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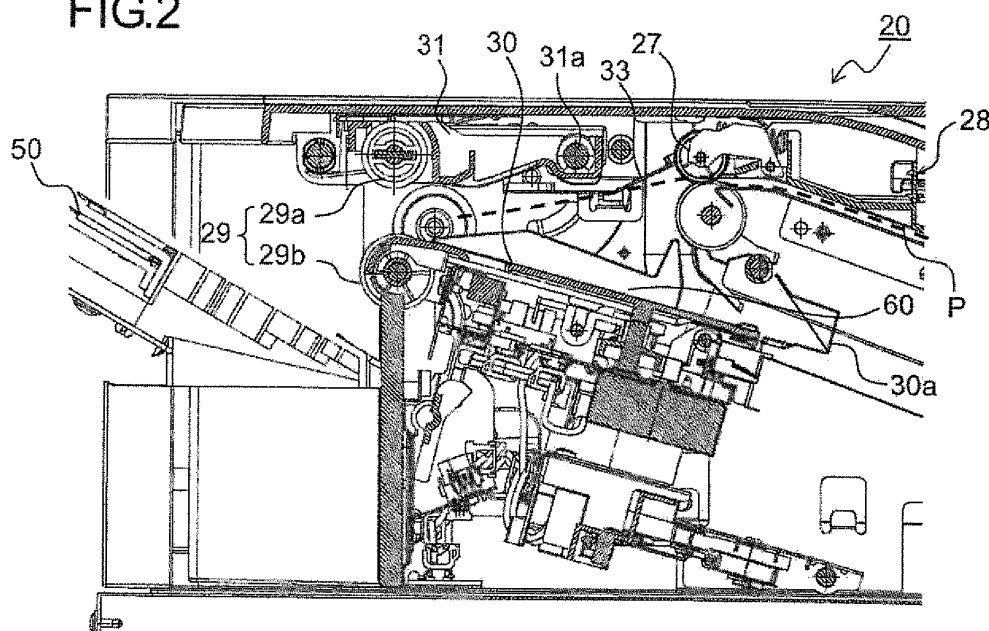
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(54) **SHEET POST-PROCESSING DEVICE AND IMAGE FORMING SYSTEM EQUIPPED WITH SAME**

(57) A sheet post-processing device (20) comprises: a processing tray (30); a discharge tray (50); and a pair of discharge rollers (29). The pair of discharge rollers (29) is constituted by a discharge roller (29a) which contacts the uppermost surface of sheets stacked in the processing tray (30), and a discharge roller (29b) which contacts the lowermost surface of the sheets stacked in the processing tray (30). The sheet post-processing de-

vice (20) discharges a sheet from the processing tray (30) to the discharge tray (50) by rotating the pair of discharge rollers (29) in the forward direction, and causes the sheet to be drawn into the processing tray (30) by rotating the discharge roller (29a) in the reverse direction in a state in which the rotation of the discharge roller (29b) is stopped.

FIG.2



Description

Technical Field

[0001] The present invention relates to a sheet post-processing device that performs post-processing such as a punch hole forming process and a binding process with respect to a sheet such as a paper sheet on which an image has been formed by an image forming apparatus such as a copy machine, a facsimile, or a printer, and an image forming system provided with the same.

Background Art

[0002] Conventionally, there is used a paper sheet post-processing device that is capable of executing a binding process of loading a plurality of paper sheets on each of which an image has been formed by an image forming apparatus such as a copy machine or a printer and binding together a bundle of the thus loaded paper sheets with a staple(s), a punch hole forming process of forming punch holes (perforations) therethrough by using a punch hole forming device, and so on.

[0003] In the paper sheet post-processing device described above, in performing a binding process, it is necessary that a paper sheet bundle be loaded in an aligned manner. For example, Patent Documents 1 and 2 disclose a paper sheet post-processing device provided with a carry-in roller pair that carries in a paper sheet on a processing tray and a discharge roller pair that discharges a paper sheet from the processing tray onto a discharge tray.

[0004] The discharge roller pair is composed of a discharge roll and a discharge roller that comes in pressure contact with or is separated from the discharge roll, and in a state where the discharge roller and the discharge roll are separated from each other, a paper sheet is carried in on the processing tray by the carry-in roller pair. Then, after a rear end of the paper sheet has passed through the carry-in roller pair, the discharge roller and the discharge roll are brought in pressure contact with each other and made to rotate reversely. Thus, the paper sheet is drawn in to an upstream side in a conveyance direction and comes in contact with a rear end restriction surface of the processing tray. In this manner, a paper sheet bundle on the processing tray is aligned.

