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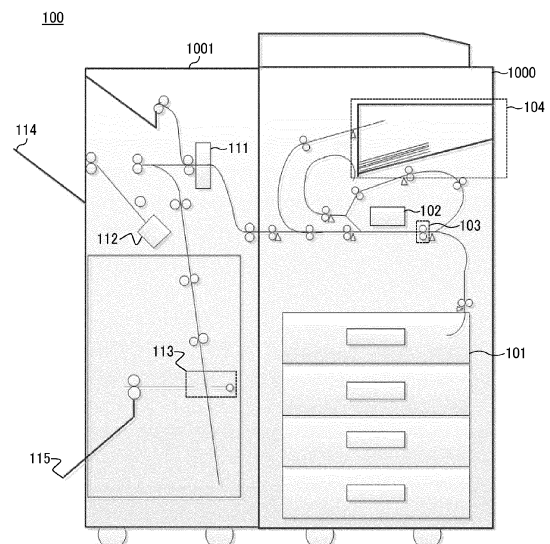
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(54) **IMAGE FORMING APPARATUS AND IMAGE FORMING SYSTEM**

(57) An image forming apparatus (1000) includes a conveyor (100F3), an image forming device (102, 100F1), and a reversing device (100F2). The conveyor (100F3) conveys a recording medium. The image forming device (102, 100F1) forms an image on the recording medium. The reversing device (100F2) reverses the recording medium in the image forming apparatus after the image forming device (102, 100F1) forms the image. The image forming device (102, 100F1) performs image formation from a first page of recording media when the image forming device (102, 100F1) performs the image formation on one side of the recording media. The image forming device (102, 100F1) performs image formation from a last page of recording media when the image forming device (102, 100F1) performs the image formation on one side of the recording.

FIG. 1



Description

BACKGROUND

Technical Field

[0001] Embodiments of the present disclosure relate to an image forming apparatus and an image forming system.

Related Art

[0002] There is a known a technology in which a relay device is disposed in midway on a conveyance path through which a recording medium is conveyed to a device such as a so-called finisher that performs post-processing after an image has been formed on the recording medium.

[0003] More specifically, first, the relay device includes two conveyance paths. The relay device receives the recording medium in a switchback path of the conveyance paths and conveys the recording medium to a merging path of the conveyance paths. As described above, a technology is known in which a relay device or any other device performs a switchback operation to reverse the front side and the back side of a recording medium, (see, e.g., Japanese Unexamined Patent Application Publication No. 2020-100477).

[0004] In the related art, the front side and the back side of the recording medium are reversed by the relay device or any other device. Accordingly, there is a disadvantage that the size of an image forming system including, for example, the relay device may increase.

SUMMARY

[0005] In light of the above-described disadvantage, an object of the present disclosure is to provide an image forming apparatus that can reverse the front side and the back side of a recording medium in the image forming apparatus and eliminates the need to reverse the front and the back side of the recording medium, for example, in a relay device and a post-processing apparatus to reduce the size of the image forming apparatus. Another purpose of the present disclosure is to ensure productivity of the image forming apparatus.

[0006] According to an embodiment of the present disclosure, an image forming apparatus includes a conveyor, an image forming device, and a reversing device. The conveyor conveys a recording medium. The image forming device forms an image on the recording medium conveyed from the conveyor. The reversing device reverses the recording medium in the image forming apparatus after the image forming device forms the image. The conveyor conveys the recording medium to ejects the recording medium to an output tray with the image on the recording medium facing down or conveys the recording medium to a post-processing apparatus with the image

on the recording medium facing up. The image forming device performs image formation from a first page of recording media when the image forming device performs the image formation on one side of the recording media and the conveyor conveys the recording media to eject the recording media to the output tray. The image forming device performs image formation from a last page of recording media when the image forming device performs the image formation on one side of the recording media and the conveyor conveys the recording media to the post-processing apparatus.

[0007] According to another embodiment of the present disclosure, an image forming apparatus includes a conveyor, an image forming device, and a reversing device. The conveyor conveys a recording medium. The image forming device form an image on the recording medium conveyed from the conveyor. The reversing device reverses the recording medium in the image forming apparatus after the image forming device forms the image. The conveyor conveys the recording medium to eject the recording medium to an output tray with the image on the recording medium facing down or conveys the recording medium to a post-processing apparatus with the image on the recording medium facing up. The image forming device performs image formation from a first page of recording media when the image forming device performs the image formation on one side of the recording media and the conveyor conveys the recording media to eject the recording media to the output tray. The image forming device performs image formation from a first page of recording media, the reversing device reverses the recording media, and the conveyor conveys the recording media to the post-processing apparatus when the image forming device performs the image formation on one side of the recording media and the conveyor conveys the recording media to the post-processing apparatus.

[0008] According to still another embodiment of the present disclosure, an image forming system includes the image forming apparatus according to the above-described embodiments. According to embodiments of the present disclosure, the size of the image forming apparatus can be reduced, and the productivity of the image forming apparatus can be ensured.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] A more complete appreciation of the disclosure and many of the attendant advantages and features thereof can be readily obtained and understood from the following detailed description with reference to the accompanying drawings, wherein:

FIG. 1 is a diagram illustrating an overall configuration of an image forming apparatus according to an embodiment of the present disclosure;
FIG. 2 is a schematic side view of the image forming

apparatus of FIG. 1, illustrating a first conveyance path provided for the image forming apparatus; FIG. 3 is a schematic side view of the image forming apparatus of FIG. 1, illustrating a second conveyance path and a third conveyance path provided for the image forming apparatus; FIG. 4 is a schematic side view of the image forming apparatus of FIG. 1, illustrating a fourth conveyance path provided for the image forming apparatus; FIG. 5 is a schematic side view of the image forming apparatus of FIG. 4 in which a recording medium is conveyed to the second conveyance path; FIG. 6 is a flowchart of first overall processing executed by an image forming apparatus, according to an embodiment of the present disclosure; FIG. 7 is a flowchart of second overall processing executed by an image forming apparatus, according to an embodiment of the present disclosure; FIG. 8 is a schematic side view of an image forming system according to a control sample of the present disclosure; FIG. 9 is a diagram illustrating a functional configuration of an image forming apparatus according to an embodiment of the present disclosure; and FIG. 10 is a diagram illustrating a hardware configuration of an image forming apparatus that performs control such as switching a conveyance path, according to an embodiment of the present disclosure.

[0010] The accompanying drawings are intended to depict embodiments of the present invention 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

[0011] 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.

[0012] 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.

[0013] Descriptions are given of embodiments of the present disclosure with reference to the drawings and specific examples in the following description. Note that the embodiments are not limited to the specific examples described below.

Overall Configuration Example of Image Forming Apparatus

[0014] FIG. 1 is a diagram illustrating an overall configuration of an image forming apparatus. In FIG. 1, an image forming apparatus 1000 according to an embodiment of the present disclosure is illustrated. For example, the image forming apparatus 1000 is coupled to, for example, a post-processing apparatus 1001 to make up an image forming system 100. Note that the post-processing apparatus 1001 may be any other type of post-processing apparatus than the post-processing apparatus 1001 illustrated in FIG. 1 depending on the presence or absence of post-processing.

[0015] In addition, a sheet ejection side on which an output tray 114 of the post-processing apparatus 1001 is disposed may be coupled with a sheet carry-in side of another post-processing apparatus 1001 to make up a configuration in which two or more post-processing apparatuses are coupled. Furthermore, the image forming system 100 may include any other apparatus(es) than the image forming apparatus 1000 and the post-processing apparatus 1001.

[0016] The image forming apparatus 1000 has a hardware configuration that includes, for example, a sheet feeder 101 and a printing device 102 serving as an image forming device.

[0017] The printing device 102 is a device that includes, for example, ink heads that apply ink to a recording medium and apply, i.e., print the ink stored in the printing device 102 to the recording medium to form an image on the recording medium. Note that the printing device 102 is not limited to an inkjet device and may be a device that performs image formation by any other suitable method such as an electrophotographic method.

[0018] The sheet feeder 101 stores recording media such as sheets of paper. Based on, for example, an instruction from an operation panel of the image forming apparatus 1000, or a print job instructed via a network, the sheet feeder 101 conveys a recording medium stored in the sheet feeder 101 toward the printing device 102 by a conveyor for image formation.

[0019] At least conveyance rollers 103 of the conveyor are arranged in pair on the conveyance path. The conveyance rollers 103 are rotated by an actuator such as a motor. More specifically, the conveyance rollers 103 rotate while nipping the recording medium to convey the recording medium toward the printing device 102. Further, a plurality of conveyance rollers may be disposed upstream and downstream from the printing device 102 in the conveyance path.

[0020] Note that it is sufficient that the conveyance rollers convey the recording medium, and the recording medium may be conveyed by, for example, an actuator, a mechanism, and a controller included in the conveyor other than the conveyance rollers. For example, a conveyance belt may be used.

[0021] When a print job is input, the image forming ap-

paratus 1000 conveys a recording medium to the printing device 102 and forms an image on the recording medium. The printing device 102 forms an image indicated by the input data on the recording medium. The input data is data transmitted from, for example, an information processing device connected to the image forming apparatus 1000 via, for example, a network. Note that the input data may be image data read by a document reader in the image forming apparatus 1000.

[0022] After the printing device 102 has formed an image on the recording medium, the image forming apparatus 1000 ejects the recording medium to the output tray 104 of the image forming apparatus 1000 or conveys the recording medium toward the post-processing apparatus 1001.

[0023] The recording medium printed by the printing device 102 is conveyed along conveyance guides and is ejected to the output tray 104 disposed above the printing device 102 while being reversed. Note that the position, shape, and arrangement of the output tray 104 are not limited to the position, shape, and arrangement illustrated in FIGS. 1, 2, 3, and 4. For example, the output tray 104 may be disposed at a different position such as a position at which an output tray protruding rightward from a right-side surface of the image forming apparatus 1000 is disposed.

