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(19) **United States**(12) **Patent Application Publication**
FUKUI et al.(10) **Pub. No.: US 2025/0256935 A1**(43) **Pub. Date: Aug. 14, 2025**(54) **POST-PROCESSING DEVICE AND IMAGE FORMING APPARATUS**(52) **U.S. Cl.**CPC *B65H 29/60* (2013.01); *B65H 37/04* (2013.01); *B65H 37/06* (2013.01); *B65H 2801/27* (2013.01)(71) Applicant: **FUJIFILM Business Innovation Corp.**, Tokyo (JP)(72) Inventors: **Eri FUKUI**, Yokohama-shi (JP); **Koji KAWANO**, Yokohama-shi (JP); **Yuki MIZUNO**, Yokohama-shi (JP)

(57)

ABSTRACT(73) Assignee: **FUJIFILM Business Innovation Corp.**, Tokyo (JP)(21) Appl. No.: **18/777,943**(22) Filed: **Jul. 19, 2024**(30) **Foreign Application Priority Data**

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A post-processing device includes: a first path along which a recording medium on which an image is formed is received and guided to a discharge unit; a second path that branches from the first path and receives the recording medium of the first path to make the first path empty and along which the recording medium is guided to a retention part temporarily retaining a recording medium to be subjected to post-processing; and a third path that branches from the second path and is usable in a case where an overlapping operation for causing the recording medium of the first path and the recording medium of the second path to overlap with each other is performed using the first path and the second path, and a leading end portion of the recording medium advancing from the first path along the second path enters the third path.

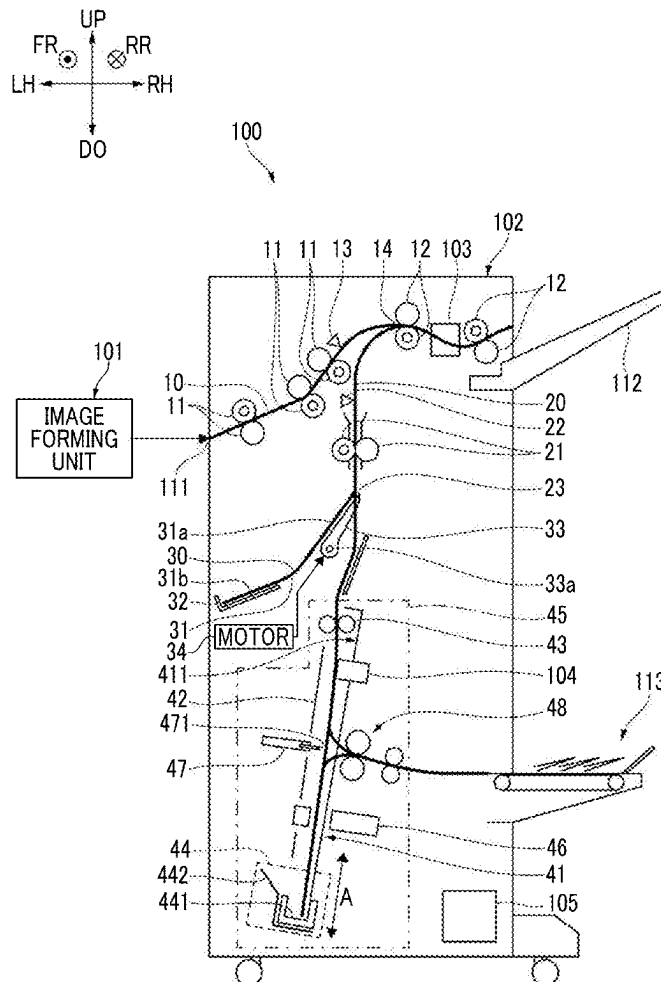


FIG. 1

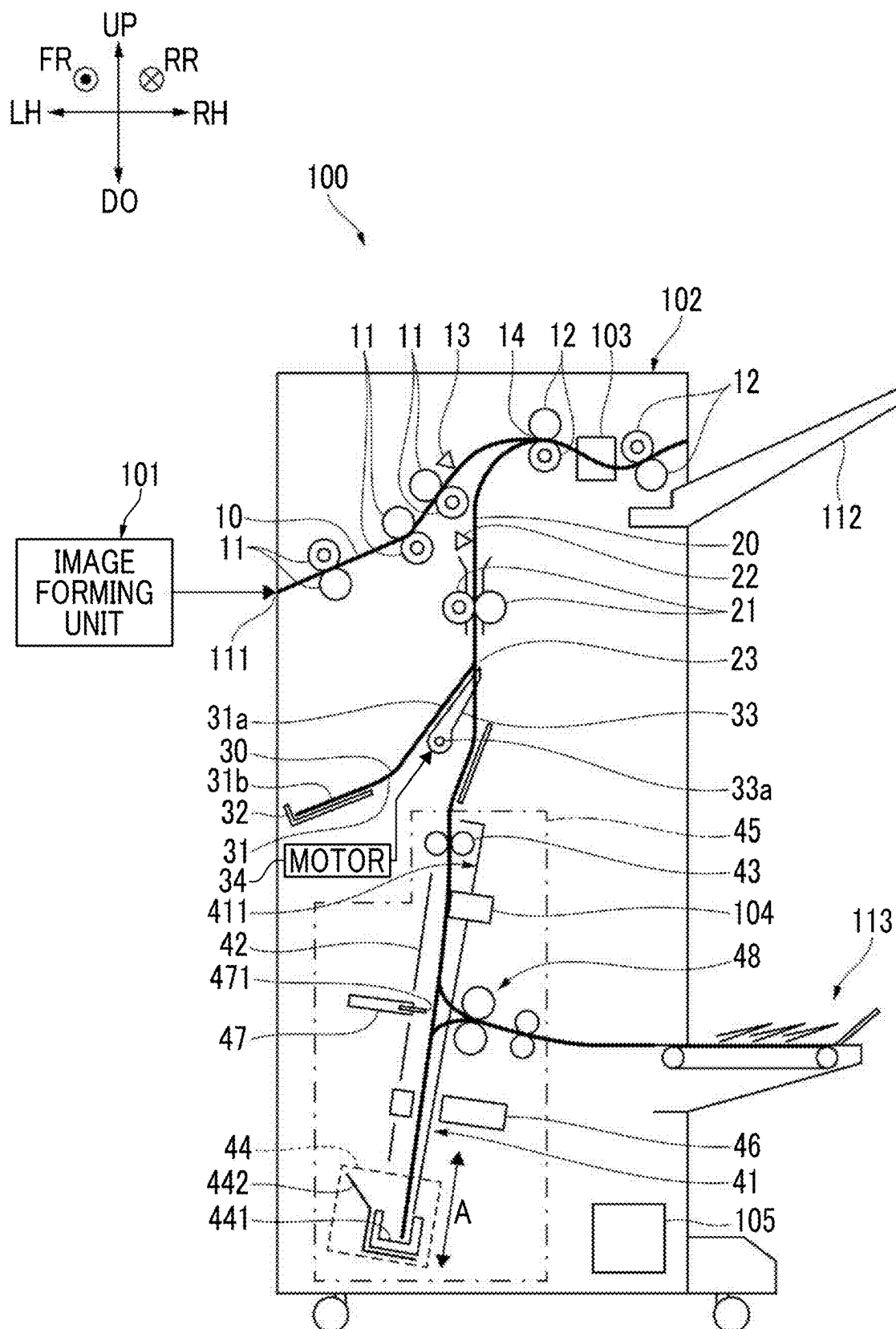


FIG. 2

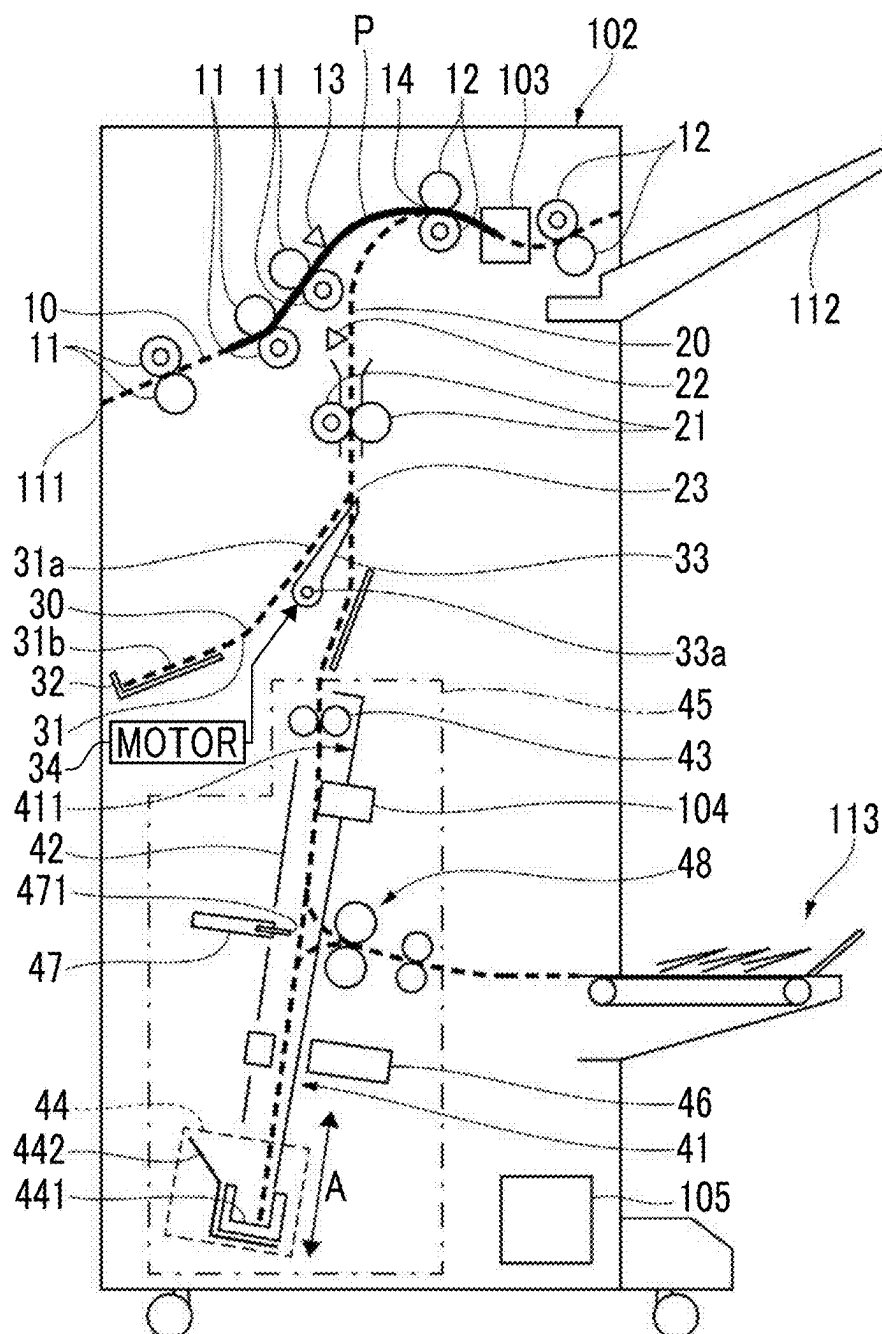
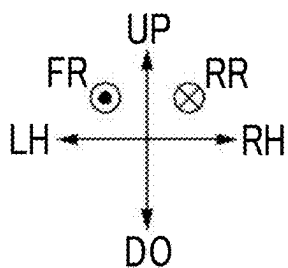