List of Citations

Patent Literature

[0005]

Patent Document 1: JP-A-H09-156820
Patent Document 2: JP-A-2013-224221

Summary of the Invention

Technical Problem

[0006] In the method described in Patent Documents 1 and 2, however, when, in a state where paper sheets are already loaded on the processing tray, a succeeding paper sheet is drawn in, the loaded paper sheets are also drawn in together with the succeeding paper sheet, which has led to a problem that an alignment property of a paper sheet bundle is decreased.

[0007] Specifically, as shown in FIG. 5, in a case where a discharge roller pair 29 is made to rotate reversely to draw in a paper sheet P2 on a processing tray 30, when both of a discharge roller 29a and a discharge roll 29b that constitute the discharge roller pair 29 are made to rotate reversely, a paper sheet bundle P1 that has been butted against a butting portion 30a of the processing tray 30 and thus is already aligned might also be drawn in at the same time as the paper sheet P2. As a result, as shown by a broken line in FIG. 5, the paper sheet bundle P1 is bent, which has led to a fear that an alignment property of a paper sheet bundle is decreased.

[0008] In view of the above-described problem, it is an object of the present invention to provide a sheet post-processing device that, when drawing in a sheet on a processing tray by using a discharge roller pair and aligning a sheet bundle, can prevent an alignment failure of the sheet bundle, and an image forming system provided with the same.

Solution to the Problem

[0009] In order to achieve the above-described object, the present invention provides a sheet post-processing device that is provided with a processing tray, a discharge tray, and a discharge roller pair. The processing tray accepts and loads thereon a prescribed number of sheets. The discharge tray is disposed on a downstream side of the processing tray in a sheet conveyance direction, and onto which sheets loaded on the processing tray are discharged. The discharge roller pair is composed of a discharge roller that comes in contact with an uppermost surface of sheets loaded on the processing tray and a discharge roll that comes in contact with a lowermost surface of the sheets loaded on the processing tray. The sheet post-processing device discharges a sheet from the processing tray onto the discharge tray by forwardly rotating the discharge roller pair, and draws in a sheet on the processing tray by reversely rotating the discharge roller in a state where the discharge roll is stopped from rotating.

Advantageous Effects of the Invention

[0010] According to a first configuration of the present invention, a sheet is drawn in on the processing tray by reversely rotating only the discharge roller in a state

where the discharge roll is stopped from rotating, and thus a drawing-in force is exerted only on a sheet being newly carried in and not on a sheet bundle that has already been aligned on the processing tray. Accordingly, there is no fear that a sheet bundle that has already been aligned is drawn in together with a sheet being newly carried in and thus is bent, so that an alignment property of a sheet bundle on the processing tray can be effectively prevented from being decreased.

Brief Description of Drawings

[0011]

[FIG. 1] is a schematic view showing an internal configuration of an image forming apparatus 100 and a paper sheet post-processing device 20 of the present invention.

[FIG. 2] is a partially enlarged view of a periphery of a processing tray 30 in the paper sheet post-processing device 20 shown in FIG. 1, which shows a state where a discharge roller 29a is disposed at a separated position.

[FIG. 3] is a partially enlarged view of the periphery of the processing tray 30 in the paper sheet post-processing device 20 shown in FIG. 1, which shows a state where the discharge roller 29a is disposed at a contact position.

[FIG. 4] is a side sectional view showing, in a paper sheet post-processing device of the present invention, how a succeeding paper sheet P2 is drawn in in a state where a paper sheet bundle P1 is loaded on a processing tray 30.

[FIG. 5] is a side sectional view showing, in a conventional paper sheet post-processing device, how a succeeding paper sheet P2 is drawn in in a state where a paper sheet bundle P1 is loaded on a processing tray 30.