[0024] After the image forming apparatus 1000 has formed an image on a recording medium, the post-processing apparatus 1001 performs post-processing on the recording medium on which the image has been formed. The post-processing apparatus 1001 includes, for example, at least one of a punching device 111, a stapling device 112, or a saddle stitching device 113. Note that the post-processing apparatus 1001 may include any other device(s) than the punching device 111, the stapling device 112, or the saddle stitching device 113 described above.

[0025] The punching device 111 forms through holes at predetermined positions on a recording medium conveyed from the image forming apparatus 1000. Note that the punching device 111 can form the through holes in a recording medium passing through the punching device 111 or may not form the through holes in the recording medium passing through the punching device 111.

[0026] The stapling device 112 is located downstream from the punching device 111, holds the conveyed recording medium in an internal tray of the stapling device 112, and drives staples on a trailing end of the recording medium. The recording medium conveyed after being switched back is stapled by the stapling device 112 and ejected to the output tray 114 of the post-processing apparatus 1001. Note that the stapling device 112 can be moved to a predetermined position in a direction orthogonal to the conveyance direction. Further, the stapling device 112 can be rotated by a predetermined angle and can change positions at which the stapling device 112 drives staples on a recording medium.

[0027] The saddle stitching device 113 is located

downstream from the punching device 111 and temporarily holds a leading end of a recording medium that has been switched back and conveyed on a tray. Subsequently, the tray is lifted and a vicinity of the center of the recording medium is pressed with a sheet folding plate, i.e., saddle stitching plate, to crease the recording medium. Then, staples are driven in the vicinity of the center of the folded recording medium, in the vicinity of the folded leading edge of the recording medium to stitch the recording medium for bookbinding. Then, the saddle-stitched recording medium is ejected to an output tray 115 of the post-processing apparatus 1001.

[0028] In addition, the recording medium that has passed through the punching device 111 can be ejected to an output tray in a vicinity of the upper surface of the post-processing apparatus 1001 or to the output tray 114 without passing through the stapling device 112 when the recording medium is not stapled by the stapling device 112 or saddle stitched by the saddle stitching device 113.

[0029] The post-processing apparatus 1001 can perform post-processing, such as sorting in the output tray 114, binding by the stapling device 112, and saddle-stitching by the saddle stitching device 113. The user switches the type of post-processing to be performed by setting a post-processing mode in advance.

[0030] In a sorting mode, post-processing such as sorting of sheets, i.e., recording media, is performed. In the sorting mode, a plurality of sheets to be sorted are conveyed such that each of the multiple sheets is shifted by a predetermined amount in a direction orthogonal to the conveyance direction (hereinafter referred to as orthogonal direction) by, for example, a pair of axially movable conveyance rollers in the vicinity of the output tray 114, or a movable lateral side presser. Then, the multiple sheets are conveyed to, for example, an output tray.

[0031] When the binding mode is performed, the binding device performs post-processing such as stapling of sheets. First, multiple sheets are stored in an internal tray. Next, the multiple sheets are conveyed from the internal tray to an end fence in the vicinity of the stapling device 112 by, for example, beating rollers and auxiliary rollers. The multiple sheets abut against the end fence. Thus, the ends of the multiple sheets are aligned.

[0032] In the internal tray, side fences of the internal tray, which is also referred to, for example, as jogger fences, hold the multiple sheets between the side fences. As described above, the multiple sheets are aligned in the orthogonal direction by the side fences.

[0033] Note that the binding device may be multiple binding devices, for example, an upper binding device and a lower binding device. After an operation of binding multiple sheets has been performed by one of the multiple binding devices, the sheets are switched with a switching claw on a discharge path and conveyed from an ejection port to the output tray.

[0034] Alternatively, the multiple binding devices may be disposed in the orthogonal direction. Accordingly, mul-

multiple sheets can be bound at different positions without moving the stapling device 112 in the orthogonal direction.

[0035] In a saddle stitching mode, first, stitching processing is performed on a central portion of multiple sheets. After the stitching processing is performed, folding processing is performed on the central portion of the multiple sheets. For example, the folding processing is performed by, for example, a sheet folding plate.

Configuration Example of Reversing Device

[0036] A configuration example of a reversing device is described in the following description. The image forming apparatus 1000 performs simplex printing to form an image on only one side of a recording medium and the image forming device performs image formation. Thereafter, the recording medium is reversed in the image forming apparatus 1000, then the recording medium is conveyed to the post-processing apparatus. The recording medium is a sheet of paper in the configuration example. Further, the image forming apparatus 1000 performs the simplex printing on four continuous sheets. Each of the four sheets of paper as the recording media is referred to as a first sheet 301, a second sheet 302, a third sheet 303, and a fourth sheet 304 in order of image formation.

[0037] For example, the image forming apparatus 1000 can reverse the recording medium by the following processing.

[0038] FIG. 2 is a schematic side view of the image forming apparatus according to the present embodiment, illustrating a first conveyance path provided for the image forming apparatus. Among surfaces of a sheet, a surface on which the printing device 102 performs image formation is referred to as a first side of the recording medium, which is a so-called front side. On the other hand, a surface different from the first side of the recording medium is referred to as a second side, which is a so-called rear side.

[0039] Accordingly, in the case of simplex printing, the printing device 102 performs image formation on the first side and does not perform image formation on the second side. On the other hand, in the case of duplex printing, the printing device 102 performs image formation in order of the first side and the second side.

[0040] In FIG. 2, the first side of the first sheet 301 directly below the printing device 102 faces upward.

[0041] When image formation is started, the first sheet 301 is conveyed from the sheet feeder 101 to a position at which the printing device 102 performs image formation. Among conveyance paths provided for the image forming apparatus 1000 along which the recording medium is conveyed, a path formed by conveyance guides extending from the conveyance roller 103 upstream from the printing device 102 toward downstream from the printing device 102, which is used by the image forming device to form an image on the recording medium, is

referred to as a first path 201.

[0042] After an image has been formed, the image forming apparatus 1000 conveys the first sheet 301 as described below.

[0043] FIG. 3 is a schematic side view of the image forming apparatus according to the present embodiment, illustrating a second conveyance path and a third conveyance path provided for the image forming apparatus. In addition to the first path 201 illustrated in FIG. 2, the image forming apparatus 1000 includes a second path 202 and a third path 203 as described below.

[0044] The second path 202 is a path formed by conveyance guides that convey the first sheet 301 from the first path 201 of the printing device 102. In other words, the second path 202 is a path located downstream from the first path 201 and includes curved conveyance guides that convey the recording medium upward from a horizontal state to a vertical state with the first side of the printed recording medium facing inward.

[0045] The second path 202 is a path formed by conveyance guides that convey the first sheet 301 to the output tray 104.

[0046] As illustrated in FIG. 3, the second path 202 is a path formed by conveyance guides that convey the recording medium to the post-processing apparatus 1001 (see FIG. 1) and convey the first sheet 301 to an ejection port formed on an outer surface of the image forming apparatus 1000.

[0047] In other words, whether the sheet conveyed from the first path 201 to the second path 202 is ejected to the output tray 104 or conveyed to the post-processing apparatus 1001 is switched and selected by the switching claw.

[0048] Note that the second path 202 is not limited to the path as illustrated in FIG. 3, and the recording medium may be conveyed from the second path 202 to three or more destinations. In other words, a path that serves as the second path 202 may be further provided with the first path 201.

[0049] The second path 202 is a path formed by conveyance guides that convey the first sheet 301 from the first path 201 in which the printing device 102 is located. In other words, the second path 202 is a path located downstream from the first path 201 and includes curved conveyance guides that convey the recording medium upward from a horizontal state to a vertical state with the first side of the printed recording facing inward.

[0050] Further, the second path 202 is a path formed by conveyance guides that convey the first sheet 301 to the output tray 104.

[0051] The third path 203 is a path that includes one end of the third path 203 formed by conveyance guides that convey the first sheet 301 from the first path 201 of the printing device 102.

[0052] In other words, the third path 203 is a path located downstream from the first path 201 and includes curved conveyance guides that convey the recording medium upward from a horizontal state to a vertical state

with the first side of the printed recording medium facing inward, inside the second path 202. Further, when the first sheet 301 is long, the third path 203 may have an opening that allows the first sheet 301 to be temporarily conveyed onto the output tray 104.

[0053] Note that, as illustrated in FIG. 3, the third path 203 may be any path as long as the recording medium on which an image has been formed on the first side of the recording medium can be temporarily stored along the third path 203. For example, the length and the shape of the third path 203 may be any other suitable length and shape than the length and the shape illustrated in FIG. 3.

[0054] The first sheet 301 is conveyed from the first path 201 to the second path 202 or the third path 203. The image forming apparatus 1000 switches whether to convey the recording medium on which the image has been formed on the first side from the first path 201 to the second path 202 or from the first path 201 to the third path 203 by a switching claw based on, for example, a condition.

[0055] In other words, after the first path 201, the image forming apparatus 1000 branches the conveyance path of the recording medium to either the second path 202 or the third path 203 as the destination. The image forming apparatus 1000 includes, for example, a switch mechanism that switches the destination to which the recording medium is conveyed in a branch point with a switching claw. Controlling such a switch mechanism as described above allows the image forming apparatus 1000 to switch which path is to be used among a plurality of paths.

[0056] As illustrated in FIG. 3, after the first sheet 301 has been conveyed to the third path 203, the image forming apparatus 1000 starts image formation on the second sheet 302 which is the next recording medium.

[0057] More specifically, after the first sheet 301 has been conveyed to the third path 203, the second sheet 302 is conveyed to the first path 201. Next, similarly to the first sheet 301, the printing device 102 forms an image on the first side of the second sheet 302.

[0058] Note that the relative positions of the first sheet 301 and the second sheet 302 are not limited to the relative positions of the first sheet 301 and the second sheet 302 illustrated in FIG. 3. The image formation on the second sheet 302 may be started at a timing when the first sheet 301 is being conveyed as long as the conveyance of the first sheet 301 is not hindered, that is, as long as the trailing edge of the first sheet 301 has passed through the printing device 102.