FIG. 3

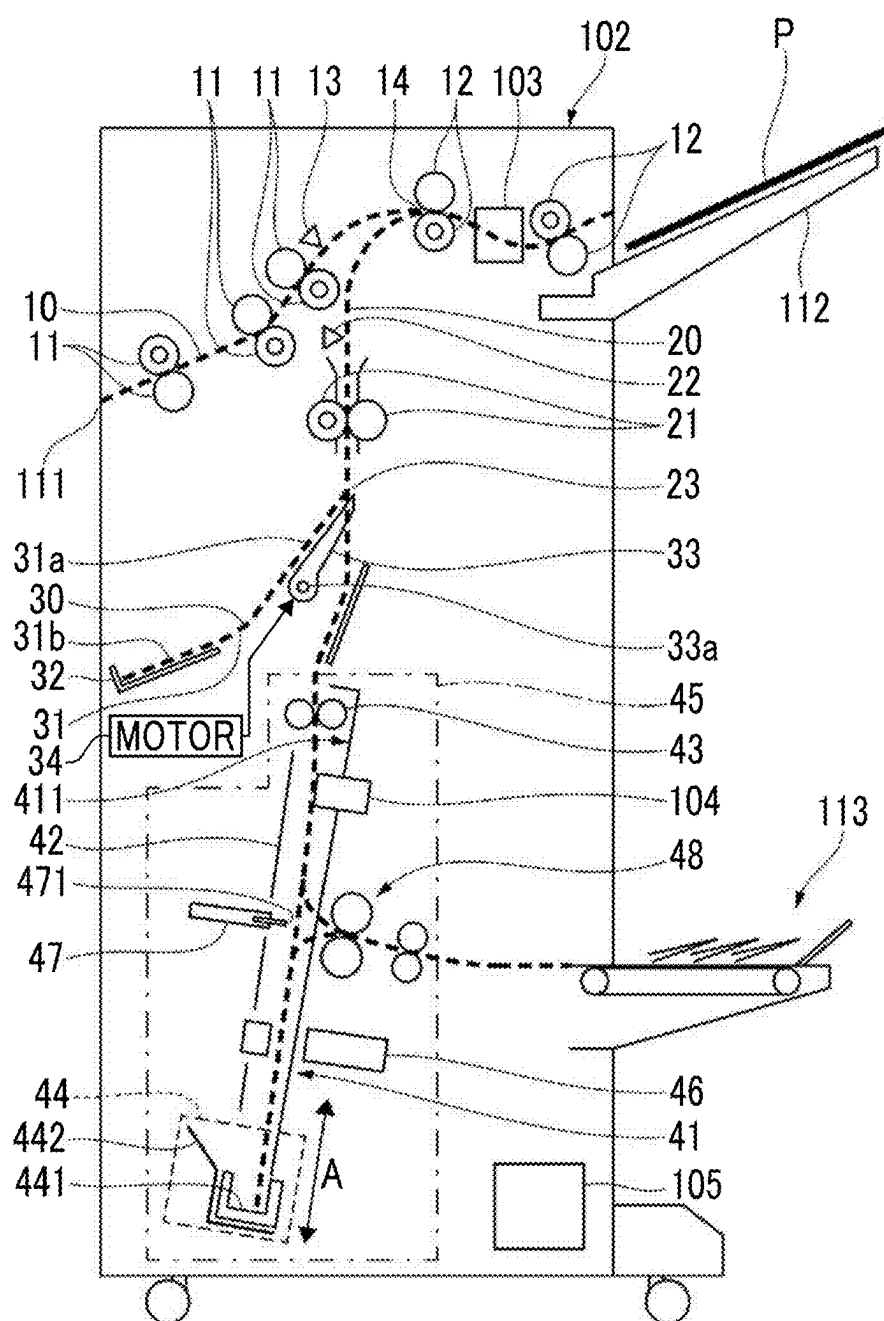
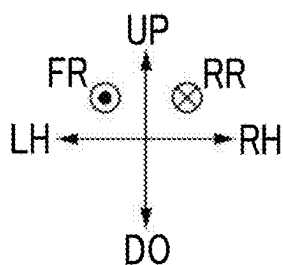


FIG. 4

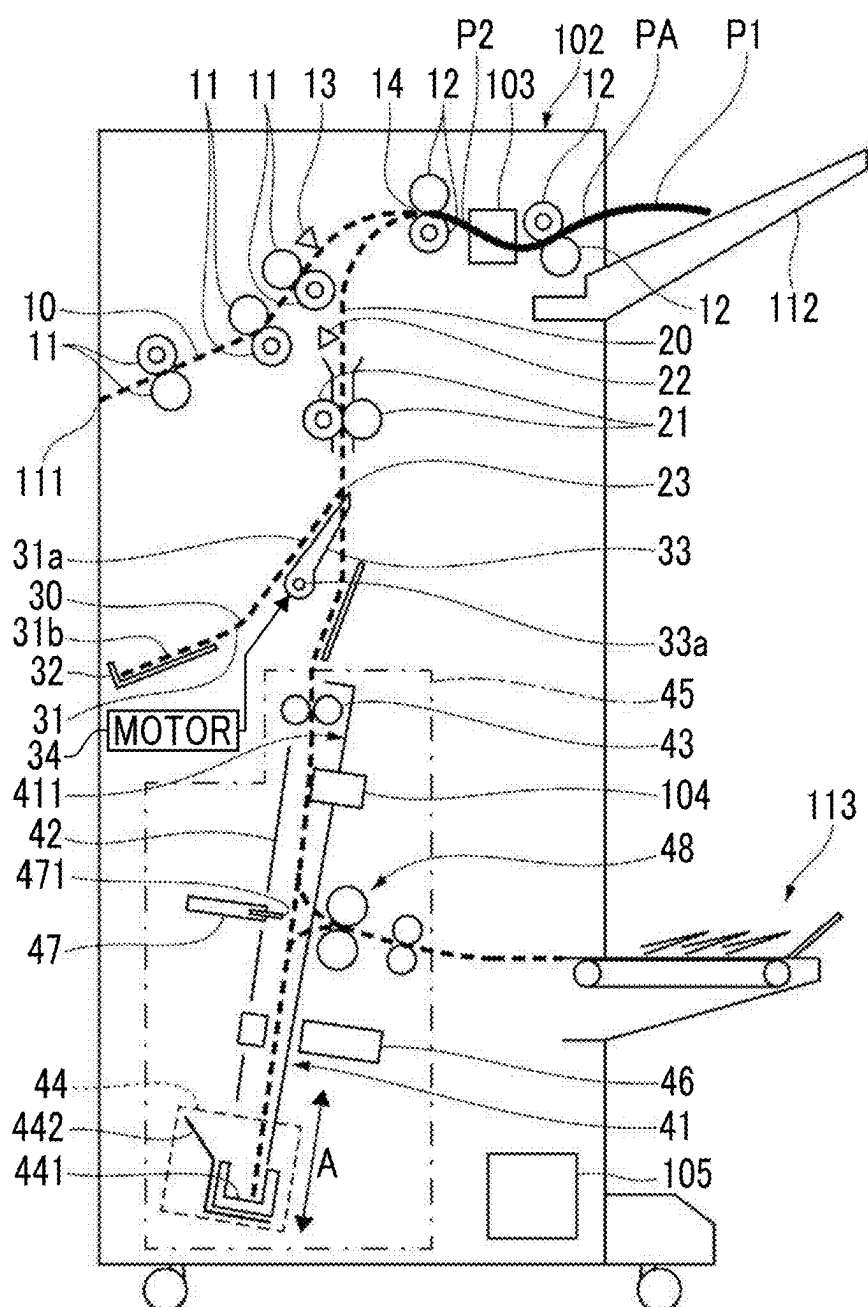
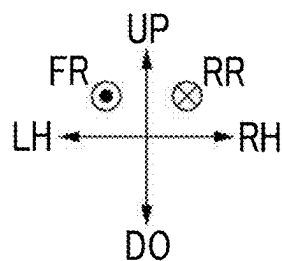


FIG. 5

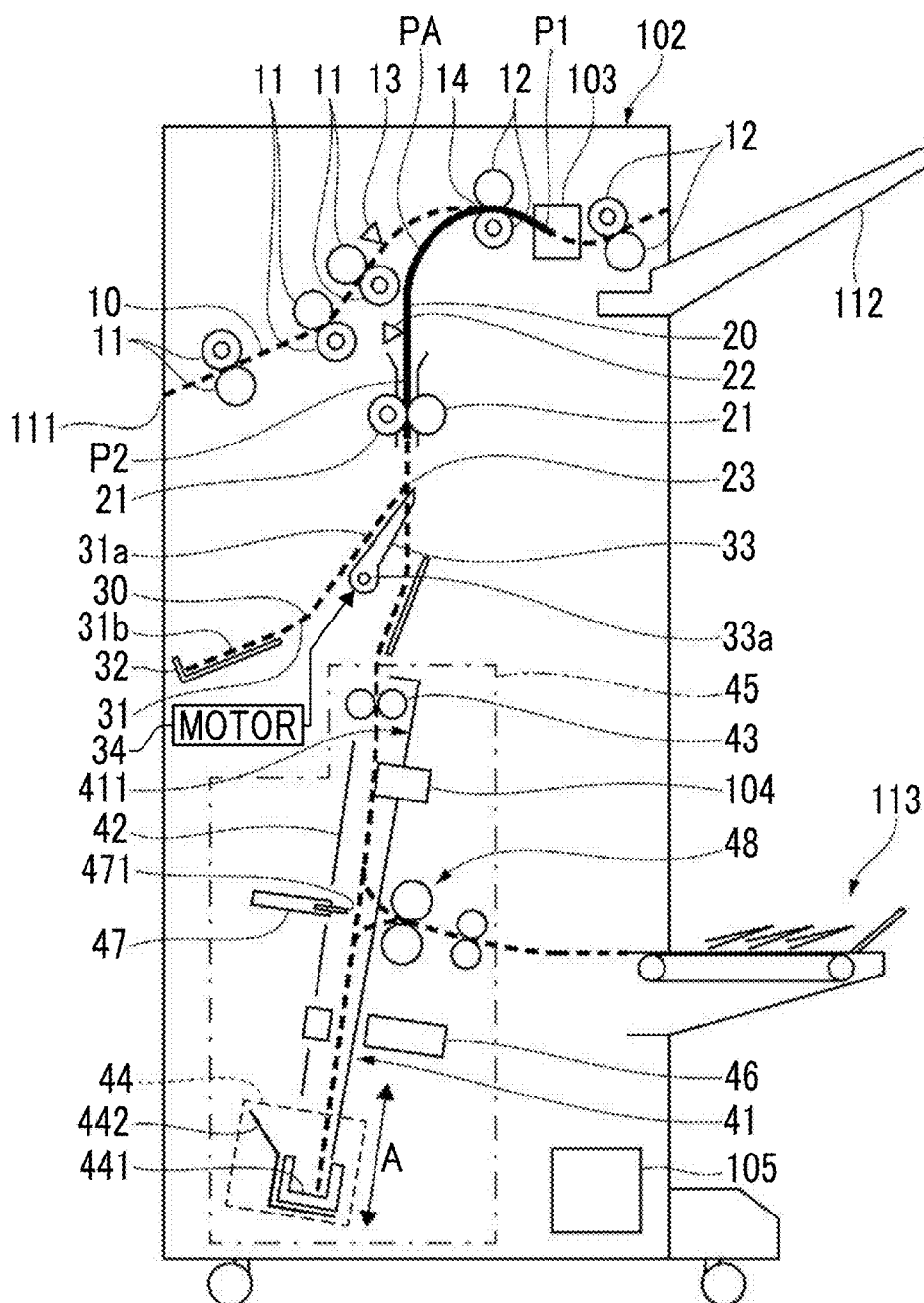
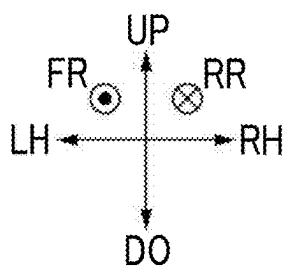