Description of Embodiments

[0012] With reference to the appended drawings, the following describes an embodiment of the present invention. First, with reference to FIG. 1, a description is given of an image forming system composed of an image forming apparatus 100 and a paper sheet post-processing device 20 of the present invention. FIG. 1 is a schematic view showing an internal configuration of the image forming apparatus 100 and the paper sheet post-processing device 20 according to the present invention. While this embodiment illustratively describes a multi-functional peripheral as one example of the image forming apparatus 100, the paper sheet post-processing device 20 of the present invention can be joined similarly also to other types of apparatuses than a digital multi-functional peripheral, such as, for example, a laser printer, an ink-jet printer, and a facsimile apparatus.

[0013] As shown in FIG. 1, the image forming appara-

tus 100 is a digital multi-functional peripheral of a so-called intra-body paper discharge type and is composed roughly of a main body housing 2a and an upper housing 2b arranged above the main body housing 2a. In the upper housing 2b, there are provided after-mentioned various types of mechanisms for reading an image of an original document as an electric signal, and an auto document feeder 3 is additionally provided above the upper housing 2b. On the other hand, in the main body housing 2a, there are provided after-mentioned various types of mechanisms for, based on the electric signal of the original document image thus read, transferring an image on a paper sheet, and the paper sheet post-processing device 20 is additionally provided in a left side portion of the main body housing 2a.

[0014] In this embodiment, the main body housing 2a is composed of a lower housing 2aa and a joint housing 2ab that is positioned above the lower housing 2aa along a right side portion and joined to the upper housing 2b. In the lower housing 2aa, there are provided a paper feed portion 4 that feeds a paper sheet P, an image forming portion 6 that forms a toner image on the paper sheet P, a fixing device 7 for fixing the toner image on the paper sheet, and so on. In the joint housing 2ab, there is provided a paper sheet discharge portion (discharge portion) 18 for conveying the paper sheet P after being subjected to fixing and discharging it from the main body housing 2a.

[0015] Furthermore, on a left side of the joint housing 2ab immediately below the upper housing 2b, an intra-body paper discharge space 16 is formed that is widely open toward a left side surface and a front. In the intra-body paper discharge space 16, there is provided a relay unit 19 that accepts and loads thereon the paper sheet P discharged from a left side surface of the joint housing 2ab and, in a case of subjecting the paper sheet P to a prescribed type of post-processing, enables conveyance of the paper sheet P to the paper sheet post-processing device 20.

[0016] In the main body housing 2a, there are provided the paper feed portion 4 that is arranged in a lower portion, a paper sheet conveyance path 5 that is arranged laterally to and above the paper feed portion 4, the image forming portion 6 that is arranged above the paper feed portion 4, and a fixing portion 7 that is arranged on a downstream side of the image forming portion 6 in a paper sheet conveyance direction (a right side in FIG. 1).

[0017] In the paper feed portion 4, there are provided a plurality of paper feed cassettes 4a that each have a separate-feed unit such as a paper feed roller provided on a downstream side in the paper sheet conveyance direction. By a rotation operation of the paper feed roller, a bundle of the paper sheets P placed in any one of the paper feed cassettes 4a are fed one by one from an uppermost one of the paper sheets P to the paper sheet conveyance path 5. By using conveyance roller pairs 5a, the paper sheet conveyance path 5 conveys the paper sheet P fed from the paper feed portion 4 to the image

forming portion 6.

[0018] Inside an apparatus main body 100, the image forming portion 6 and the fixing portion 7 are arranged so as to be elongated in a width direction (a front-back direction, a direction orthogonal to a paper plane of FIG. 1) orthogonal to the paper sheet conveyance direction. In an upper portion in the lower housing 2aa, from a left side in FIG. 1, the image forming portion 6 and the fixing portion 7 are provided in this order side by side along the conveyance direction of the paper sheet P (a left-to-right direction).

[0019] The image forming portion 6 forms a prescribed toner image on the paper sheet P by the electrophotographic process. The image forming portion 6 is provided with a photosensitive drum 9 that is an image carrier supported rotatably about an axis, and around the photosensitive drum 9, there are arranged along a rotation direction thereof, a charging device 11, an exposure device 12, a developing device 13, a transfer device 14, a cleaning device 15, and an unshown static elimination device. In the fixing portion 7, the paper sheet P on which a toner image has been transferred at the image forming portion 6 is sandwiched between a fixing roller pair 7a that is composed of a heating roller and a pressing roller and thus is heated and pressed so that the unfixed toner image is fixed on the paper sheet P.