[0059] FIG. 4 is a schematic side view of the image forming apparatus according to the present embodiment, illustrating a fourth path provided for the image forming apparatus. As illustrated in FIG. 4, a fourth path 204 is a path formed by conveyance guides along which the first sheet 301 located in the third path 203 is switched back and conveyed. In other words, the fourth path 204 is a path that is located downstream from the third path 203 when the recording medium is switched back, conveys

the printed recording medium in a horizontal state with the first side of the recording medium facing upward, and includes curved conveyance guides that extend downward. The fourth path 204 is a path formed by conveyance guides that convey the first sheet 301 located in the fourth path 204 to the first path 201 again with the first side of the recording medium facing downward.

[0060] As illustrated in FIG. 4, when the recording medium is switched back from the third path 203 and passes through the fourth path 204, the first side and the second side of the recording medium are reversed. More specifically, when the recording medium passes through the fourth path 204, the recording medium rotates to perform so-called pitch rotation.

[0061] Note that the recording medium may be reversed in a path other than the fourth path 204. However, desirably, the image forming apparatus 1000 reverses the recording medium in the fourth path 204 used for duplex printing. As described above, in the image forming apparatus 1000, the recording medium passes through, for example, the fourth path 204 to be reversed. Accordingly, the need for conveyance guides or conveyance rollers that serve as another path can be obviated. Note that, in the fourth path 204, the conveyance guides in the horizontal direction are longer than the conveyance guides in the vertical direction downstream from the conveyance guide in the horizontal direction. Accordingly, the time for which a print component such as ink to be printed on the recording medium by the printing device 102 is dried is increased and a region of the recording medium that contacts and slides on the conveyance guides is reduced.

[0062] As illustrated in FIG. 4, the recording medium is conveyed from the first path 201 to the third path 203, switched back, conveyed from the third path 203 to the fourth path 204, rotated, and conveyed again to the first path 201.

[0063] In other words, the first side of the recording medium conveyed from the fourth path 204 to the first path 201 faces downward and the second side of the recording medium faces upward.

[0064] Note that when the simplex printing is performed, image formation, i.e., printing, is not performed on the second side of the recording medium that passes through the printing device 102 after the printing is performed on the first side. On the other hand, when the duplex printing is performed in which the recording medium is conveyed along the same path as in the simplex printing, the printing device 102 can perform image formation on the second side of the recording medium.

[0065] As described above, in a condition in which the recording medium is conveyed to the post-processing apparatus 1001 in simplex printing, the recording medium is conveyed to the post-processing apparatus 1001 without formation of an image on the second side of the recording medium facing upward. At this time, the switching claw is in a position such that the recording medium that has been conveyed to the second path 202 is to be

conveyed toward the post-processing apparatus 1001. Accordingly, similarly to the case in which the duplex printing is performed with the second side of the recording medium facing upward, the recording medium is conveyed toward the post-processing apparatus 1001. Note that in duplex printing, when the recording medium is ejected not to the post-processing apparatus 1001 but to the output tray 114, the recording medium is conveyed again through the third path 203 and the fourth path 204. Thus, the recording medium can be ejected with the first side of the recording medium facing downward. However, the productivity of the image forming apparatus 1000 is higher when the recording medium is conveyed to the post-processing apparatus 1001.

[0066] At the same time as or after the first sheet 301 is conveyed to the fourth path 204, the image forming apparatus 1000 conveys the second sheet 302 having an image formed on the first side of the second sheet 302 to the third path 203 in the same manner as the first sheet 301.

[0067] Further, similarly to the first sheet 301 and the second sheet 302, the image forming apparatus 1000 starts image formation on the third sheet 303.

[0068] FIG. 5 is a schematic side view of the image forming apparatus in which a recording medium is conveyed to the second path, according to the present embodiment. The first sheet 301 located on the fourth path 204, as illustrated in FIG. 4, is conveyed to the second path 202 as illustrated in FIG. 5. In other words, after the first sheet 301 has been conveyed to the second path 202, the first sheet 301 is conveyed to the post-processing apparatus 1001.

[0069] More specifically, the image forming apparatus 1000 conveys the first sheet 301 located on the fourth path 204, as illustrated in FIG. 4, to the second path 202 via the first path 201 as illustrated in FIG. 5.

[0070] As illustrated in FIGS. 4 and 5, the first sheet 301 has passed through the third path 203 and the fourth path 204. Accordingly, the first side of the first sheet 301 faces downward and the second side of the first sheet 301 faces upward in the second path 202 when the first sheet 301 is reconveyed to the second path 202.

[0071] Then, before the first sheet 301 reaches a branch point of the second path 202 and the third path 203, the image forming apparatus 1000 switches the destination to which the first sheet 301 is conveyed to a direction in which the second path 202 continues with the switching claw.

[0072] As described above, for example, in the second path 202, the image forming apparatus 1000 can reverse the first sheet 301 such that the side of the first sheet 301 on which an image has been formed, i.e., the first side of the first sheet 301 facing upward is turned upside down to face downward.

[0073] Similar to the first sheet 301, when, for example, the third path 203 and the fourth path 204 are employed, the image forming apparatus 1000 can reverse the first side and the second side of the second sheet 302, the

third sheet 303, and the fourth sheet 304.

[0074] More specifically, when the second sheet 302 is conveyed to the second path 202 from a state illustrated in FIG. 5 in a similar manner to the first sheet 301, the image forming apparatus 1000 can reverse the second sheet 302, the third sheet 303, and the fourth sheet 304 such that the first side of each of the second sheet 302, the third sheet 303, and the fourth sheet 304 faces down.

[0075] When the third sheet 303 is conveyed to the fourth path 204 from a state illustrated in FIG. 5 in a similar manner to, for example, the first sheet 301, the image forming apparatus 1000 can reverse the third sheet 303 in a similar manner to the first sheet 301 and the second sheet 302.

[0076] When the fourth sheet 304 is conveyed to, for example, the third path 203 in a similar manner to, for example, the first sheet 301 from a state illustrated in FIG. 5, the image forming apparatus 1000 can reverse the fourth sheet 304 in a similar manner to the first sheet 301, the second sheet 302, and the third sheet 303.

[0077] As described above, even when a plurality of recording media such as the first sheet 301, the second sheet 302, the third sheet 303, and the fourth sheet 304 are handled, the image forming apparatus 1000 can reverse each of the recording medium in the image forming apparatus 1000 if the image forming apparatus includes a reversing device including, for example, the third path 203 and the fourth path 204.

[0078] For this reason, when the recording medium can be reversed in the image forming apparatus 1000, for example, a reversing device can be eliminated from the relay device. Accordingly, in the case of the image forming apparatus 1000 having such a configuration as described above, for example, the relay device can be reduced in size even when the recording medium is reversed in the image forming apparatus 1000. Thus, the image forming system 100 can be reduced in size.

Example of Overall Processing of Image Forming Apparatus

[0079] FIG. 6 is a flowchart of first overall processing executed by the image forming apparatus 1000, according to an embodiment of the present disclosure. The image forming apparatus 1000 performs overall processing as described below. A description is given below of a case in which a print job is input from, for example, a controller and printing is started.

[0080] In the overall processing described below, the image forming apparatus 1000 determines whether to perform binding processing in step S0601, whether to perform simplex printing or duplex printing in step S0602, and whether to perform multiple-page printing in step S0609 based on conditions as a print job input in advance. Note that the overall processing is not limited to step S0601, step S0602, and step S0608 as long as whether reversing the recording medium is necessary can be determined. The conditions may be determined

in any other suitable order or procedure.

[0081] In step S0601, the image forming apparatus 1000 determines whether to perform binding processing.

[0082] Next, if it is determined that the binding processing is to be performed (YES in step S0601), the image forming apparatus 1000 proceeds to step S0602. On the other hand, if it is determined that the binding processing is not to be performed (NO in step S0601), the image forming apparatus 1000 proceeds to step S0609.

[0083] In step S0602, the image forming apparatus 1000 determines whether to perform simplex printing or duplex printing.

[0084] Next, if it is determined the simplex printing is to be performed (simplex printing in step S0602), the image forming apparatus 1000 proceeds to step S0607. On the other hand, if it is determined that the duplex printing is to be performed (duplex printing in step S0602), the image forming apparatus 1000 proceeds to step S0603.

[0085] In step S0603, the image forming apparatus 1000 forms an image on a first side of the recording medium among both sides of the recording medium.

[0086] In step S0604, the image forming apparatus 1000 reverses the first side and the second side of the recording medium using the third path 203 and the fourth path 204.

[0087] In step S0605, the image forming apparatus 1000 forms an image on the second side of the recording medium among both sides of the recording medium.

[0088] In step S0606, the image forming apparatus 1000 conveys the recording medium to the second path 202. Then, the image forming apparatus 1000 conveys the recording medium from the second path 202 to, for example, the post-processing apparatus 1001 based on the input condition.

[0089] In step S0607, the image forming apparatus 1000 forms an image on the first side of the recording medium among both sides of the recording medium.

[0090] In step S0608, the image forming apparatus 1000 reverses the first side and the second side of the recording medium using the third path 203 and the fourth path 204.

[0091] In step S0607 and step S0608, that is, in a condition in which simplex printing and binding processing are to be performed, the overall processing is different in that image formation is not performed on the second side of the recording medium in step S0605 compared with step S0603, step S0604, and step S0605.

[0092] In a condition in which the binding processing is to be performed (YES in step S0601), the overall processing reverses the recording medium using the third path 203 and the fourth path 204, for example, in a similar manner to step S0604 or step S0608. When the recording medium is reversed as described above, the recording medium is accumulated on, for example, the output tray 114 of the post-processing apparatus 1001 in a state in which the first side of the recording medium faces downward.

[0093] When the binding processing is not performed,

in step S0609, the image forming apparatus 1000 determines whether continuous multiple page printing is to be performed.