FIG. 6

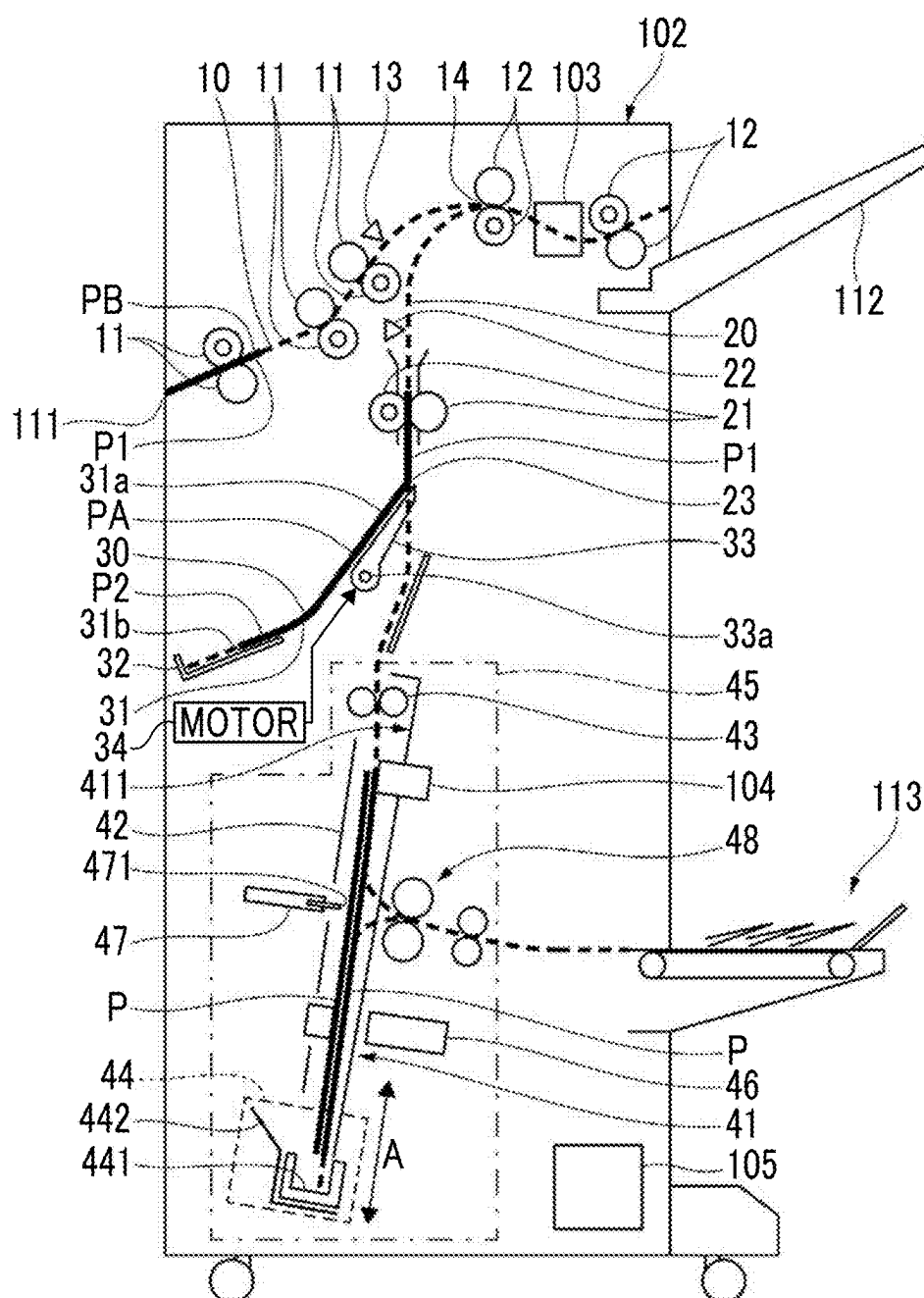
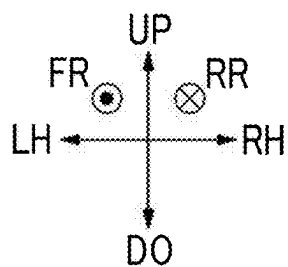


FIG. 7

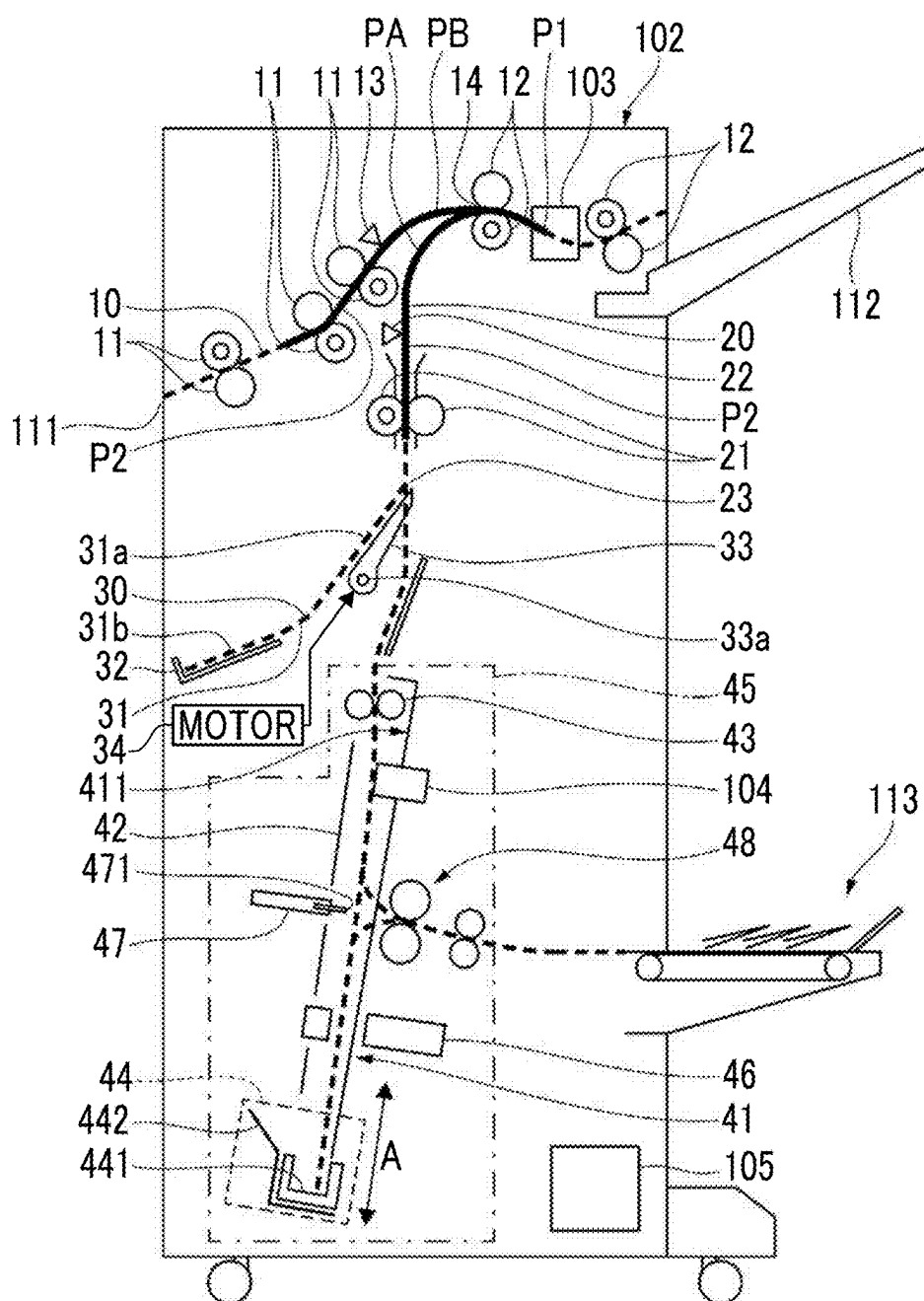
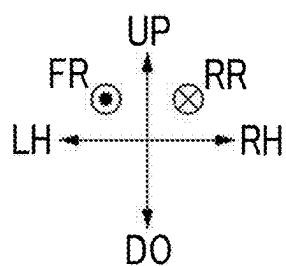


FIG. 8

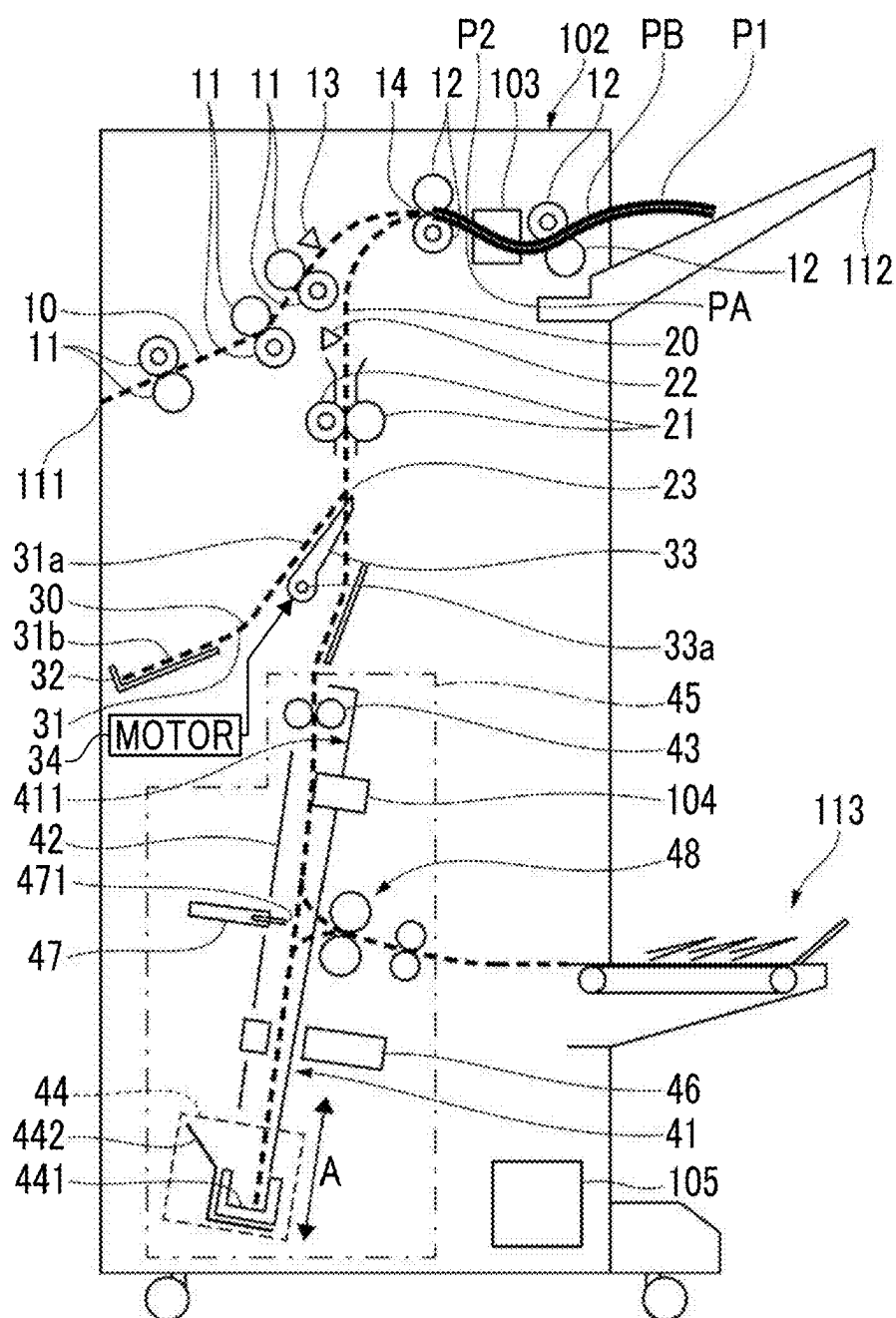
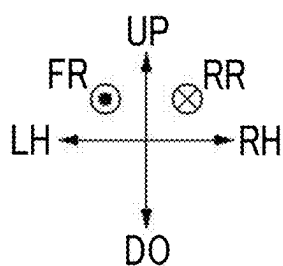


