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POST-PROCESSING DEVICE AND IMAGE FORMING APPARATUS

Abstract

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.

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Background/Summary

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.

Description

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 **31***a* and a second member **31***b*. A portion where the first member **31***a* and the second member **31***b* 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 **31***b* far from the first member **31***a*. 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 **33***a*. More specifically, since the gate **33** is rotated about the rotating shaft **33***a* 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 P**1** and a tail end portion thereof will be described as a second end portion P**2**. 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 P**1** and a tail end portion of the recording medium PA is a second end portion P**2**, the recording medium PA is temporarily stopped when the second end portion P**2** 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 P**2** has passed the branch point **14**.

[0096] The first end portion P**1** 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 P**2** of the recording medium PA serves as a leading end portion, and the first end portion P**1** serves as a tail end portion.

[0098] In the case shown in FIG. **5**, the second end portion P**2** of the recording medium PA is positioned at the transport rollers **21** of the second path **20**, and the first end portion P**1** 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 P**2** of the recording medium PA is separated from the stopper **32** of the third path **30**.

[0101] The second end portion P**2** of the recording medium PA is positioned on the third path **30**, and the first end portion P**1** 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 P**1**, 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 P**1**, 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 P**2** of the recording medium PA is positioned on the second path **20**, and the second end portion P**2** 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 P**1** 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 P**2** 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 P**2** 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 P**2**, 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 S**101**).
[0118] In a case where the overlapping control is performed (Yes in Step S**101**), 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 S**102**). 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 S**102**), 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 S**103**). 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 S**104**).
[0121] In a case where the overlapping operation is completed (Step S**105**), 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 S**106**). 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 S**108**), and a series of processing end.
[0123] In a case where the overlapping control is not performed (No in Step S**101**) 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 S**102**), the control unit **105** (see FIG. **1**) proceeds to Step S**106** 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 H**1** of the first path **10** and a range H**2** 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 **10**A and a side thereof facing the first discharge unit **112** forms a discharge-side portion **10**B, the overlapping portion ΔH is positioned in a hatched region **106** that is divided by the receiving-side portion **10**A 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 **20**A which is a portion on a side corresponding to the sheet loading part **411** and a second portion **20**B 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 θa between the third path **30** and the first portion **20**A of the

second path **20** and an angle θb between the third path **30** and the second portion **20**B of the second path **20** are compared with each other, the angle θa is smaller than the angle θb. That is, "θa<θb" 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 recording 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.

Claims

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.