[0094] Next, if continuous multiple page printing is to be performed (YES in step S0609), the image forming apparatus 1000 proceeds to step S0610. On the other hand, if continuous multiple page printing is not to be performed or multiple single page printing is to be performed (NO in step S0609), the image forming apparatus 1000 proceeds to step S0612.

[0095] In step S0610, the image forming apparatus 1000 changes the order of a plurality of continuous pages on which image formation is to be performed. The image forming apparatus 1000 performs, for example, data rearrangement such that the printing is performed in reverse order (third page, second page, and first page) to the order (first page, second page, and third page) indicated by the input data.

[0096] In step S0611, the image forming apparatus 1000 performs image formation. In other words, the image forming apparatus 1000 performs image formation of a plurality of pages in the reverse order changed in the previous step of step S0610.

[0097] To be more specific, in step S0610, before image formation, the image forming apparatus 1000 rearranges the order of pages such that the image formation is started from the last page among the first to last pages indicated by the input data and image formation of the first page is lastly performed. When the rearrangement of the pages to be printed is performed as described above, the image forming apparatus 1000 performs image formation and accumulate the printed pages, for example, on the output tray 114 of the post-processing apparatus 1001 sequentially from the last page.

[0098] In other words, when an image has been formed on the last page among the multiple pages indicated by the input data, the image forming apparatus 1000 first accumulate the last page. Such a configuration as described above allows the image forming apparatus 1000 to accumulate the pages on which images have been formed in order from the last page among the multiple pages indicated by the input data and accumulate the first page at the end.

[0099] If the recording medium can be accumulated in the order as described above, the user can omit the operation of rearranging the pages after the images have been formed on all the pages. For this reason, changing the order in which the recording media are accumulated allows to omit the operation of rearranging a plurality of pages under the condition that the pages are not bound. Accordingly, the productivity can be enhanced.

[0100] In step S0612, the image forming apparatus 1000 performs image formation. In step S0612, one page, instead of a plurality of pages, is printed. Accordingly, the image forming apparatus 1000 performs image formation based on, for example, input data without performing, for example, step S0610.

[0101] When one page is to be printed, i.e., when a

plurality of pages is not to be printed, after step S0612, the image forming apparatus 1000 ejects the printed sheet to the output tray 114 of the post-processing apparatus 1001 to which the sheet is ejected face-up or to the output tray 104 of the image forming apparatus 1000 to which the sheet is ejected face-down. In the above-described condition, the recording medium is conveyed without being reversed, that is, while maintaining the relation between the first side and the second side of the recording medium. Accordingly, the image forming apparatus 1000 does not perform, for example, step S0604, or step S0608, when the multiple pages are not to be printed.

[0102] Note that, in step S0612, when one page is to be printed, step S0612 in which the order of pages is arranged is not performed. However, even when one page is to be printed, changing the order of the one page may be performed in step S0612 and the last page may be processed as one page.

[0103] As described above, when binding processing is not necessary in simplex printing and the recording medium is not reversed, the recording medium does not pass through the third path 203 and the fourth path 204. The image forming apparatus 1000 conveys the recording medium to the second path 202 when image formation is completed in the first path 201.

[0104] When a route that does not pass through the third path 203 and the fourth path 204 is selected as described above, the recording medium can be ejected quickly. Thus, the productivity of the image forming apparatus 1000 can be enhanced. Even when one page is to be printed, after image formation is performed, the recording medium is conveyed as is while the first side and the second side of the recording medium are not reversed.

[0105] FIG. 7 is a flowchart of second overall processing executed by the image forming apparatus 1000, according to an embodiment of the present disclosure. The image forming apparatus 1000 performs the following overall processing according to, for example, conditions.

[0106] More specifically, when simplex printing is performed, the conditions include, for example, whether to perform stapling processing by the post-processing apparatus 1001, whether to specify the direction of stapling when performing stapling processing, or whether to perform N-up printing in which multiple pages are composited onto a single page.

[0107] In step S0701, particularly when continuous multiple page printing is to be performed, the image forming apparatus 1000 changes the order of pages on which image formation is to be performed.

[0108] In step S0702, the image forming apparatus 1000 performs image formation.

[0109] In step S0703, the image forming apparatus 1000 conveys the recording medium to the post-processing apparatus 1001 via the second path 202.

[0110] When staples are to be driven and the direction of the staples is not specified, legs of the staples may be

present on the first side of the recording medium.

[0111] In this case, the image forming apparatus 1000 conveys the recording medium without reversing the recording medium and while maintaining the relation between the first side and the second side of the recording medium. The staples are driven onto the first side and the second side of the recording medium in a state in which the order of the first side and the second side of the recording medium is maintained. Thus, the productivity of the image forming apparatus 1000 is enhanced.

[0112] On the other hand, when the staples are driven such that tip ends of the staples driven through to the second side of recording medium, that is, when the staples are driven from the first side of the recording medium toward the second side, it is difficult to perform post-processing unless the recording medium is reversed before performing the post-processing.

[0113] For this reason, under a condition in which the direction of the staple is not specified, the recording medium is subjected to post-processing in which staples are driven in a direction that does not require reversing of the recording medium. More specifically, the staples are driven onto the recording medium in a direction in which the tip ends of the staples are driven through to the first side of the recording medium.

[0114] Performing the post-processing in which the staples are driven in the direction such that reversing of the recording medium may be obviated as described above allows the productivity of the image forming apparatus 1000 to be enhanced as compared with a case in which the recording medium is reversed.

[0115] Note that in a case in which the staples are driven such that tip ends of the staples are driven through to the second side of recording medium, that is, in a case in which the staples are driven from the first side of the recording medium toward the second side, the order of pages on which image formation is performed is not changed. Thus, the recording medium is reversed before post-processing is performed and conveyed to the post-processing apparatus 1001.

[0116] In addition, in the overall processing described above, in a case in which image formation is not performed on the second side of the recording medium, that is, under a condition of simplex printing, the image forming apparatus 1000 increases the conveyance speed of the recording medium by the conveyance rollers 103 to be higher than the conveyance speed in a case in which image formation is performed on the first side of the recording medium. Thus, the productivity of the image forming apparatus 1000 can be enhanced.

[0117] Hereinafter, the conveyance speed until image formation by the image forming device is performed (including a conveyance speed during image formation) is referred to as a first conveyance speed. In other words, the first conveyance speed is a conveyance speed until image formation on the first side of the recording medium is completed. Accordingly, the first conveyance speed is a speed in accordance with the processing such as image

formation.

[0118] After the image forming device forms an image on the first side of the recording medium, the image forming apparatus 1000 increases the conveyance speed and conveys the recording medium. Hereinafter, the conveyance speed after the image forming device has formed an image on the first side of the recording medium is referred to as a second conveyance speed.

[0119] In other words, the second conveyance speed is a conveyance speed higher than the first conveyance speed. In addition, switching between the first conveyance speed and the second conveyance speed is performed, for example, at a time point when image formation on the first side of the recording medium is completed.

[0120] In a case in which a recording medium is reversed and conveyed to the post-processing apparatus 1001 before post-processing is performed without changing the order of pages on which image formation is performed under a condition of simplex printing, the image forming apparatus 1000 increases the conveyance speed after the image forming device performs image formation on the first side of the recording medium. In other words, desirably processing such as reversing and conveyance of the recording medium performed, after the image forming device forms an image on the first side of the recording medium, is performed at the second conveyance speed. In this way, if the recording medium can be conveyed at high speed, the time until image formation on the next recording medium is started can be shortened.

Control Sample

[0121] FIG. 8 is a schematic side view of an image forming system according to a control sample of the present disclosure. The image forming system, according to the control sample, includes a recording device 2 as an image forming apparatus and an intermediate device 3 as a relay device coupled to the recording device 2 and disposed between the recording device 2 and a post-processing apparatus.

[0122] In the control sample, after a recording medium is received in a direction indicated by first arrow A1 in the intermediate device 3, the recording medium is switched back in a direction indicated by second arrow A2. In the control sample, after the intermediate device 3 receives the recording medium in a direction indicated by third arrow B1, the recording medium is switched back in a direction indicated by fourth arrow B2.

[0123] As described above, when the relay device such as the intermediate device 3 reverses the recording medium, the relay device secures a path for reversing the recording medium. For this reason, the relay device is likely to be large by the amount of securing the path.

[0124] On the other hand, the recording medium is reversed in the image forming apparatus 1000. Thus, for example, a relay device does not need a path for reversing

ing the recording medium.

[0125] In addition, in the control sample, while the recording medium is reversed in the direction indicated by the first arrow A1 and the second arrow A2, the recording medium is reversed in a direction indicated by the third arrow B1 and the fourth arrow B2. Accordingly, the recording medium is alternately conveyed in two paths.

[0126] A binding device of the post-processing apparatus performs binding processing after aligning a conveyed recording medium. In the control sample, each time the recording medium is conveyed, an operation of aligning the recording medium is performed. Accordingly, the recording medium is conveyed while securing the interval with the next recording medium to secure the time for performing the operation of aligning the recording medium.

[0127] In addition, since performing binding processing or sheet ejection processing takes time after the operation of aligning the medium is performed, the recording medium is conveyed at an interval from the next recording medium.

[0128] As described above, in the control sample, the size of the image forming system is not reduced because the relay device is necessary and it takes more time because the recording medium passes through the relay device. Accordingly, the productivity of the image forming system is low.

Conditions

[0129] The conditions are set in the image forming apparatus 1000 in advance, for example. Note that the conditions are not limited to being set in advance in the image forming apparatus 1000, and image data such as input data may include a parameter indicating the conditions, or the parameter of the input data may define all or a part of the conditions. Alternatively, the conditions may be set by operating an input device included in the image forming apparatus 1000 or by inputting data for setting the conditions to the image forming apparatus 1000.

Functional Configuration Example

[0130] FIG. 9 is a diagram illustrating a functional configuration of the image forming system 100 of FIG. 1. The image forming system 100 includes the image forming apparatus 1000 and the post-processing apparatus 1001 coupled to each other.