FIG. 9

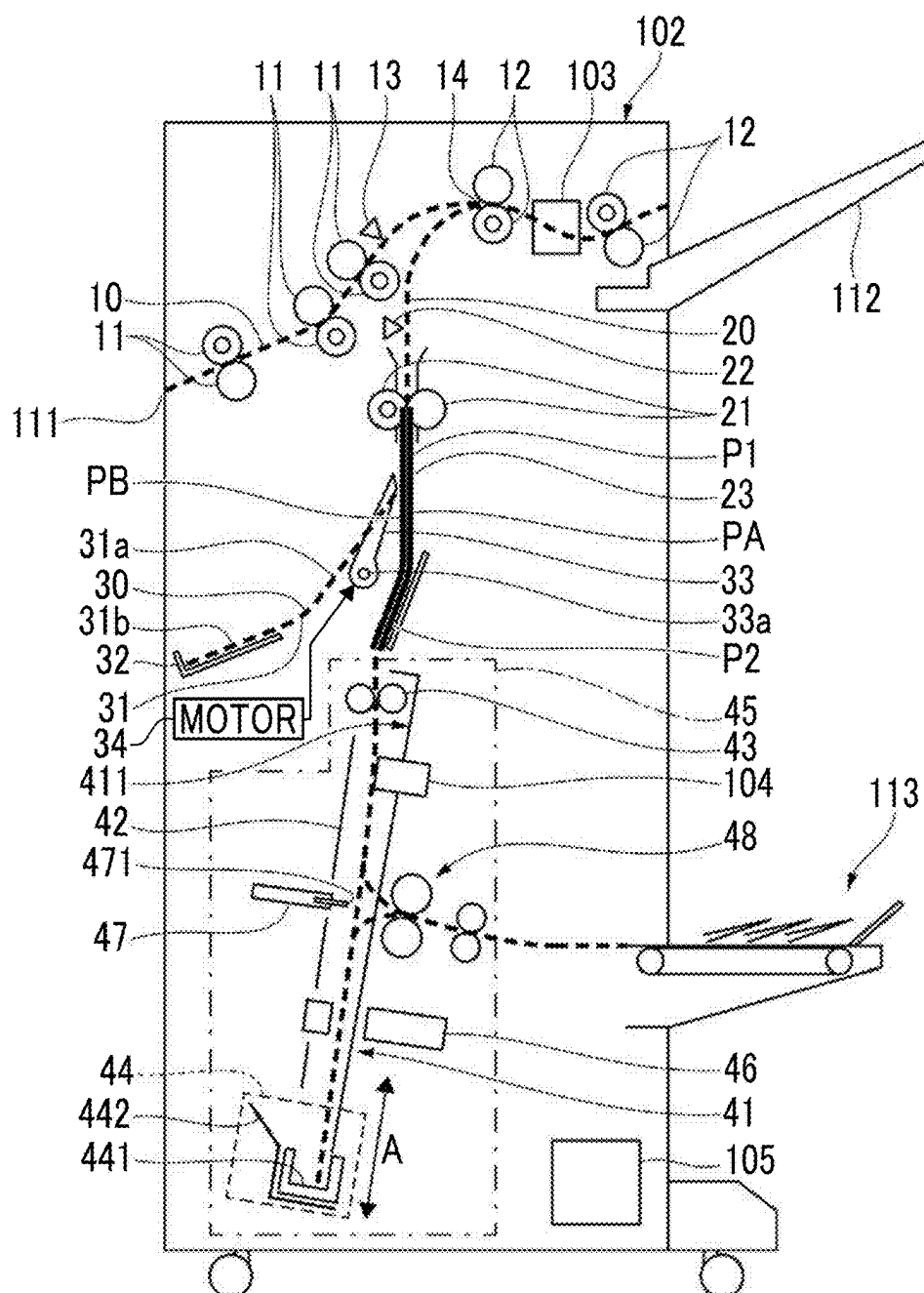
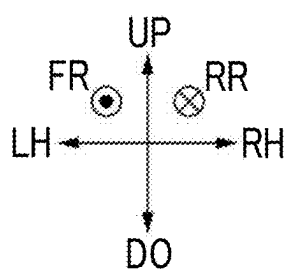


FIG. 10

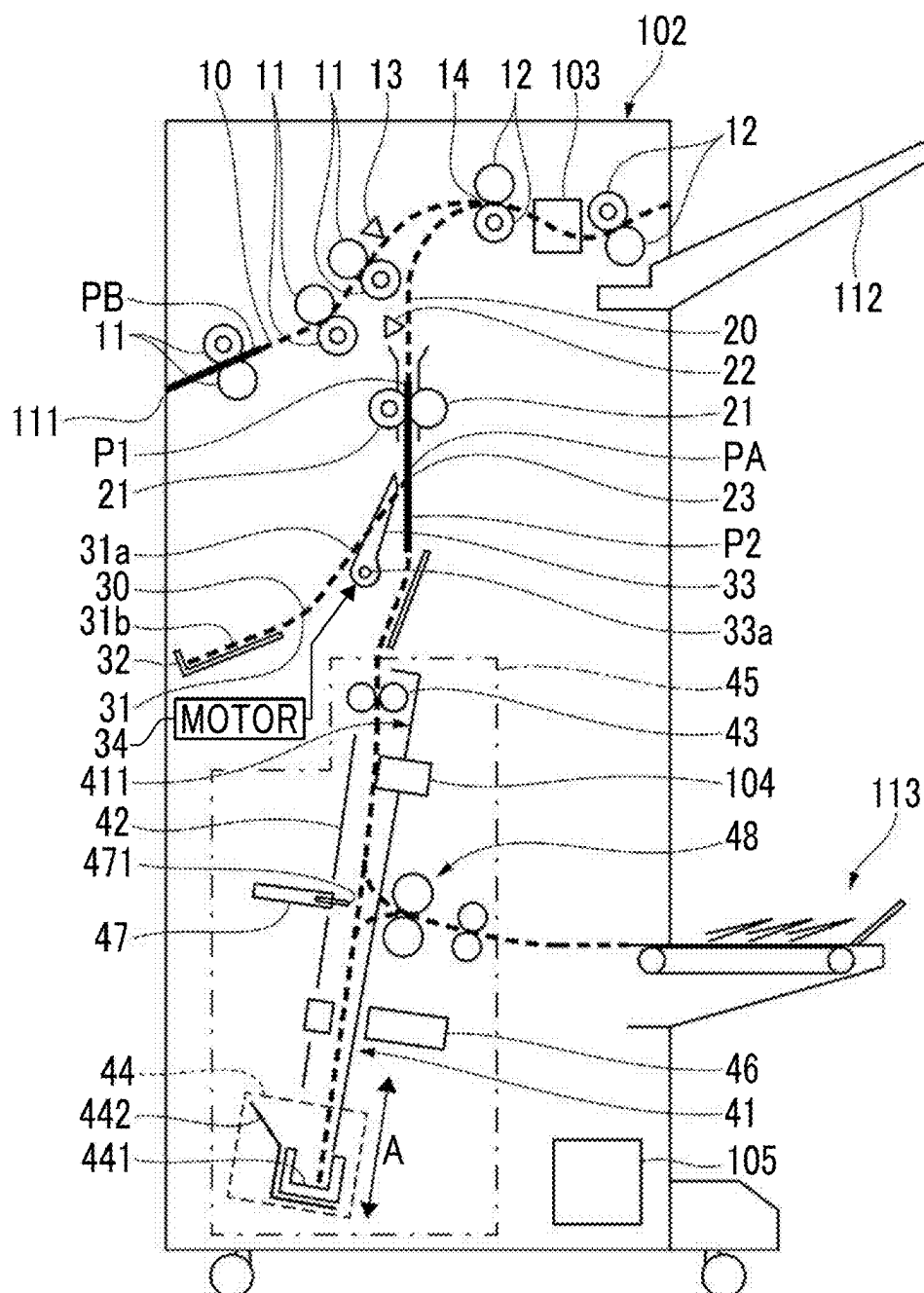
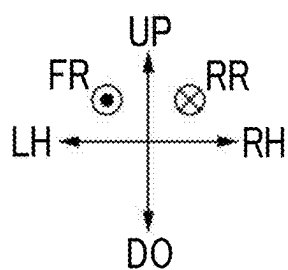


