the amount of operation of the post-processing apparatus not to be reduced is not set.

(297) Aspect 15

(298) In the output system according to Aspect 13 or 14, when the amount of operation of the post-processing apparatus acquired from the output device exceeds a value set in advance, the display device displays a message recommending a setting in which the amount of operation of the post-processing apparatus to be reduced is set or another setting in which the amount of operation of the post-processing apparatus not to be reduced is not set.

(299) Aspect 16

(300) In the output system according to Aspect 13 or 14, when the amount of operation of the post-processing apparatus acquired from the output device exceeds a value set in advance, the setting reception unit sets, as an initial setting, a mode in which the amount of operation of the post-processing apparatus to be reduced is set or another mode in which the amount of operation of the post-processing apparatus not to be reduced is not set.

(301) The above-described embodiments are illustrative and do not limit the present invention. Thus, numerous additional modifications and variations are possible in light of the above teachings. For example, elements and/or features of different illustrative embodiments may be combined with each other and/or substituted for each other within the scope of the present invention. Any one of the above-described operations may be performed in various other ways, for example, in an order different from the one described above.

(302) The functionality of the elements disclosed herein may be implemented using circuitry or processing circuitry which includes general purpose processors, special purpose processors, integrated circuits, application specific integrated circuits (ASICs), digital signal processors (DSPs), field programmable gate arrays (FPGAs), conventional circuitry and/or combinations thereof which are configured or programmed to perform the disclosed functionality. Processors are

considered processing circuitry or circuitry as they include transistors and other circuitry therein. In the disclosure, the circuitry, units, or means are hardware that carries out or is programmed to perform the recited functionality. The hardware may be any hardware disclosed herein or otherwise known which is programmed or configured to carry out the recited functionality. When the hardware is a processor which may be considered a type of circuitry, the circuitry, means, or units are a combination of hardware and software, the software being used to configure the hardware and/or processor.

(303) In another aspect, an output method performed by an output device including a post-processing apparatus to execute post-processing on an output product includes receiving a processing setting pattern that is determined in accordance with an output condition of the output product and corresponding to an operation to be performed by the post-processing apparatus, the output condition, and image data of an image to be formed on the output product and controlling output of the image data based on the processing setting pattern and the output condition.

(304) In another aspect, a communication terminal that communicates, via a network, with an output device that performs a print job received from the communication terminal using a post-processing apparatus includes circuitry to receive an output condition of an output product on a screen, determine a processing setting pattern corresponding to an operation of the post-processing apparatus according to the output condition, and transmit the processing setting pattern, the output condition, and image data of an image to be formed on the output product to the output device.

(305) In another aspect, an output method performed by an output system including a communication terminal that executes a printer driver and an output device that outputs image data received from the printer driver includes receiving an output condition of an output product on a screen, determining a processing setting pattern corresponding to an operation of a post-processing apparatus according to the output condition, transmitting the processing setting pattern, the output condition, and image data of an image to be formed on the output product to an output device, receiving the processing setting pattern, the output condition, and the image data of the image to be formed on the output product, and controlling output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition.

Claims

1. An output device communicably connected with a post-processing apparatus for executing post-processing on an output product output from the output device, the output device comprising: circuitry configured to: receive a processing setting pattern that is determined in accordance with an output condition of the output product and corresponding to an operation to be performed by the post-processing apparatus, the output condition, and image data of an image to be formed on the output product; and control output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition, wherein in a case in which the output condition indicates to reduce an amount of operation of the post-processing apparatus from a home position, the processing setting pattern is determined to be a print setting pattern in which the amount of operation of the post-processing apparatus is reduced as compared with a case in which the output condition indicates not to reduce the amount of operation.

2. The output device according to claim 1, wherein the processing setting pattern includes at least one of a rotation of the image data to be output, indication of whether a front face of a sheet faces upward at a time of ejection of the sheet, or indication of whether a document orientation is landscape or portrait.

3. The output device according to claim 1, wherein the output condition includes at least one of a sheet feeding direction, indication of whether to print on both faces or one face of a sheet, or a position where the post-processing apparatus executes processing on the output product.