[0131] The image forming apparatus 1000 includes an image forming device 100F1, a reversing device 100F2, and a conveyor 100F3.

[0132] The image forming device 100F1 performs an image forming procedure for forming an image on a recording medium having a first side and a second side. The image forming device 100F1 includes, for example, the printing device 102.

[0133] The reversing device 100F2 performs reversing processing of reversing the first side of the recording me-

dium and the second side of the recording medium in the image forming apparatus 1000 after image formation is performed by the image forming device 100F1. The reversing device 100F2 includes, for example, the third path 203, the fourth path 204.

[0134] The conveyor 100F3 performs conveyance procedures for conveying the recording medium to the post-processing apparatus 1001. The conveyor 100F3 includes, for example, the conveyance rollers 103.

[0135] The post-processing apparatus 1001 includes a post-processing device 100F4.

[0136] The post-processing device 100F4 performs post-processing procedures for performing post-processing on the recording medium conveyed by the conveyor 100F3. The post-processing device 100F4 includes, for example, a punching device 111, a stapling device 112, and a saddle stitching device 113.

[0137] In the image forming system 100, the image forming apparatus 1000 reverses the recording medium and conveys the recording medium to the post-processing apparatus 1001. Such a configuration as described above allows the recording medium to be reversed in the image forming apparatus 1000. Accordingly, it is not necessary to provide a relay device between the image forming apparatus 1000 and the post-processing apparatus 1001. Accordingly, even when the recording medium is reversed, the image forming system 100 can be reduced in size.

Hardware Configuration Example in which Control such as Switching is Performed

[0138] FIG. 10 is a diagram illustrating a hardware configuration for performing control such as switching of the conveyance path illustrated in FIG. 1. For example, the image forming system 100 has a hardware configuration including a central processing unit (CPU) 500, a motor driver 501, a motor 502, a sensor 503, and a switch 504.

[0139] The CPU 500 is an example of a controller and an arithmetic device. For example, the CPU 500 performs output control for driving the motor 502 for conveying a recording medium via the motor driver 501.

[0140] Further, the CPU 500 performs input control for detecting a recording medium by the sensor 503.

[0141] Further, the CPU 500 performs control to switch a path by a switching claw interlocked with the switch 504.

[0142] Note that the hardware is not limited to the configuration illustrated in FIG. 10, and the configuration may include, for example, other switching devices, control devices, actuators, sensors, and mechanisms.

Other Embodiment

[0143] The above-described control method may be implemented by, for example, a program. In other words, the control method is a method executed by a computer by causing a controller, an arithmetic device, a storage device, an output device, an input device to operate in

cooperation with each other based on a program. Further, the program may be written and distributed in a storage device, a storage medium, or may be distributed through an electric communication line.

[0144] Each apparatus described above may not be one apparatus. In other words, each apparatus may be a system including a plurality of apparatuses.

[0145] The image forming apparatus 1000 is an inkjet printer that requires ink drying time. However, the image forming apparatus 1000 may be an electrophotographic printer that requires heat and pressure fixing processing. Further, the image forming apparatus 1000 may be a commercial printer, an office printer, or a personal printer.

[0146] The recording medium is a sheet including plain paper, thick paper, and thin paper. However, the recording medium may be an overhead projector sheet, a film, a flexible thin plate, in addition to coated paper, label paper, other than a sheet of paper. Further, the recording medium may be roll paper to be cut.

[0147] In other words, the material of the recording medium may be a material to which ink droplets or paint such as toner can be adhered and to which the ink droplets or the paint can be fixed or adhered and permeated.

[0148] Examples of the recording medium include a recording medium such as paper, a film, or cloth, an electronic substrate, an electronic component such as a piezoelectric element (also referred to as a piezoelectric member), a powder layer (also referred to as a powder layer), an organ model, and an inspection cell.

[0149] As described above, the material of the recording medium may be paper, yarn, fiber, fabric, leather, metal, plastic, glass, wood, ceramic, or a combination thereof, which can be coated with paint, and may be formed into a convex shape or a permeable shape, or may be formed into a concave shape by surface excavation.

[0150] Embodiments of the present disclosure are not limited to the above-described embodiments, and various modifications can be made without departing from the technical scope of the present disclosure. It is therefore to be understood that the disclosure of the present specification may be practiced otherwise by those skilled in the art than as specifically described herein. Such embodiments and modifications thereof are included in the scope and gist according to the embodiments of the present disclosure and are included in the embodiments described in claims and the equivalent scope thereof.

[0151] 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.

Claims**1.** An image forming apparatus (1000) comprising:

a conveyor (100F3) configured to convey a recording medium; an image forming device (102, 100F1) configured to form an image on the recording medium conveyed from the conveyor (100F3); and

a reversing device (100F2) configured to reverse the recording medium in the image forming apparatus (1000) after the image forming device (102, 100F1) forms the image, wherein the conveyor (100F3) conveys the recording medium to eject the recording medium to an output tray with the image on the recording medium facing down or conveys the recording medium to a post-processing apparatus (1001) with the image on the recording medium facing up, and

wherein the image forming device (102, 100F1) performs image formation from a first page of recording media when the image forming device (102, 100F1) performs the image formation on one side of the recording media and the conveyor conveys the recording media to eject the recording media to the output tray, and wherein the image forming device (102, 100F1) performs image formation from a last page of recording media when the image forming device (102, 100F1) performs the image formation on one side of the recording media and the conveyor (100F3) conveys the recording media to the post-processing apparatus (1001).

2. The image forming apparatus (1000) according to claim 1, wherein the image forming device (102, 100F1) performs the image formation from the last page of the recording media and the conveyor conveys the recording media to the post-processing apparatus (1001) when the image forming device (102, 100F1) performs the image formation on one side of a plurality of continuous sheets of the recording media.**3.** The image forming apparatus (1000) according to claim 1, wherein the conveyor conveys the recording media without passing the recording media through the reversing device when the image forming device (102, 100F1) performs the image formation from the last page of the recording media and the conveyor conveys the recording media to the post-processing apparatus (1001).**4.** The image forming apparatus (1000) according to claim 1, wherein the image forming device (102, 100F1) is

disposed above at a position of the recording medium placed when the image is formed on the recording medium.

5. An image forming apparatus (1000) comprising:

a conveyor (100F3) configured to convey a recording medium;

an image forming device (102, 100F1) configured to form an image on the recording medium conveyed from the conveyor; and

a reversing device (100F2) configured to reverse the recording medium in the image forming apparatus (1000) after the image forming device (100F2) forms the image, wherein the conveyor (100F3) conveys the recording medium to eject the recording medium to an output tray with the image on the recording medium facing down or conveys the recording medium to a post-processing apparatus (1001) with the image on the recording medium facing up,

wherein the image forming device (102, 100F1) performs image formation from a first page of recording media when the image forming device (102, 100F1) performs the image formation on one side of the recording media and the conveyor (100F3) conveys the recording media to eject the recording media to the output tray, and wherein the image forming device (102, 100F1) performs image formation from a first page of recording media, the reversing device (100F2) reverses the recording media, and the conveyor (100F3) conveys the recording media to the post-processing apparatus (1001) when the image forming device (102, 100F1) performs the image formation on one side of the recording media and the conveyor (100F3) conveys the recording media to the post-processing apparatus (1001).

6. The image forming apparatus (1000) according to claim 5, wherein the conveyor (100F3) conveys the recording media to the post-processing apparatus (1001) when the image forming device (102, 100F1) performs the image formation on one side of a plurality of continuous sheets of the recording media.**7.** The image forming apparatus (1000) according to claim 1, wherein the image forming device (102, 100F1) is disposed above at a position of the recording medium placed when the image is formed on the recording medium.**8.** The image forming apparatus (1000) according to claim 3,

wherein the conveyor (100F3) conveys the recording medium at a greater speed when the reversing device (100F2) reverses the recording medium than a speed when the image forming device (102, 100F1) forms the image on the recording medium.

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9. An image forming system (100) comprising the image forming apparatus according to any one of claims 1 to 8,
wherein the post-processing apparatus (1001) is configured to drive a staple on the recording medium as post-processing.
10. The image forming system (100) according to claim 9,
wherein the post-processing apparatus (1001) is configured to drive the staple in a plurality of directions with respect to the recording medium.