FIG. 11

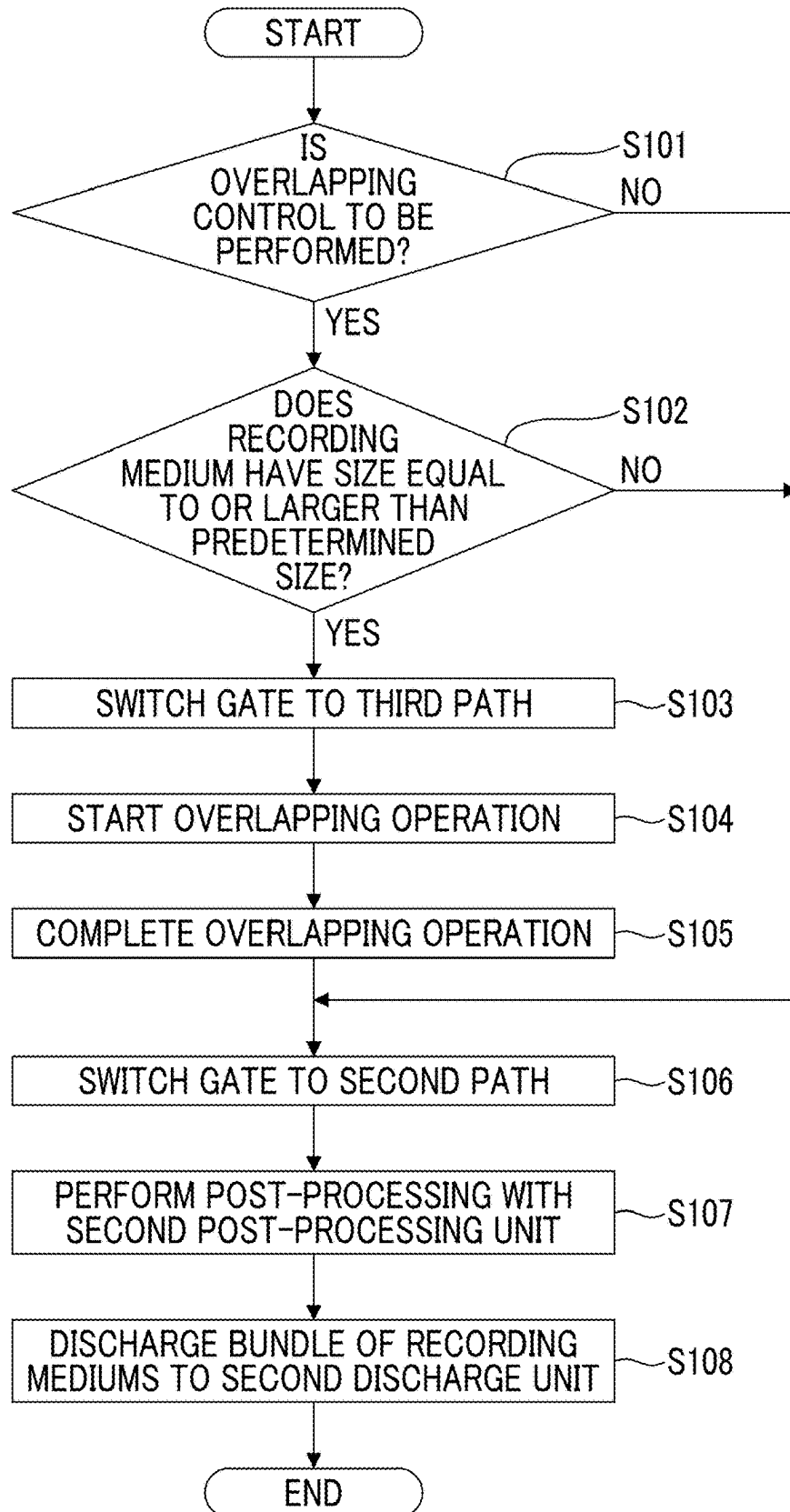
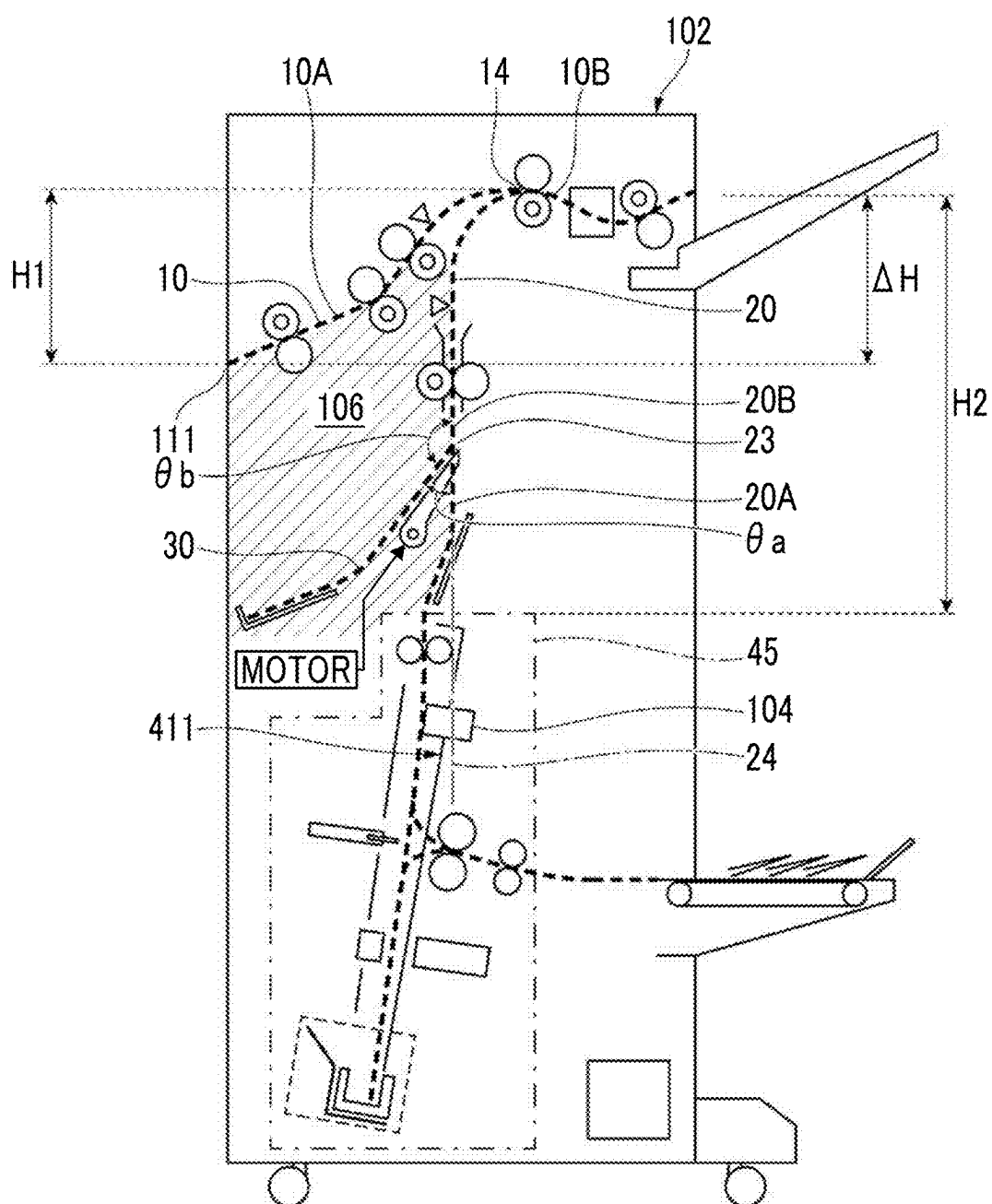
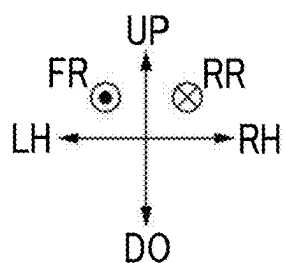


FIG. 12



POST-PROCESSING DEVICE AND IMAGE FORMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2024-020036 filed Feb. 14, 2024.

BACKGROUND

(i) Technical Field

[0002] The present invention relates to a post-processing device and an image forming apparatus.

(ii) Related Art

[0003] For example, JP2011-184177A discloses a sheet post-processing device including: a first transport path along which sheets to be transported are guided to a first post-processing unit; a first standby path that branches from a branch point of the first transport path; a second standby path that is formed continuously from the first standby path and joined to the first transport path; a transport standby path on which the sheets to be transported to the first post-processing unit along the first standby path and the second standby path are made to stand by; a second transport path which branches from a branch point of the first standby path and along which the sheets to be transported to the first standby path are guided to a second post-processing unit; a first path switching unit that is provided at the branch point of the first transport path and switches and connects the first transport path to the first standby path or the first post-processing unit; and a second path switching unit that is provided at the branch point of the first standby path and switches and connects the first standby path to the second standby path or the second transport path.

SUMMARY

[0004] Here, a case where recording mediums having different sizes are handled in a case where an operation for causing recording mediums to overlap with each other is performed using paths in the device for performing post-processing on recording mediums on which images are formed is conceivable. In a case where an overlapping operation for large recording mediums is performed on a path on which an overlapping operation for small recording mediums is performed, it is necessary to ensure the length of the path in the device in accordance with the large recording medium. For this reason, the device is increased in size.

[0005] Aspects of non-limiting embodiments of the present disclosure relate to a post-processing device and an image forming apparatus that are reduced in size, as compared to a case where a path in a device is lengthened in accordance with the size of a large recording medium in the device that performs an overlapping operation for large recording mediums on a path on which an overlapping operation for small recording mediums is performed.

[0006] Aspects of certain non-limiting embodiments of the present disclosure overcome the above disadvantages and/or other disadvantages not described above. However, aspects of the non-limiting embodiments are not required to overcome the disadvantages described above, and aspects of

the non-limiting embodiments of the present disclosure may not overcome any of the disadvantages described above.

[0007] According to an aspect of the present disclosure, there is provided a post-processing device including: a first path along which a recording medium on which an image is formed is received and guided to a discharge unit; a second path that branches from the first path and receives the recording medium of the first path to make the first path empty and along which the recording medium is guided to a retention part temporarily retaining a recording medium to be subjected to post-processing; and a third path that branches from the second path and is usable in a case where an overlapping operation for causing the recording medium of the first path and the recording medium of the second path to overlap with each other is performed using the first path and the second path, a leading end portion of the recording medium advancing from the first path along the second path entering the third path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Exemplary embodiment(s) of the present invention will be described in detail based on the following figures, wherein:

[0009] FIG. 1 is a schematic diagram showing a configuration of an image forming apparatus according to a present exemplary embodiment;

[0010] FIG. 2 is a diagram illustrating a first transport example of a recording medium;

[0011] FIG. 3 is a diagram illustrating the first transport example of the recording medium;

[0012] FIG. 4 is a diagram illustrating a second transport example of a recording medium;

[0013] FIG. 5 is a diagram illustrating the second transport example of the recording medium;

[0014] FIG. 6 is a diagram illustrating the second transport example of the recording medium;

[0015] FIG. 7 is a diagram illustrating the second transport example of the recording medium;

[0016] FIG. 8 is a diagram illustrating the second transport example of the recording medium;

[0017] FIG. 9 is a diagram illustrating the second transport example of the recording medium;

[0018] FIG. 10 is a diagram illustrating a third transport example of a recording medium;

[0019] FIG. 11 is a flowchart showing a control example of a gate; and

[0020] FIG. 12 is a diagram illustrating a relationship between a first path, a second path, and a third path.

DETAILED DESCRIPTION

[0021] Exemplary embodiments of the present invention will be described in detail below with reference to the accompanying drawings.

Image Forming Apparatus 100

[0022] First, a configuration of an image forming apparatus 100 according to the present exemplary embodiment will be described. FIG. 1 is a schematic diagram showing the configuration of the image forming apparatus 100 according to the present exemplary embodiment.

[0023] An arrow UP shown in the drawing indicates an upper side of the apparatus, and an arrow DO indicates a lower side of the apparatus. Further, an arrow LH shown in

the drawings indicates a left side of the apparatus and an arrow RH indicates a right side of the apparatus. Furthermore, an arrow FR shown in the drawings indicates a front side of the apparatus and an arrow RR indicates a rear side of the apparatus. Since these directions are directions defined for the convenience of description, the configuration of the apparatus is not limited to these directions. The word “apparatus” may be omitted in each direction of the apparatus. That is, for example, “the upper side of the apparatus” may be simply referred to as “the upper side”, and “the lower side of the apparatus” may be simply referred to as “the lower side”.

[0024] Further, in the following description, “up-down direction” may be used to mean “both an upper side and a lower side”, “any one of the upper side or the lower side”, or “height direction”. The height direction referred to herein is a direction indicated by the arrow UP and the arrow DO.

[0025] “Right-left direction” may be used to mean “both a left side and a right side” or “any one of the left side or the right side”. “Right-left direction” may also be referred to as a lateral side, a lateral direction, and a horizontal direction.

[0026] “Front-rear direction” may be used to mean “both a front side and a rear side” or “any one of the front side or the rear side”. “Front-rear direction” may also be referred to as a lateral side, a lateral direction, and a horizontal direction. Furthermore, the up-down direction, the right-left direction, and the front-rear direction are directions intersecting with each other, specifically, directions orthogonal to each other.

[0027] Further, a symbol in which “x” is written in “○” in the drawings means an arrow from the front to the back of the plane of the paper. Furthermore, a symbol in which “•” is written in “○” in the drawings means an arrow from the back to the front of the plane of the paper.

[0028] Moreover, dimensional ratios of parts shown in the respective drawings in the up-down direction, the right-left direction, and the front-rear direction may differ from actual dimensional ratios.