[0020] In the upper housing 2b, an image reading portion 8 is provided. The image reading portion 8 reads image information of an original document. In a case where an original document is manually placed one by one so as to be read by the image reading portion 8, an auto document feeder 3 is opened, and an original document is placed on a contact glass 8a that is provided on an upper surface of the upper housing 2b. In a case where an original document is automatically supplied one by one from an original document bundle so as to be read by the image reading portion 8, the original document bundle is placed on a paper feed tray 3a of the auto document feeder 3 in a closed state. In this configuration, when an original document bundle is placed on the paper feed tray 3a, an original document is automatically and sequentially fed one by one from said original document bundle onto the contact glass 8a. In either case, an original document positioned on the contact glass 8a is irradiated with light from an unshown exposure lamp, and light reflected therefrom is guided as image light to a photoelectric conversion portion (a CCD) via an optical system such as a reflection mirror and an imaging lens (none of them is shown).

[0021] The following describes a basic operation of the image forming apparatus 100 configured as above. First, a surface of the photosensitive drum 9 that rotates counterclockwise in FIG. 1 is uniformly charged by the charging device 11. Subsequently, based on image information read at the image reading portion 8, a circumferential surface of the photosensitive drum 9 is irradiated with a laser beam from the exposure device 12 (a laser device or the like), so that an electrostatic latent image is formed

on the surface of the photosensitive drum 9. The electrostatic latent image is supplied with toner as a developer from the developing device 13, and thus a toner image is formed.

[0022] Next, the paper sheet P from the paper feed portion 4 passes through the paper sheet conveyance path 5 and is conveyed at prescribed timing toward the photosensitive drum 9 on which the toner image has been formed. Further, by the transfer device 14 formed of a transfer roller or the like, the toner image on the surface of the photosensitive drum 9 is transferred on the paper sheet P. Then, the paper sheet P on which the toner image has been transferred is separated from the photosensitive drum 9 and conveyed toward the fixing portion 7. The paper sheet P is heated and pressed while passing through the fixing roller pair 7a, and thus the toner image is fixed.

[0023] After completion of a transfer process of transferring the toner image on the paper sheet P, the photosensitive drum 9 is subjected to removal of residual toner remaining on an outer circumferential surface thereof by the cleaning device 15 and then to a static elimination process of eliminating residual charge by the static elimination device (not shown). After that, the outer circumferential surface of the photosensitive drum 9 is subjected again to a charging process by the charging device 11, and thereafter, subsequent image formation is performed in a similar manner.

[0024] The paper sheet P that has passed through the fixing device 7 is conveyed, as it is, perpendicularly upward along the paper sheet conveyance path 5 into the joint housing 2ab. Inside the joint housing 2ab, an upper portion of the paper sheet conveyance path 5 is branched leftward into two upper and lower conveyance paths, and the conveyance direction of the paper sheet P is switched by a switch claw 17 that is disposed at a branching portion.

[0025] Inside the joint housing 2ab, the paper sheet discharge portion 18 is provided. The paper sheet discharge portion 18 has an upper discharge roller pair 18a and a lower discharge roller pair 18b that is disposed immediately below the upper discharge roller pair 18a, and the paper sheet P conveyed along the paper sheet conveyance path 5 is guided to the upper conveyance path or the lower conveyance path by the switch claw 17.

[0026] When guided to the upper conveyance path by the switch claw 17, the paper sheet P is discharged leftward from the upper discharge roller pair 18a. When guided to the lower conveyance path by the switch claw 17, the paper sheet P is discharged leftward by the lower discharge roller pair 18b. A guiding direction of the switch claw 17 is switched by an unshown control portion.

[0027] The relay unit 19 is demountably mounted to a bottom surface 16a of the intra-body paper discharge space 16. In the intra-body paper discharge space 16, a detection sensor (not shown) that detects mounting of the relay unit 19 is provided. The detection sensor is formed of a PI sensor or the like and transmits a detection

result to the control portion.

[0028] Furthermore, the bottom surface 16a has an inclined surface formed thereon, which is inclined upward toward a downstream side in a paper sheet discharge direction (a left side in FIG. 1). When the relay unit 19 has been demounted from the intra-body paper discharge space 16, the bottom surface 16a is used as a paper sheet discharge tray. In this case, the detection sensor detects that the relay unit 19 has not been mounted, and upon this detection result being transmitted to the control portion, the switch claw 17 guides the paper sheet P to the upper discharge roller pair 18a. Then, the paper sheet P, after being discharged from the upper discharge roller pair 18a, is discharged on the bottom surface 16a.