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FIG. 1

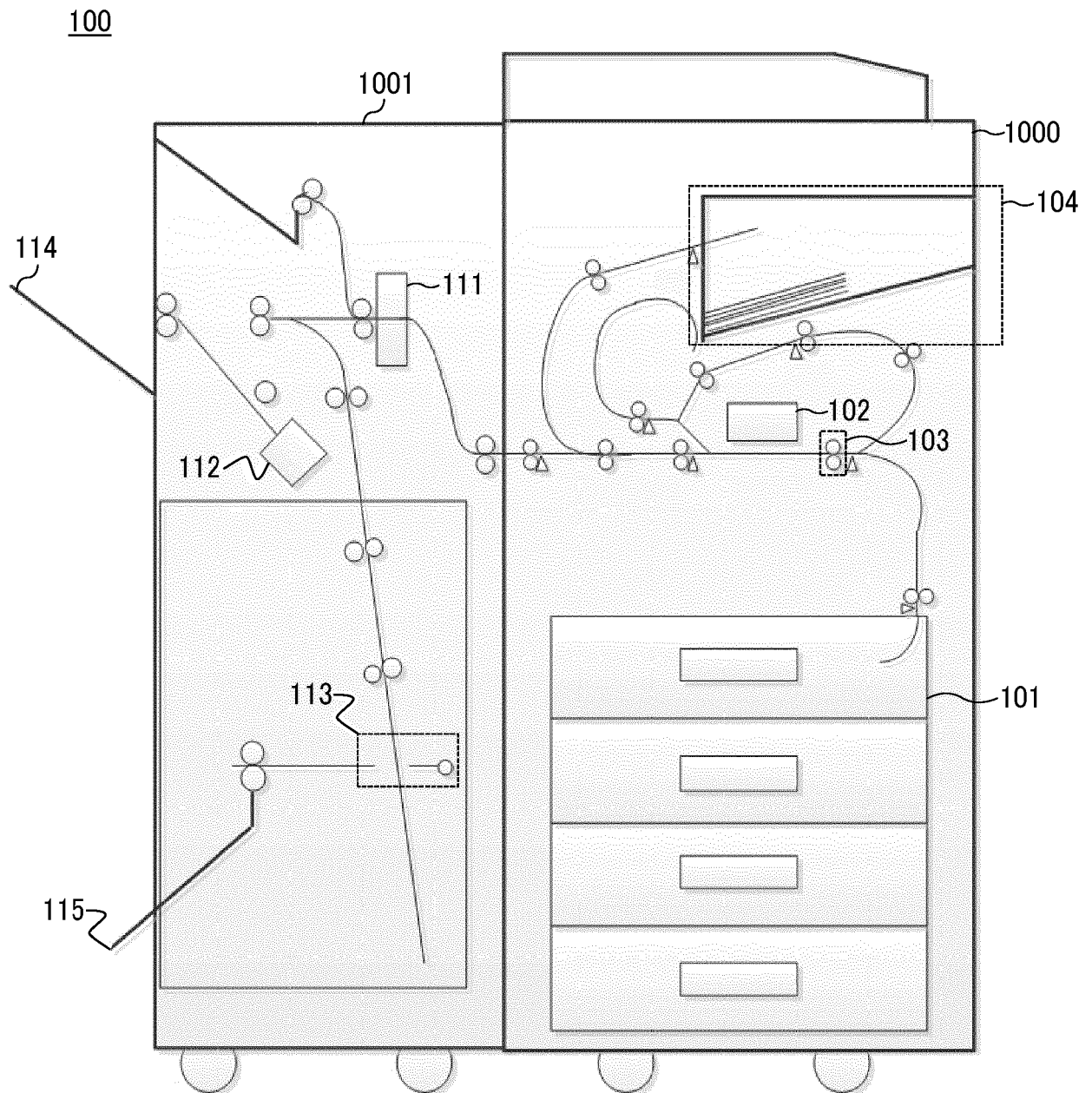


FIG. 2

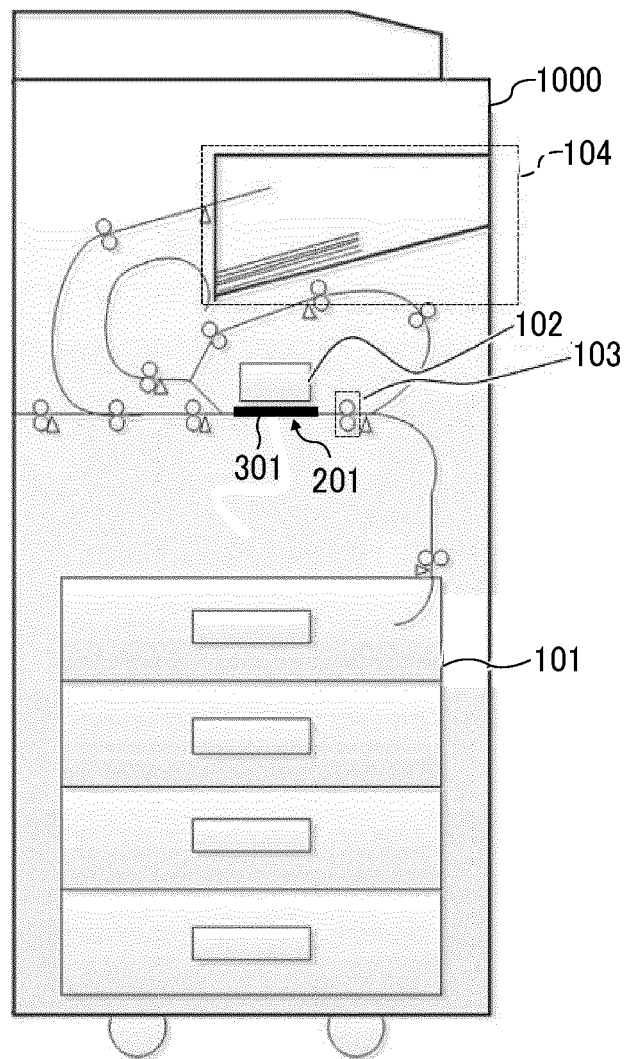


FIG. 3

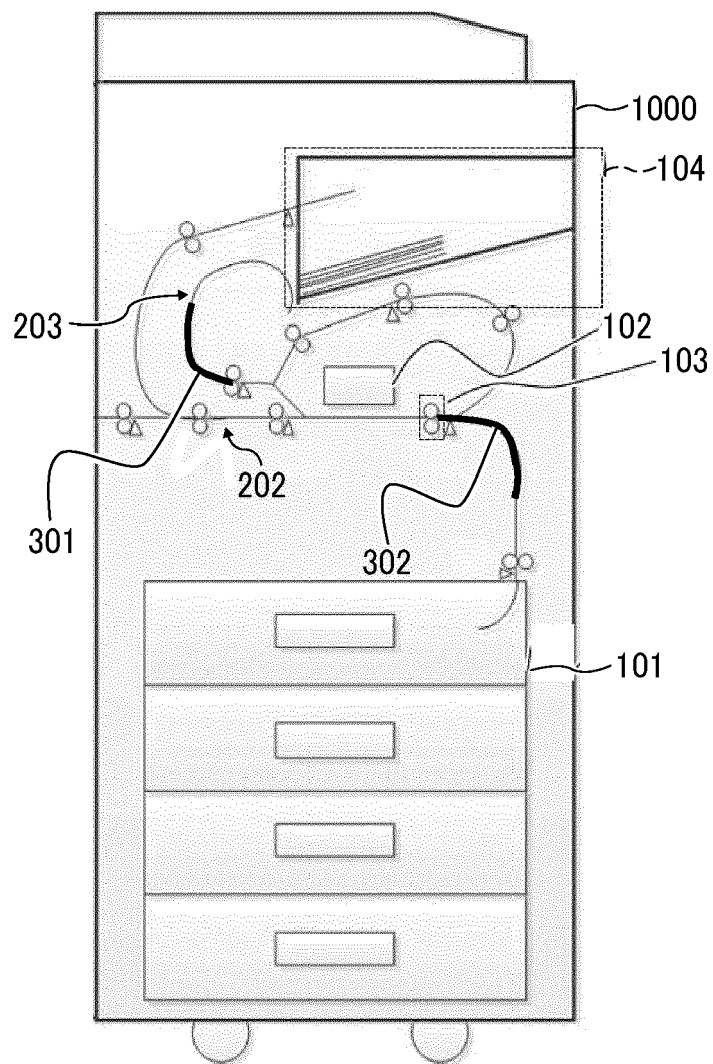


FIG. 4

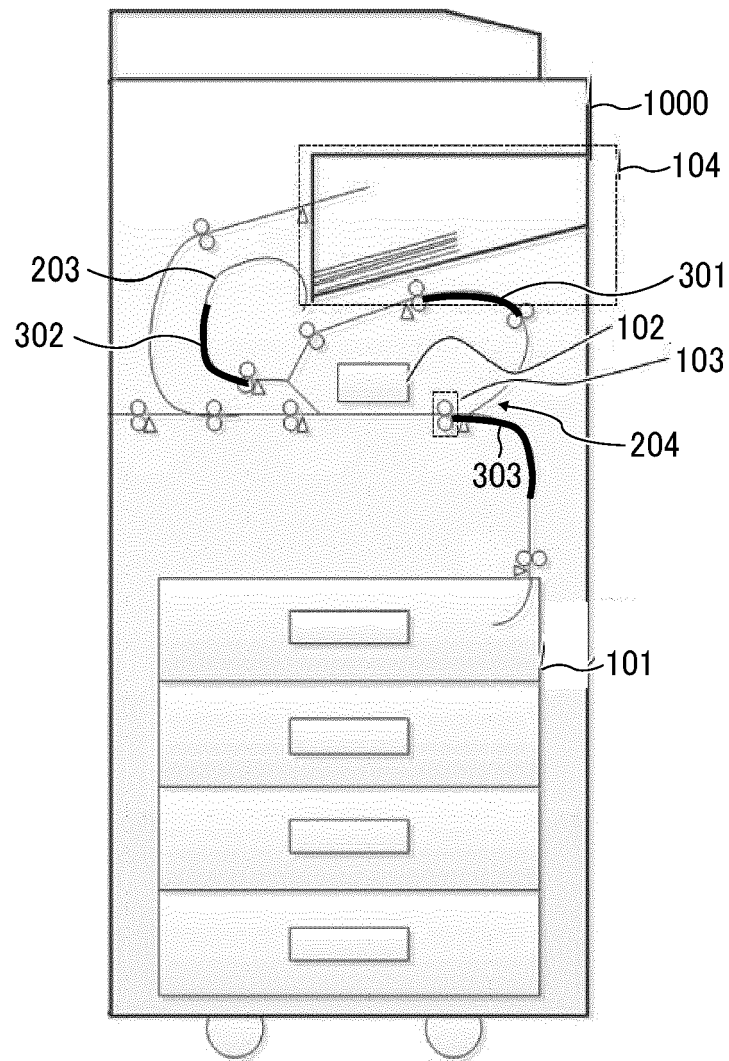
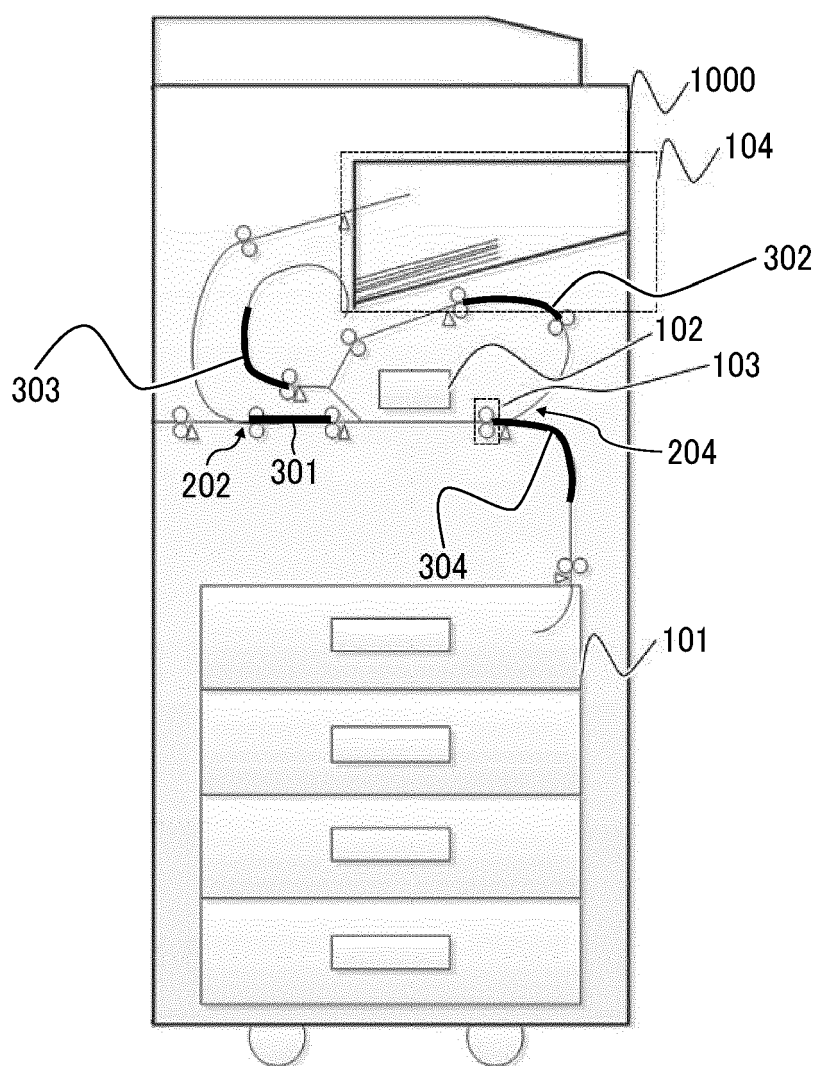