[0029] The image forming apparatus 100 shown in FIG. 1 is an apparatus that forms an image on a recording medium P (see FIG. 2), and includes an image forming unit 101 and a post-processing device 102 as shown in FIG. 1. Each part of the image forming apparatus 100, specifically, the image forming unit 101 and the post-processing device 102 will be described below.

Image Forming Unit 101

[0030] The image forming unit 101 shown in FIG. 1 is a component unit that forms an image on the recording medium P. For example, an electrophotographic image forming unit that forms an image on the recording medium P using toner is used as the image forming unit 101.

[0031] The electrophotographic image forming unit performs, for example, respective steps of charging, exposure, development, transfer, and fixing to form an image on the recording medium P. Specifically, the electrophotographic image forming unit performs, for example, the respective steps of charging, exposure, development, and transfer to form an image on a transfer body, transfers the image from the transfer body to the recording medium P, and then fixes the image to the recording medium P, so that the image can be formed on the recording medium P.

[0032] An example of the image forming unit is not limited to the electrophotographic image forming unit

described above and may be, for example, an inkjet image forming unit, and various image forming units can be used. The inkjet image forming unit jets, for example, ink droplets from a jet part to the recording medium P to form an image on the recording medium P.

Post-Processing Device 102

[0033] The post-processing device 102 shown in FIG. 1 is a device that performs post-processing, which is processing to be performed on the recording medium P on which the image is formed by the image forming unit 101, and includes a first post-processing unit 103 and a second post-processing unit 104.

[0034] Further, the post-processing device 102 includes a control unit 105 that controls each part. The control unit 105 includes, for example, a CPU, a RAM, a ROM, and the like.

[0035] The first post-processing unit 103 of the post-processing device 102 performs binding processing of binding a plurality of recording mediums P with a stapler as the post-processing, but the post-processing is not limited thereto. For example, the post-processing may be cutting processing of cutting the recording medium P, punching processing of forming a hole in the recording medium P, and the like, or may be processing to be performed on the recording medium P on which the image is formed.

[0036] The second post-processing unit 104 of the post-processing device 102 performs binding processing and folding processing on, for example, a middle portion of the plurality of recording mediums P in a transport direction as the post-processing to produce a booklet. The binding processing and the folding processing may be referred to as saddle-stitching hereinafter.

[0037] Further, the post-processing device 102 includes a receiving unit 111 that receives the recording medium P on which the image is formed by the image forming unit 101, and a first discharge unit 112 to which the recording medium P received by the receiving unit 111 and subjected to the post-processing by the first post-processing unit 103 is to be discharged.

[0038] Furthermore, the post-processing device 102 includes a second discharge unit 113 to which the recording medium P received by the receiving unit 111 and subjected to the post-processing by the second post-processing unit 104 is to be discharged.

[0039] The first discharge unit 112 is an example of a discharge unit.

[0040] In the post-processing device 102, the receiving unit 111 and the first discharge unit 112 are positioned on the upper side of the device, and the second discharge unit 113 is positioned on the lower side of the device. Further, the receiving unit 111 is provided on the left side of the post-processing device 102, and the first discharge unit 112 and the second discharge unit 113 are provided on the right side of the post-processing device 102.

[0041] The post-processing device 102 includes a first path 10 that is a path along which the recording medium P received by the receiving unit 111 is transported to the first discharge unit 112, and a second path 20 which branches from a branch point 14 of the first path 10 and extends downward and along which the recording medium P is transported to the second post-processing unit 104. In addition, the recording mediums P that advance to the second post-processing unit 104 on the second path 20 are subjected to the post-processing by the second post-processing unit

104 as described above, and are discharged to the second discharge unit 113 as a booklet.

[0042] Further, the post-processing device 102 includes a third path 30 that branches from a branch point 23 of the second path 20 and extends obliquely downward, in addition to the first path 10 and the second path 20 described above.

[0043] Furthermore, in the present exemplary embodiment, the third path 30 is provided on one side of the second path 20 facing the image forming unit 101, that is, facing the receiving unit 111 in consideration of effective use of the internal layout of the post-processing device 102, a reduction in the degree of bending of the recording medium P in a case where the recording medium P is transported to the third path 30, and the like. However, the position of the third path 30 is not limited thereto, and a configuration in which the third path 30 is provided on one side of the second path 20 opposite to the image forming unit 101 is also conceivable. Accordingly, a leading end portion of the recording medium P transported along the third path 30 can protrude from an outer surface of the post-processing device 102, so that it is possible to cope with a recording medium P longer in the transport direction.

[0044] The path of the recording medium P is shown in FIG. 1 by a thick line.

[0045] The first path 10 is provided with transport rollers 11, transport rollers 12 that are positioned closer to the first discharge unit 112 than the transport rollers 11, and a first detection unit 13 that is positioned between the transport rollers 11 and 12. The transport rollers 12 are provided at the branch point 14 of the first path 10 in the present exemplary embodiment.

[0046] The first detection unit 13 detects an end portion, for example, a leading end portion of the recording medium P transported along the first path 10.

[0047] The transport rollers 11 can control a transport speed of the recording medium P. Further, the transport rollers 11 can control a transport timing at which the recording medium P is transported on the first path 10 on the basis of a detection result of the first detection unit 13.

[0048] The transport rollers 12 are adapted to be capable of being rotated in a normal direction and a reverse direction, and can switch back the recording medium P on the first path 10. That is, in a case where the transport rollers 12 are rotated in the normal direction, the recording medium P is discharged to the first discharge unit 112. Furthermore, in a case where the transport rollers 12 are rotated in the reverse direction, the recording medium P switched back on the first path 10 is transported to the second path 20.

[0049] “Switching back” described herein means switching of a transport direction or a traveling direction of the recording medium P to an opposite direction. That is, a leading end portion of the recording medium P in a case where the traveling direction is one direction serves as a tail end portion in a case where the traveling direction is switched by “switching back” and the recording medium advances in the other direction which is an opposite direction. The leading end portion and the tail end portion of the recording medium P before “switching back” serve as the tail end portion and the leading end portion after “switching back”, respectively.

[0050] The second path 20 is provided with transport rollers 21 and a second detection unit 22 that is positioned closer to the branch point 14 of the first path 10 than the transport rollers 21.

[0051] The second detection unit 22 detects an end portion, for example, a leading end portion of the recording medium P transported along the second path 20.

[0052] The transport rollers 21 can be rotated in a normal direction and a reverse direction like the transport rollers 12 of the first path 10 described above, and can switch back the recording medium P on the second path 20. That is, in a case where the transport rollers 21 are rotated in the normal direction, the recording medium P is transported downward. Further, in a case where the transport rollers 21 are rotated in the reverse direction, the recording medium P switched back on the second path 20 is returned from the branch point 14 to the first path 10.

[0053] An operation for returning the recording medium P of the second path 20 to the first path 10 is performed at a timing at which the first detection unit 13 detects the recording medium P received by the receiving unit 111. Accordingly, the preceding recording medium P of the second path 20 and the recording medium P of the first path 10 following the recording medium P are made to overlap with each other on the first path 10. A bundle of a plurality of recording mediums P overlapping with each other as described above can be transported on the second path 20 and this can be repeated to form a bundle of more recording mediums P.

[0054] As described above, an overlapping operation, which is an operation for causing the recording mediums P received in order by the receiving unit 111 to overlap with each other to form a bundle of a plurality of recording mediums, can be performed in the post-processing device 102 according to the present exemplary embodiment. The bundle of the recording mediums P, which are caused to overlap with each other by such an overlapping operation, is transported to the above-described second post-processing unit 104, and is subjected to the post-processing by the second post-processing unit 104.

[0055] In addition, in a case where the recording medium P received by the receiving unit 111 is not subjected to the overlapping operation and is not subjected to the post-processing in the second post-processing unit 104, the recording medium P is discharged from the first path 10 to the first discharge unit 112.

[0056] Further, in a case where the recording mediums P received by the receiving unit 111 are subjected to the overlapping operation and then subjected to the post-processing by the second post-processing unit 104, the recording mediums P are transported from the first path 10 to the second path 20, are subjected to the post-processing by the second post-processing unit 104, and are discharged to the second discharge unit 113 as a booklet.

[0057] An aspect in which the recording mediums P received by the receiving unit 111 are subjected to the overlapping operation and then discharged to the first discharge unit 112 and an aspect in which the recording mediums P received by the receiving unit 111 are not subjected to the overlapping operation, are subjected to the post-processing of the second post-processing unit 104 one by one, and are then discharged to the second discharge unit 113 is also conceivable.

[0058] Further, although the recording medium P received by the receiving unit 111 is transported to the second post-processing unit 104 via the second path 20 from the first path 10 in the present exemplary embodiment, a modification example in which a path (not shown) along which the

recording medium P received by the receiving unit 111 is directly transported to the second path 20 without passing along the first path 10 is additionally provided is also conceivable.

[0059] The third path 30 is provided with a chute 31, a stopper 32, a gate 33, and a motor 34 that drives the gate 33.

[0060] The motor 34 is a dedicated drive source for driving only the gate 33, but is not limited thereto. It is also conceivable that the motor 34 is used as, for example, a drive source for driving the transport rollers 21 as well.

[0061] The chute 31 is a plate-like member that guides the recording medium P entering the third path 30, and holds the recording medium P on an upper surface thereof. The chute 31 includes a first member 31a and a second member 31b. A portion where the first member 31a and the second member 31b are connected to each other is formed in a smooth arc shape.

[0062] The stopper 32 is a member that defines a moving end of the recording medium P entering the third path 30, and is provided at an end portion of the second member 31b far from the first member 31a. The third path 30 is provided with the stopper 32, and the third path 30 is not a path along which a recording medium passes but a dead end path. Therefore, the recording medium P entering the third path 30 goes out from the third path 30 by being turned over.

[0063] Here, in a case where the recording medium P enters the third path 30, the tail end portion of the recording medium P is held by the transport rollers 21. In a case where the recording medium P entering the third path 30 is held by the transport rollers 21, the leading end portion of the recording medium P is positioned not to be in contact with the stopper 32. In a case where the recording medium P entering the third path 30 is not held by the transport rollers 21, the stopper 32 prevents the recording medium P from falling out of the third path 30.

[0064] The gate 33 is provided at the branch point 23 of the second path 20 and switches a direction in which the recording medium P of the second path 20 advances. Examples of the direction in which the recording medium P advances include a direction in which the recording medium P is guided to the third path and a direction in which the recording medium P is guided to a sheet loading part 411.

[0065] In the present exemplary embodiment, the gate 33 can be rotated about a rotating shaft 33a. More specifically, since the gate 33 is rotated about the rotating shaft 33a by receiving a driving force from the motor 34, a posture of the gate 33 is changed such that a direction in which the recording medium P advances is changed.

[0066] Examples of such a change in the posture include a case where the posture of the gate is changed from a posture (see FIG. 1) in which the gate blocks the second path 20 to a posture in which the gate does not block the second path 20 and a case where the posture of the gate is changed from the posture in which the gate does not block the second path 20 to the posture (see FIG. 1) in which the gate blocks the second path 20. That is, the former is a case where the recording medium P is guided from the second path 20 to the sheet loading part 411, and the latter is a case where the recording medium P is guided to the third path 30.

[0067] In a case where the gate 33 shown in FIG. 1 is in the posture in which the gate blocks the second path 20 as described above, the recording medium P transported from the first path 10 advances to the third path 30. On the other hand, in a case where the gate 33 is in the posture in which

the gate does not block the second path 20, the recording medium P transported from the first path 10 travels straight along the second path 20 to the sheet loading part 411 of the second post-processing unit 104.

[0068] The gate 33 is an example of a switching member.