4. The output device according to claim 3, wherein the post-processing apparatus is a stapler, and

the output condition includes indication of whether a long edge is bound or a short edge is bound by the stapler.
5. The output device according to claim 4, wherein, according to whether the output condition includes the sheet feeding direction, the indication of whether to print on both faces or the one face of the sheet, and the indication of whether the long edge is bound or the short edge is bound by the stapler, a rotation of the image data to be output, indication of whether a front face of the sheet faces upward at a time of ejection of the sheet, and indication of whether a document orientation is landscape or portrait included in the processing setting pattern are determined.
6. The output device according to claim 4, wherein, in a case in which the output condition includes a long-edge feed as the sheet feeding direction, the indication of printing on the one face of the sheet, and a staple position set to an upper right, the processing setting pattern includes a rotation by 180 degrees of the image data of the image to be formed on the output product and a front face of the sheet facing upward at a time of ejection of the sheet.
7. The output device according to claim 4, wherein, in a case in which the output condition includes a long-edge feed as the sheet feeding direction, the indication of printing on both faces of the sheet, a staple position set to an upper right, and the indication that the short edge is bound by the stapler, the processing setting pattern includes a rotation by 180 degrees of the image data of the image to be formed on the output product and a front face of the sheet facing upward at a time of ejection of the sheet.
8. An output system comprising: a communication terminal comprising first circuitry; an output device communicably connected with the post-processing apparatus, the output device comprising second circuitry configured to output an output product having an image, the image being formed based on image data received from the communication terminal; and a post-processing apparatus to execute post-processing on the output product, the first circuitry of the communication terminal being configured to execute a printer driver to: receive an output condition of the output product via a screen; determine a processing setting pattern corresponding to an operation to be performed by the post-processing apparatus according to the output condition; and transmit the processing setting pattern, the output condition, and the image data to be output to the output device, and the second circuitry of the output device being configured to: receive the processing setting pattern, the output condition, and the image data of the image to be formed on the output product; and control output of the image data using the post-processing apparatus based on the processing setting pattern and the output condition, wherein the output device further includes a memory that stores an amount of operation of the post-processing apparatus in association with the output condition, and the first circuitry is configured to execute the printer driver to: estimate the amount of operation of the post-processing apparatus in a case in which the output condition indicates to reduce the amount of operation of the post-processing apparatus, using the amount of operation of the post-processing apparatus associated with the output condition indicating not to reduce the amount of operation; and display the amount of operation of the post-processing apparatus acquired from the memory and an estimated amount of operation of the post-processing apparatus.
9. The output system according to claim 8, wherein the post-processing apparatus is a stapler, and in a case in which the output condition includes stapling, the first circuitry is configured to determine the processing setting pattern.
10. The output system according to claim 9, wherein, in a case in which the output condition indicates to reduce the amount of operation of the post-processing apparatus, the first circuitry is configured to determine the processing setting pattern.
11. The output system according to claim 8, wherein, in a case in which a setting indicating to reduce the amount of operation of the post-processing apparatus is received on the screen, the output condition is displayed on the screen in a mode in which a setting of the output condition included in the processing setting pattern is not received.
12. The output system according to claim 8, wherein the output device includes a memory that

stores the amount of operation of the post-processing apparatus in association with the output condition, and the first circuitry is configured to execute the printer driver to display, in association with a number of jobs in which the image data is output, a first line representing accumulation of the amount of operation of the post-processing apparatus in a past acquired from the memory, a second line representing a standard relationship between the number of jobs and a change in the amount of operation of the post-processing apparatus, and a third line representing a predicted relationship between the number of jobs and the change in the amount of operation of the post-processing apparatus, which is predicted in a case in which the amount of operation of the post-processing apparatus is to be reduced.

13. The output system according to claim 8, wherein, in a case in which the amount of operation of the post-processing apparatus acquired from the memory exceeds a value set in advance, the first circuitry is configured to display a message recommending a setting indicating to reduce the amount of operation of the post-processing apparatus.

14. The output system according to claim 8, wherein, in a case in which the amount of operation of the post-processing apparatus acquired from the output device exceeds a value set in advance, the first circuitry is configured to set, as an initial setting, a mode in which the amount of operation of the post-processing apparatus to be reduced is set or another mode in which the amount of operation of the post-processing apparatus not to be reduced is not set.

15. An output method performed by a communication terminal that executes a printer driver, the method comprising: receiving an output condition of an output product via a screen; determining a processing setting pattern corresponding to an operation to be performed on the output product by a post-processing apparatus according to the output condition; transmitting, to an output device, the processing setting pattern, the output condition, and image data of an image to be formed on the output product; and in a case in which the output condition indicates to reduce an amount of operation of the post-processing apparatus from a home position, determining the processing setting pattern to be a print setting pattern in which the amount of operation of the post-processing apparatus is reduced as compared with a case in which the output condition indicates not to reduce the amount of operation.

16. A non-transitory recording medium storing a plurality of program codes which, when executed by one or more processors, causes the one or more processors to perform the method according to claim 15.