FIG. 5



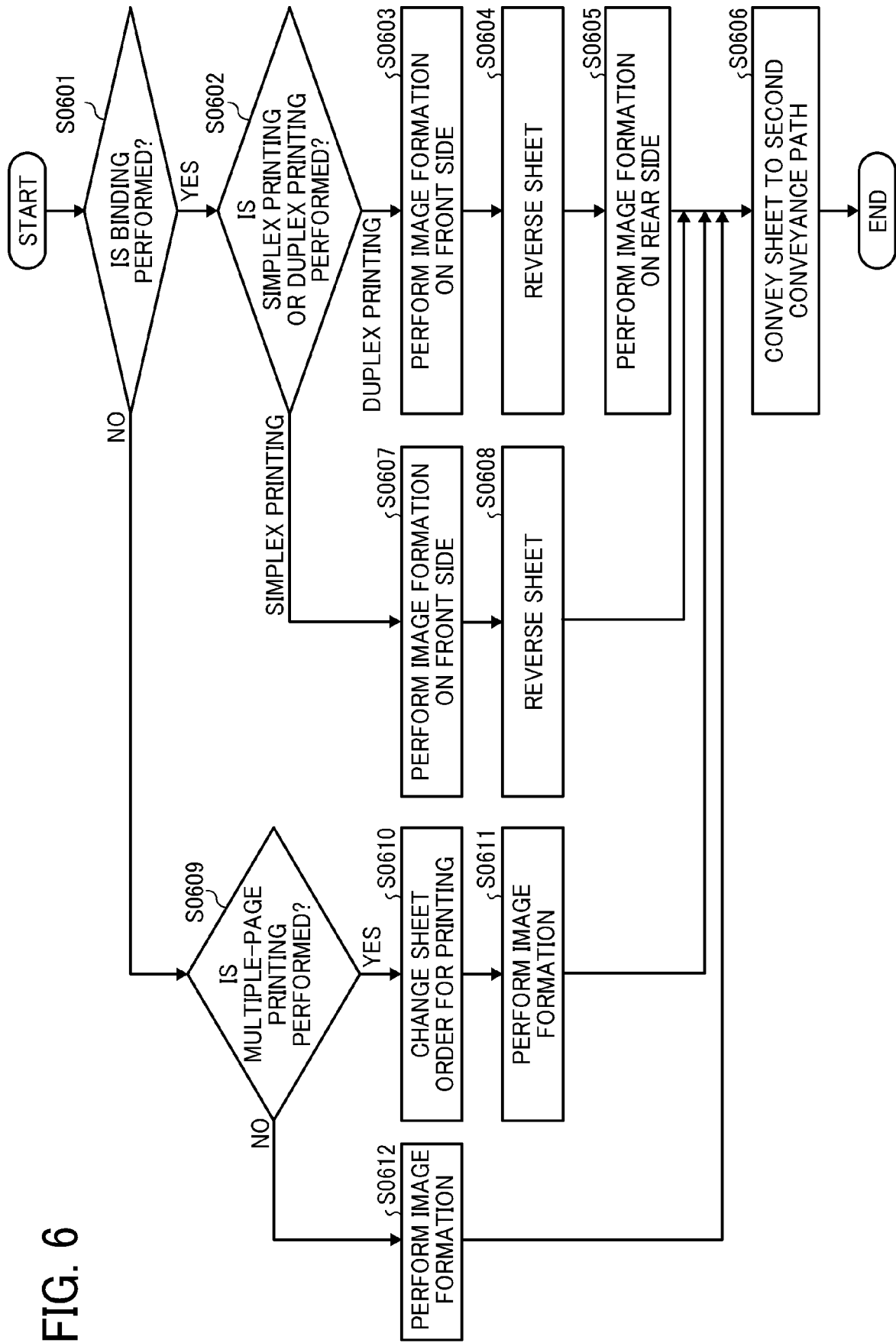


FIG. 7

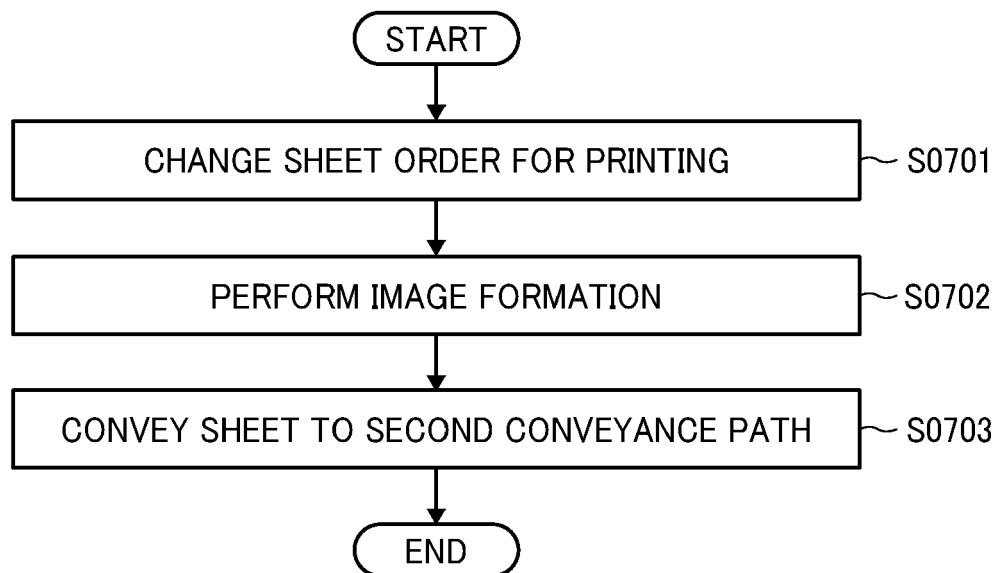


FIG. 8

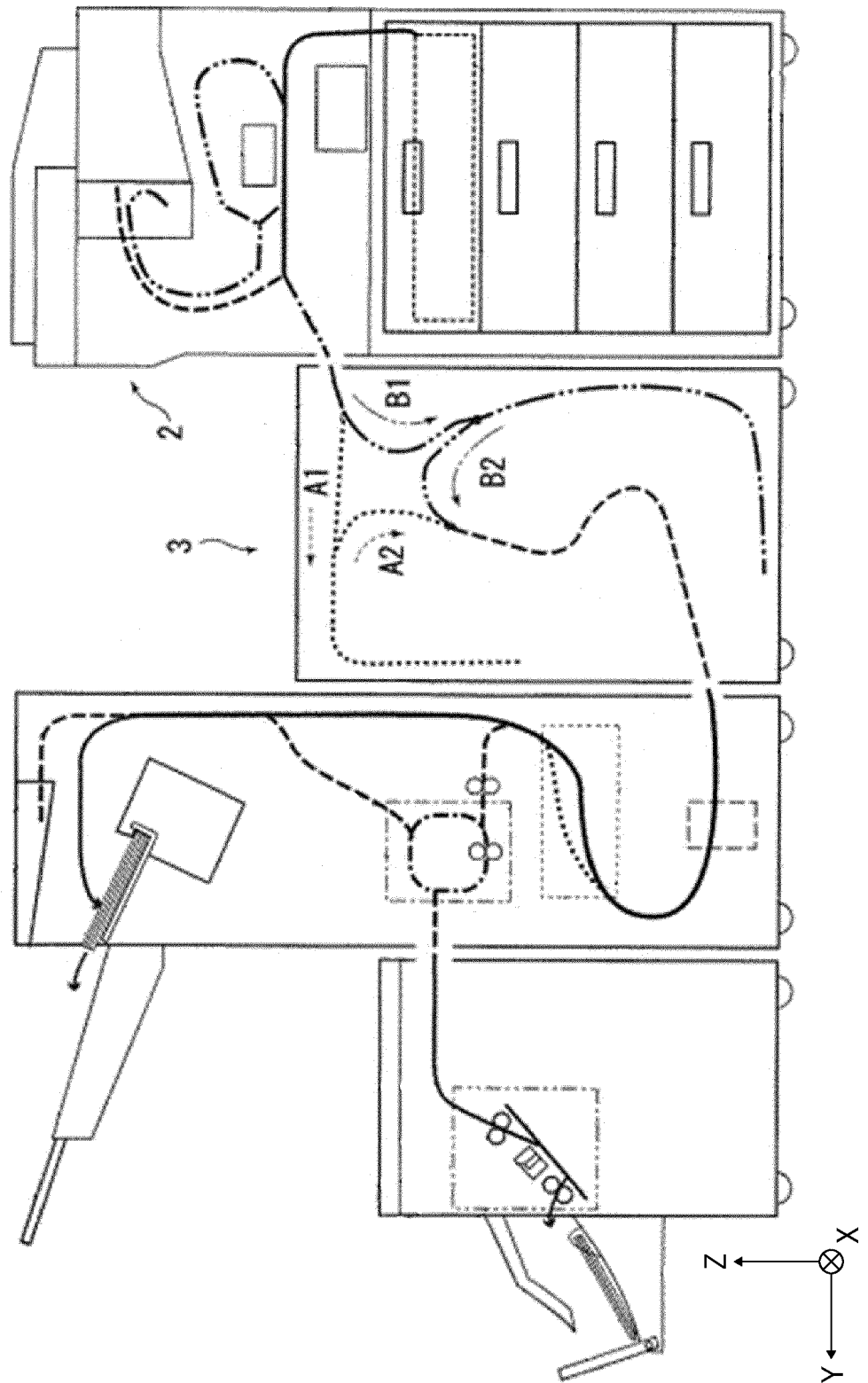


FIG. 9

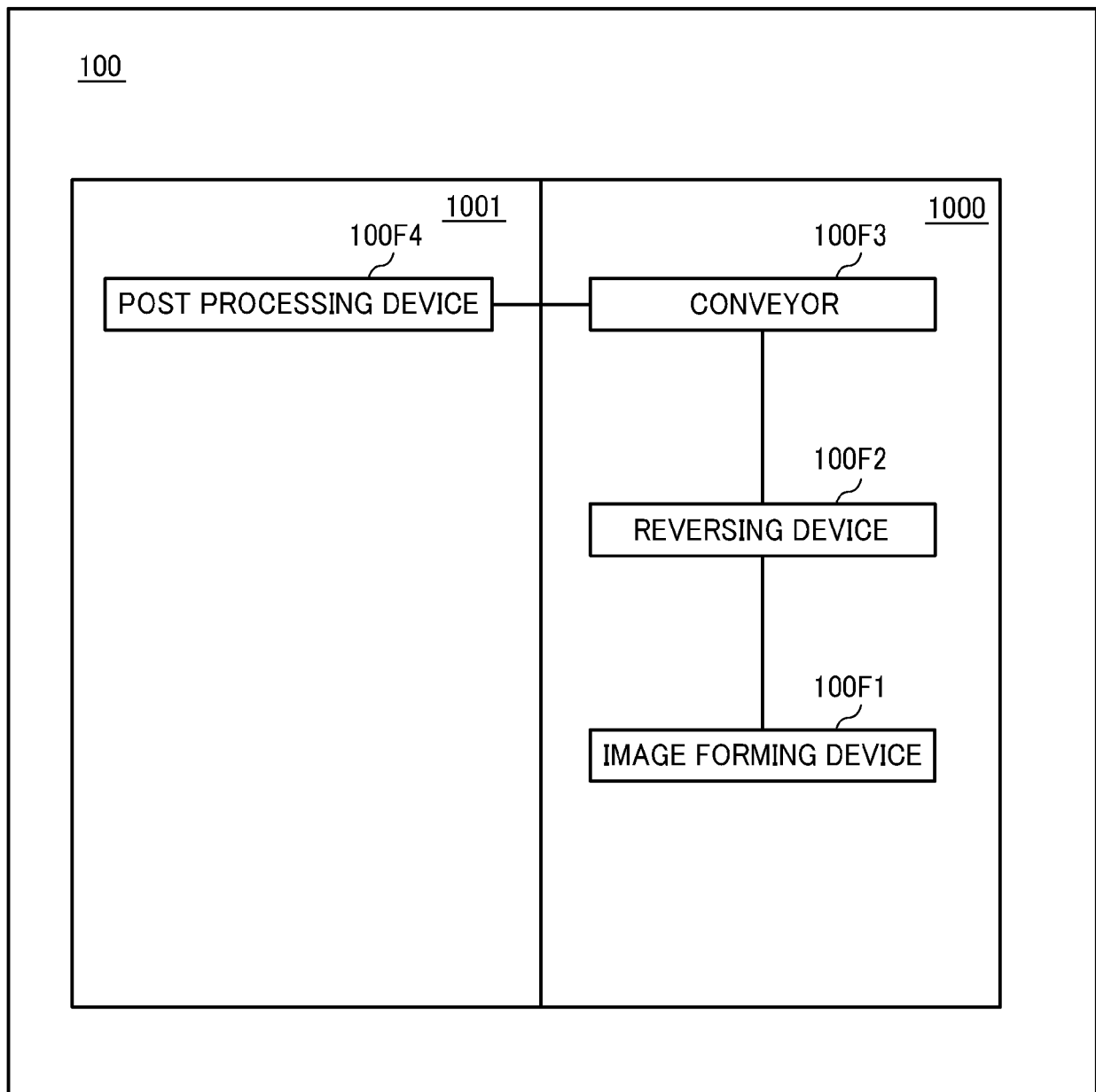
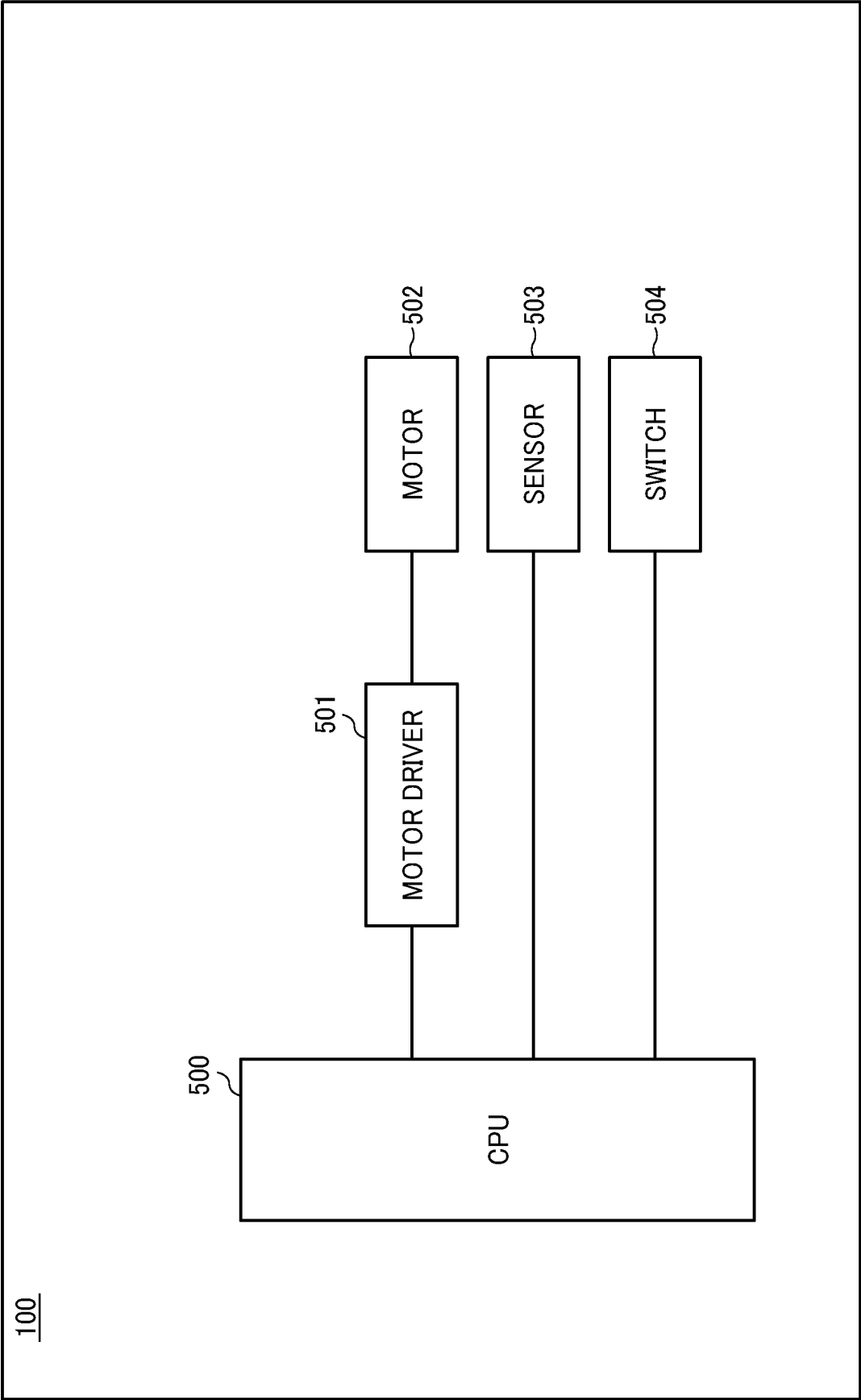


FIG. 10





EUROPEAN SEARCH REPORT

Application Number

EP 22 16 0756

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The Hague		29 July 2022	Loi, Alberto
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