[0069] Next, a configuration of the second post-processing unit 104 will be described. As described above, the recording medium P is transported to the second post-processing unit 104 along the second path 20, the second post-processing unit 104 performs saddle-stitching processing, and a produced booklet is discharged to the second discharge unit 113. “A bundle of the recording mediums P” or simple “bundle” also includes a bundle formed of one recording medium P.

[0070] As shown in FIG. 1, the second post-processing unit 104 is provided with a compile tray 41, a guide 42, feed rollers 43, an end guide 44, a sheet aligning member 45, a stapler 46, a folding knife 47, and folding rollers 48. An operation of each part of the second post-processing unit 104 is controlled by the control unit 105. For example, an opening/closing mechanism for the end guide 44, the operations of the folding knife 47 and the folding rollers 48, and the like are controlled by the control unit 105.

[0071] The recording mediums P sequentially transported from the image forming apparatus 100 are loaded onto the compile tray 41. Accordingly, a bundle of one or a plurality of recording mediums P is formed. The number of recording mediums in the bundle of the recording mediums P is specified by the setting of printing processing to be performed. In the present specification, the “a bundle of sheets” also includes a bundle formed of one recording medium P.

[0072] The compile tray 41 includes a plate-like sheet loading part 411 having a size corresponding to the recording medium P.

[0073] The sheet loading part 411 is a member onto which a bundle of recording mediums P on which saddle-stitching is to be performed is to be loaded. The second path 20 guides the recording medium P to the sheet loading part 411.

[0074] The sheet loading part 411 is an example of a retention part that temporarily retains a recording medium to be subjected to post-processing.

[0075] The guide 42 is disposed at a position facing the compile tray 41 and guides the recording medium P fed from the feed rollers 43. The guide 42 is disposed along the compile tray 41 with a gap between the guide 42 and the compile tray 41.

[0076] The feed rollers 43 feed the recording medium P, which is transported from the image forming apparatus 100, toward the compile tray 41. In a case where printing processing is performed on the plurality of recording mediums P, the recording medium P is fed by the feed rollers 43 a number of times corresponding to the number of sheets to be printed.

[0077] The end guide 44 includes a butting part 441 against which a lower end portion of the bundle of the recording mediums P butts, and an opening/closing mechanism 442 that can press and hold the recording mediums P of which the lower end portions butt against the butting part 441.

[0078] The butting part 441 is adapted to be movable in the up-down direction A. Accordingly, the position of the recording medium P can be changed in accordance with the

processing to be performed on the bundle of the recording mediums P, that is, the binding processing and the folding processing.

[0079] The opening/closing mechanism **442** is adapted to be movable in a direction intersecting with the up-down direction A and to be capable of changing a storage width in which the recording medium P is to be stored. That is, the opening/closing mechanism **442** can be moved in a thickness direction of the bundle of the recording mediums P. More specifically, any one of a closed state or an open state is selected. The closed state is a state where the opening/closing mechanism **442** is moved in a direction in which the storage width is reduced in a case where the post-processing is to be performed to clamp and press the bundle of the recording mediums P, and the open state is a state where the opening/closing mechanism **442** is moved in a direction in which the storage width is increased to allow the recording mediums P to be taken in and out without clamping the bundle of the recording mediums P.

[0080] The sheet aligning member **45** is a tamper which presses, that is, tamps the bundle loaded onto the compile tray **41** to align the bundles of sheets. The sheet aligning member **45** may be adapted to press the bundle from above to align the bundle in the up-down direction together with the butting part **441** of the end guide **44**. The sheet aligning member **45** may perform an operation for aligning a recording medium P whenever the recording medium P is transported onto the compile tray **41**, or may align sheets after a number of recording mediums P determined according to the setting of the printing processing are loaded onto the compile tray **41**.

[0081] The stapler **46** performs the binding processing on a bundle of sheets loaded on the compile tray **41**. The binding processing of binding a bundle of sheets using a binding staple has been assumed and described in the present exemplary embodiment. However, for example, a mechanism for pressure-bonding sheets to bind the sheets without using a binding staple may be used as the binding processing.

[0082] The folding knife **47** presses the bundle of the recording mediums P. The folding knife **47** is disposed at a position facing the compile tray **41**.

[0083] The folding knife **47** includes a protruding part **471** that is adapted to be capable of advancing to and retreating from the compile tray **41** over a width direction of the recording medium P. The folding knife **47** is disposed at a position where the protruding part **471** is not in contact with the bundle loaded onto the compile tray **41** in a state where the protruding part **471** is in a retreat position. The folding knife **47** passes through an opening portion of the compile tray **41** and reaches the folding rollers **48** provided on the back side of the compile tray **41** in a state where the protruding part **471** advances to the compile tray **41**. Therefore, in a case where the protruding part **471** advances toward the compile tray **41** in a state where the bundle is loaded onto the compile tray **41**, the folding knife **47** is in contact with the surface of the bundle and presses the bundle toward the opening portion of the compile tray **41**. Accordingly, the bundle of the recording mediums P is bent to form a bent portion at a position where the bundle is pressed by the protruding part **471** of the folding knife **47**.

[0084] Next, various transport examples of the recording medium P in the post-processing device **102** will be described.

[0085] In the description of various transport examples, in consideration of a case where the recording medium is switched back, a leading end portion of a recording medium P in a case where the recording medium P is received by the receiving unit **111** of the post-processing device **102** will be described as a first end portion P1 and a tail end portion thereof will be described as a second end portion P2. Further, one alphabet character is added after “P” to distinguish each recording medium P in the overlapping operation, and it is assumed that a recording medium PB is transported after a recording medium PA.

[0086] Furthermore, in the drawings illustrating various transport examples, the first path **10**, the second path **20**, and the third path **30** along which the recording medium P is transported are shown by broken lines and the recording medium P to be transported is shown by a solid line.

[0087] A first transport example, a second transport example, and a third transport example of the recording medium P will be described below.

First Transport Example

[0088] First, the first transport example will be described. The first transport example is an example in which a recording medium P is transported to the first discharge unit **112** along the first path **10**.

[0089] FIGS. **2** and **3** are diagrams illustrating the first transport example of a recording medium P, and show the transport of the recording medium P in time series.

[0090] In the first transport example, as shown in FIG. **2**, a recording medium P received by the receiving unit **111** of the post-processing device **102** is transported along the first path **10**, and is subjected to the post-processing performed by the first post-processing unit **103** in this case. The recording medium P subjected to the post-processing further advances along the first path **10** and is discharged from the first discharge unit **112** as shown in FIG. **3**. In the first transport example, the recording medium P is not switched back.

[0091] In the first transport example, one recording medium P is discharged from the first discharge unit **112** after being subjected to the post-processing performed by the first post-processing unit **103**, but the present invention is not limited thereto. That is, a case where the recording medium P is discharged from the first discharge unit **112** without being subjected to the post-processing performed by the first post-processing unit **103** is also conceivable.

[0092] Further, a case where recording mediums P are discharged from the first discharge unit **112** as a bundle is also conceivable. That is, in the first transport example, an overlapping operation also using the second path **20** is not performed, but a case where an overlapping operation is performed to discharge a plurality of recording mediums P from the first discharge unit **112** is also conceivable.

Second Transport Example

[0093] Next, the second transport example will be described. The second transport example is an example in which recording mediums PA and PB are discharged to the second discharge unit **113** along the first path **10** and the second path **20**, and an overlapping operation for the recording mediums PA and PB is performed.

[0094] FIGS. 4, 5, 6, 7, 8, and 9 are diagrams illustrating the second transport example of the recording mediums PA and PB, and show the second transport example in time series.

[0095] In the second transport example, in a case where a leading end portion of the recording medium PA received by the receiving unit 111 of the post-processing device 102 is a first end portion P1 and a tail end portion of the recording medium PA is a second end portion P2, the recording medium PA is temporarily stopped when the second end portion P2 reaches the position of the transport rollers 12 as shown in FIG. 4. In other words, the recording medium PA is stopped at a position where the second end portion P2 has passed the branch point 14.

[0096] The first end portion P1 of the recording medium PA is positioned outside the device from the first discharge unit 112.

[0097] After that, the recording medium PA is switched back and transported to the second path 20 from the branch point 14 as shown in FIG. 5. The second end portion P2 of the recording medium PA serves as a leading end portion, and the first end portion P1 serves as a tail end portion.

[0098] In the case shown in FIG. 5, the second end portion P2 of the recording medium PA is positioned at the transport rollers 21 of the second path 20, and the first end portion P1 thereof is positioned at the transport rollers 12 of the first path 10.

[0099] In a case shown in FIG. 5, the gate 33 of the third path 30 is in the posture in which the gate blocks the second path 20. For this reason, in a case where the recording medium PA further advances along the second path 20 from the state shown in FIG. 5, the recording medium PA is deviated from the second path 20 and guided to the third path 30 by the gate 33 as shown in FIG. 6.

[0100] In a case shown in FIG. 6, the recording medium PA is held by the transport rollers 21. The second end portion P2 of the recording medium PA is separated from the stopper 32 of the third path 30.

[0101] The second end portion P2 of the recording medium PA is positioned on the third path 30, and the first end portion P1 is positioned at the transport rollers 21 of the second path 20. The third path 30 is a transport path that can be used in a case where an overlapping operation is performed.

[0102] In addition, in the case shown in FIG. 6, the recording medium PA is transported from the first path 10 to the second path 20 and the third path 30 and the first path 10 is empty. That is, since a state where the recording medium PB subsequent to the recording medium PA can be transported is made, the recording medium PB is received by the receiving unit 111 and the first end portion P1, which is a leading end portion, travels along the first path 10 as shown in FIG. 6.

[0103] In a case shown in FIG. 7, the first end portions P1, which are the leading end portions of the recording medium PA and the recording medium PB, overlap with each other on the first path 10. The second end portion P2 of the recording medium PA is positioned on the second path 20, and the second end portion P2 of the recording medium PB is positioned on the first path 10.

[0104] At a timing when the subsequent recording medium PB passes through the branch point 14 of the first path 10, the preceding recording medium PA returns to the

first path 10 from the second path 20 via the branch point 14, so that the overlapping operation is performed.

[0105] In a case shown in FIG. 8, the recording medium PA and the recording medium PB overlap with each other on the first path 10. As in the case of FIG. 4, the first end portions P1 of the recording medium PA and the recording medium PB are positioned outside the device from the first discharge unit 112.

[0106] The recording medium PA and the recording medium PB overlapping with each other are switched back, and enter the second path 20 from the branch point 14 of the first path 10 in a case shown in FIG. 9. The gate 33 of the third path 30 is in a posture in which the gate blocks the third path 30. For this reason, as shown in FIG. 9, the recording medium PA and the recording medium PB do not advance to the third path 30 at the branch point 23 of the second path 20, but advance to the second path 20 and are transported to the second post-processing unit 104.

[0107] Here, in a case where the above-described overlapping operation for the recording medium PA and the recording medium PB is performed, a case where a bundle of the recording mediums P is already transported to the second post-processing unit 104 is conceivable. FIG. 6 described above shows a state where the bundle of the recording mediums P is transported to the second post-processing unit 104, and a description will be made using FIG. 6.

[0108] In the state shown in FIG. 6, in a case where the third path 30 is not used when the recording medium PA retreats from the first path 10, the second end portion P2 of the recording medium PA is positioned not on the third path 30 but on the second path 20. For this reason, there is a concern that the second end portion P2 of the recording medium PA may interfere with the recording medium P of the second post-processing unit 104 depending on the length of the recording medium P of the second post-processing unit 104 and the length of the recording medium PA.