[0029] On the other hand, in a case where the detection sensor detects that the relay unit 19 has been mounted in the intra-body paper discharge space 16, and this detection result is transmitted to the control portion, the switch claw 17 guides the paper sheet P to the lower discharge roller pair 18b. Then, after being discharged from the lower discharge roller pair 18b, the paper sheet P is carried into the relay unit 19. The paper sheet P that has been carried into the relay unit 19 passes through the relay unit 19 and is carried into the paper sheet post-processing device 20.

[0030] It is also possible to display a detection result on an operation portion (not shown) so as to allow a user to switch, on an operation panel, the guiding direction in which the paper sheet P is guided. Furthermore, an upper surface portion of the relay unit 19 also has a function as a paper sheet discharge tray on which the paper sheet P discharged from the upper discharge roller pair 18a is placed.

[0031] Inside the paper sheet post-processing device 20, there are provided a punch hole forming device 21 that performs punch hole formation with respect to the paper sheet P that has been carried in, a processing tray 30 that loads (stacks) thereon a plurality of the paper sheets P that have been carried in, and a stapler 40 that binds a paper sheet bundle loaded on the processing tray 30 with a staple(s). On a side surface of the paper sheet post-processing device 20, a discharge tray 50 is provided that is vertically movable to a position appropriate for discharging the paper sheet P.

[0032] The punch hole forming device 21 is disposed at an upper portion in the paper sheet post-processing device 20 and forms a plurality of punch holes through the paper sheet P along either of its side end edges (a front side or a rear side of the apparatus) parallel to the conveyance direction of the paper sheet P. On an upstream side of the punch hole forming device 21 and at a substantially middle portion in a direction orthogonal to the paper sheet conveyance direction (a direction perpendicular to the paper plane of FIG. 1), a carry-in detection sensor (not shown) is disposed that detects a tip end of the paper sheet P carried into the paper sheet post-processing device 20 by a paper sheet carry-in roller

pair provided in the relay unit 19.

[0033] Based on detection timing at which the tip end of the paper sheet P is detected by the carry-in detection sensor, the control portion (not shown) controls driving of the paper sheet carry-in roller pair in the relay unit 19 and thereby adjusts punch hole forming positions on the paper sheet P in the conveyance direction thereof, which is conveyed to the punch hole forming device 21. Specifically, a conveyance direction pulse adjustment value is set that is used to perform addition/subtraction to/from a reference conveyance pulse value for a period from a time when the tip end or a rear end of the paper sheet P is detected by the carry-in detection sensor to a time when the paper sheet carry-in roller pair is stopped.

[0034] FIG. 2 and FIG. 3 are each a partial sectional view of a periphery of the processing tray 30 in the paper sheet post-processing device 20. With respect to the paper sheet conveyance direction, on a downstream side of the punch hole forming device 21 (see FIG. 1), a first discharge roller pair 27 is arranged. On an upstream side of the first discharge roller pair 27, an actuator-type paper sheet detection sensor 28 that detects passing of the paper sheet P is disposed.

[0035] Moreover, below the first discharge roller pair 27, there are provided the processing tray 30 that loads thereon, in an aligned manner, a prescribed number of the paper sheets P conveyed by the first discharge roller pair 27 and the stapler 40 (see FIG. 1) that performs a binding process with respect to a bundle of the paper sheets P (paper sheet bundle) loaded on the processing tray 30.

[0036] With respect to the paper sheet conveyance direction, on a downstream side of the processing tray 30, a second discharge roller pair 29 is arranged that discharges a paper sheet bundle from the processing tray 30 onto the discharge tray 50. The second discharge roller pair 29 is composed of a discharge roller 29a that is made of rubber and is rotatable forwardly and reversely by a drive motor (not shown) and a discharge roll 29b that is made of resin and rotates following rotation of the discharge roller 29a. The discharge roller 29a is supported by a roller holder 31 that is swingable up and down about a pivot shaft 31a as a fulcrum.