[0109] A measure for limiting the length of the recording mediums P, PA, and PB handled by the post-processing device 102 to a short length or for lengthening the length of the second path 20 of the post-processing device 102 is conceivable as a measure for preventing such interference. Such a measure causes the use of the post-processing device 102 to be restricted or causes the device to increase in size.

[0110] Therefore, in the present exemplary embodiment, a configuration in which the third path 30 can be used in a case where an overlapping operation for causing the recording medium PA and the recording medium PB to overlap with each other using the first path 10 and the second path 20 is performed is employed to prevent restriction on the use and an increase in the size of the device.

[0111] The second end portion P2, which is the leading end portion of the preceding recording medium PA, is caused to enter the third path 30, so that the overlapping operation can be performed even in a case where the lengths of the recording medium PA and the recording medium PB are long and the bundle of the recording mediums P has been transported to the post-processing device 102.

Third Transport Example

[0112] FIG. 10 is a diagram illustrating a third transport example of a recording medium P. FIG. 10 corresponds to

FIG. 6 of the second transport example showing a case where an overlapping operation is performed for the recording mediums PA and PB.

[0113] The sizes of recording mediums PA and PB in the third transport example shown in FIG. 10 are smaller than the sizes of recording mediums in the second transport example. For this reason, even in a case where a bundle of recording mediums P is already loaded into the sheet loading part 411, there is no concern that the recording medium PA switched back on the first path 10 and transported to the second path 20 interferes with the recording mediums P of the sheet loading part 411 even though not being guided to the third path 30.

[0114] Therefore, in the third transport example, the gate 33 is not changed to a posture in which the gate blocks the second path 20. As shown in FIG. 10, the gate 33 is in a posture in which the gate blocks the third path 30.

[0115] Meanwhile, even in a case where the size of a recording medium P is large as in the second transport example in addition to a case where the size of the recording medium P of the sheet loading part 411 is small, it is conceivable that a control not to guide the recording medium P to the third path 30 is performed in a case where there is no concern that the recording medium P interferes with the recording medium P of the sheet loading part 411.

[0116] FIG. 11 is a flowchart showing a control example of the gate 33.

[0117] In the control example shown in FIG. 11, in a case where the control unit 105 (see FIG. 1) of the post-processing device 102 receives a signal indicating that a recording medium P (see FIG. 2) is transported, the control unit 105 determines whether or not to perform an overlapping control that is a control to perform an overlapping operation for the recording medium P as an object to be transported (Step S101).

[0118] In a case where the overlapping control is performed (Yes in Step S101), the control unit 105 (see FIG. 1) determines whether or not a recording medium PA as an object to be transported has a size equal to or larger than a predetermined size (Step S102). The predetermined size described herein is determined in accordance with a path length of the post-processing device 102, and an example thereof is a size larger than A4 and does not include a B5 size.

[0119] In a case where the recording medium PA as an object to be transported has a size equal to or larger than the predetermined size (Yes in Step S102), the control unit 105 (see FIG. 1) drives the motor 34 to switch the gate 33 such that the second path 20 is blocked by the gate 33 and the recording medium PA advances to the third path 30 (Step S103). A case where the recording medium PA has a size equal to or larger than the predetermined size is an example of a case where the recording medium satisfies a predetermined condition indicating an outer shape.

[0120] Then, the overlapping operation is started (Step S104).

[0121] In a case where the overlapping operation is completed (Step S105), the control unit 105 (see FIG. 1) drives the motor 34 to switch the gate 33 such that the third path 30 is blocked by the gate 33 and the recording medium P advances to the second path 20 (Step S106). Accordingly, the bundle of the recording mediums P is transported to the second post-processing unit 104.

[0122] The transported bundle of the recording mediums P is subjected to post-processing by the second post-processing unit 104 to be saddle-stitched and is discharged to the second discharge unit 113 (see FIG. 1) (Step S108), and a series of processing ends.

[0123] In a case where the overlapping control is not performed (No in Step S101) or in a case where the recording medium PA as an object to be transported does not have a size equal to or larger than the predetermined size (No in Step S102), the control unit 105 (see FIG. 1) proceeds to Step S106 and switches the gate to the second path 20 such that the recording medium PA is not guided to the third path 30.

[0124] FIG. 12 is a diagram illustrating a relationship between the first path 10, the second path 20, and the third path 30.

[0125] As shown in FIG. 12, the first path 10 includes an overlapping portion ΔH , which is a portion of which the position in a height direction, that is, in a direction of an arrow UP and an arrow DO overlaps with the second path 20. The overlapping portion ΔH is a portion in which a range H1 of the first path 10 and a range H2 of the second path 20 overlap each other in the height direction.

[0126] More specifically, in a case where the first path 10 is divided at the position of the branch point 14 such that a side of the first path 10 facing the receiving unit 111 forms a receiving-side portion 10A and a side thereof facing the first discharge unit 112 forms a discharge-side portion 10B, the overlapping portion ΔH is positioned in a hatched region 106 that is divided by the receiving-side portion 10A of the first path 10 and the second path 20.

[0127] The overlapping portion ΔH is an example of a portion of which the position in the height direction overlaps with the second path. The region 106 is an example of a divided region.

[0128] Further, the third path 30 is provided on a side on which the sheet loading part 411 of the post-processing device 102 is positioned in a case where the inside of the post-processing device 102 is divided by the second path 20 and a virtual extension line 24 extending downward from the second path 20. Since the third path 30 and the sheet loading part 411 are positioned on the same side with respect to the second path 20 and the virtual extension line 24 of the second path 20, a curl state of the recording medium P in a case where the recording medium P enters the third path 30 does not hinder the recording medium P from entering the sheet loading part 411.

[0129] In addition, a case where the second path 20 is divided into a first portion 20A which is a portion on a side corresponding to the sheet loading part 411 and a second portion 20B which is a portion on a side opposite to the sheet loading part 411 at the position of the branch point 23 is conceivable. In a case where an angle θ_a between the third path 30 and the first portion 20A of the second path 20 and an angle θ_b between the third path 30 and the second portion 20B of the second path 20 are compared with each other, the angle θ_a is smaller than the angle θ_b . That is, " $\theta_a < \theta_b$ " is satisfied. Since the third path 30 can be recognized as a substantially single arc shape and does not have, for example, an S-shape, it can be said that the third path 30 has a small number of curvature change points.

Supplementary Note

(((1)))

[0130] A post-processing device comprising:**[0131]** a first path along which a recording medium on which an image is formed is received and guided to a discharge unit;**[0132]** a second path that branches from the first path and receives the recording medium of the first path to make the first path empty and along which the recording medium is guided to a retention part temporarily retaining a recording medium to be subjected to post-processing; and**[0133]** a third path that branches from the second path and is usable in a case where an overlapping operation for causing the recording medium of the first path and the recording medium of the second path to overlap with each other is performed using the first path and the second path, a leading end portion of the recording medium advancing from the first path along the second path entering the third path.

(((2)))

[0134] The post-processing device according to (((1))),**[0135]** wherein the third path includes a portion of which a position in a height direction overlaps with the second path.

(((3)))

[0136] The post-processing device according to (((2))),**[0137]** wherein the portion of the third path is positioned in a region divided by a portion of the first path on a receiving side of the recording medium and the second path.

(((4)))

[0138] The post-processing device according to (((3))),**[0139]** wherein the third path is provided on a side on which the retention part is positioned in a case where an inside of the device is divided by the second path and a virtual extension line of the second path.

(((5)))

[0140] The post-processing device according to any one of (((1))) to (((4))),**[0141]** wherein in a case where the second path is divided into a first portion, which is a portion on a side corresponding to the retention part, and a second portion, which is a portion on a side opposite to the retention part, at a position of a branch of the third path, an angle between the third path and the first portion is smaller than an angle between the third path and the second portion.

(((6)))

[0142] The post-processing device according to any one of (((1))) to (((5))),**[0143]** wherein the leading end portion enters the third path in a case where the recording medium satisfies a predetermined condition indicating an outer shape.

(((7)))

[0144] A post-processing device comprising:**[0145]** a first path along which a recording medium on which an image is formed is received and guided to a discharge unit;**[0146]** a second path that branches from the first path and receives the recording medium of the first path to make the first path empty and along which the record-

ing medium is guided to a retention part temporarily retaining a recording medium to be subjected to post-processing; and

[0147] a third path that is usable in a case where an overlapping operation for causing the recording medium of the first path and the recording medium of the second path to overlap with each other is performed using the first path and the second path in a case where the recording medium is retained in the retention part, and branches from the second path at a position where the third path does not interfere with the recording medium of the retention part, a leading end portion of the recording medium advancing from the first path along the second path entering the third path.

(((8)))

[0148] The post-processing device according to (((7))), further comprising:**[0149]** a switching member that is provided at the position where the third path branches from the second path and switches a direction in which the recording medium advances.

(((9)))

[0150] The post-processing device according to (((8))),**[0151]** wherein the switching member guides the recording medium to the third path in a case where the overlapping operation is performed, and switches the direction in which the recording medium advances from the third path to the retention part in a case where the overlapping operation ends.

(((10)))

[0152] An image forming apparatus comprising:**[0153]** the post-processing device according to (((1))) or (((7))).**[0154]** The foregoing description of the exemplary embodiments of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

What is claimed is:

1. A post-processing device comprising:

a first path along which a recording medium on which an image is formed is received and guided to a discharge unit;

a second path that branches from the first path and receives the recording medium of the first path to make the first path empty and along which the recording medium is guided to a retention part temporarily retaining a recording medium to be subjected to post-processing; and

a third path that branches from the second path and is usable in a case where an overlapping operation for causing the recording medium of the first path and the recording medium of the second path to overlap with each other is performed using the first path and the second path, a leading end portion of the recording

medium advancing from the first path along the second path entering the third path.

2. The post-processing device according to claim 1, wherein the third path includes a portion of which a position in a height direction overlaps with the second path.
3. The post-processing device according to claim 2, wherein the portion of the third path is positioned in a region divided by a portion of the first path on a receiving side of the recording medium and the second path.
4. The post-processing device according to claim 3, wherein the third path is provided on a side on which the retention part is positioned in a case where an inside of the device is divided by the second path and a virtual extension line of the second path.
5. The post-processing device according to claim 1, wherein in a case where the second path is divided into a first portion, which is a portion on a side corresponding to the retention part, and a second portion, which is a portion on a side opposite to the retention part, at a position of a branch of the third path, an angle between the third path and the first portion is smaller than an angle between the third path and the second portion.
6. The post-processing device according to claim 1, wherein the leading end portion enters the third path in a case where the recording medium satisfies a predetermined condition indicating an outer shape.
7. A post-processing device comprising:
 - a first path along which a recording medium on which an image is formed is received and guided to a discharge unit;
 - a second path that branches from the first path and receives the recording medium of the first path to make the first path empty and along which the recording

medium is guided to a retention part temporarily retaining a recording medium to be subjected to post-processing; and

- a third path that is usable in a case where an overlapping operation for causing the recording medium of the first path and the recording medium of the second path to overlap with each other is performed using the first path and the second path in a case where the recording medium is retained in the retention part, and branches from the second path at a position where the third path does not interfere with the recording medium of the retention part, a leading end portion of the recording medium advancing from the first path along the second path entering the third path.
8. The post-processing device according to claim 7, further comprising:
 - a switching member that is provided at the position where the third path branches from the second path and switches a direction in which the recording medium advances.
 9. The post-processing device according to claim 8, wherein the switching member guides the recording medium to the third path in a case where the overlapping operation is performed, and switches the direction in which the recording medium advances from the third path to the retention part in a case where the overlapping operation ends.
 10. An image forming apparatus comprising:
 - the post-processing device according to claim 1.
 11. An image forming apparatus comprising:
 - the post-processing device according to claim 7.

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