[0037] Above the processing tray 30 and on a downstream side of the first discharge roller pair 27 (a left side in FIG. 2), there is arranged a tapping member 33 for tapping, in a processing tray 30 direction, the paper sheet P carried in by the first discharge roller pair 27 so that the paper sheet P is aligned in line with a tray surface. The processing tray 30 is provided so as to be inclined downward toward a rear end side of the paper sheet P loaded thereon (a downstream side with respect to a direction in which the paper sheet is drawn in on the processing tray 30, namely, the right side in FIG. 2). The second discharge roller pair 29 rotates reversely, and thus the paper sheet P is drawn in from the rear end side on the processing tray 30, and the rear end of the paper sheet P comes in contact with the butting portion 30a.

Thus, on the processing tray 30, a bundle of paper sheets is loaded in a state where rear ends of the paper sheets are aligned. Furthermore, on the processing tray 30, there is provided a pair of side end alignment cursors 60 that aligns a paper sheet bundle loaded on the processing tray 30 in a width direction (a direction perpendicular to a paper plane of FIG. 2).

[0038] The stapler 40 is movable in the paper sheet width direction orthogonal to the conveyance direction by a movement mechanism (not shown) and, depending on how a binding process is to be performed, moves to a prescribed position along a lower end portion of the processing tray 30.

[0039] Next, a description is given of an operation of the paper sheet post-processing device 20. When the paper sheet P (shown by a broken line in FIG. 2 and FIG. 3) that has been subjected to an image forming process at the image forming apparatus 100 is carried in, in a case where an instruction has been given to perform punch hole formation, by the punch hole forming device 21, punch holes are formed at prescribed positions on the paper sheet P conveyed (for example, two positions along its side end edge on the front side of the apparatus). In a case where no instruction has been given to perform punch hole formation, the paper sheet P passes, as it is, through the punch hole forming device 21.

[0040] Then, the paper sheet P is conveyed further to a downstream side by the first discharge roller pair 27. At this time, as shown in FIG. 2, the roller holder 31 has swung upward, so that the discharge roller 29a is disposed at a position (retracted position) away from the discharge roll 29b. Thus, the paper sheet P conveyed by the first discharge roller pair 27 passes through a gap between the discharge roller 29a and the discharge roll 29b to protrude to the discharge tray 50.

[0041] At timing at which the rear end of the paper sheet P has passed through the first discharge roller pair 27, the roller holder 31 is made to swing downward so that the discharge roller 29a is disposed at a position (contact position) where the discharge roller 29a comes in contact with the discharge roll 29b. After that, the tapping member 33 is driven to align the paper sheet P in line with the processing tray 30. In this state, the discharge roller 29a is made to rotate reversely (a counterclockwise direction in FIG. 3), and thus the paper sheet P is drawn in along the processing tray 30, and the rear ends of the paper sheets P thus drawn in are aligned by the butting portion 30a. The butting portion 30a is not formed continuously over an entire region in the paper sheet width direction but formed to be partially cut out. At this time, an upper portion of the paper sheet P is in a state of being nipped by the second discharge roller pair 29, with a tip end thereof protruding from the second discharge roller pair 29 to above the discharge tray 50. In drawing in the paper sheet P along the processing tray 30, in order to prevent the paper sheet P from being drawn in to an extent more than necessary, the paper sheet P is nipped in a state where the discharge roller 29a is

brought to pressure contact with the discharge roll 29b by using only a self-weight of the roller holder 31.

[0042] Then, when acceptance of a bundle of the paper sheets P is completed, the stapler 40 is made to move to cut-out positions of the butting portion 30a, and rear ends of the paper sheet bundle are inserted into a staple portion 40a where a binding process with respect to the paper sheet bundle is performed. After the binding process with respect to the paper sheet bundle has been performed at the staple portion 40a, the second discharge roller pair 29 is made to rotate forwardly (an arrow direction in FIG. 3), and thus the paper sheet bundle is conveyed upward along the processing tray 30 to be discharged onto the discharge tray 50. In discharging a paper sheet bundle onto the discharge tray 50, the discharge roller 29a is brought to pressure contact with the discharge roll 29b by, besides using the self-weight of the roller holder 31, biasing the roller holder 31 downward using a biasing member such as a spring. Thus, a paper sheet bundle is nipped by a force greater than that in a case of drawing in the paper sheet P, so that the paper sheet bundle can be reliably discharged onto the discharge tray 50.

[0043] Furthermore, in a case where an instruction has been given to perform shift-discharge, in discharging a paper sheet bundle onto the discharge tray 50 by driving the second discharge roller pair 29, first, the roller holder 31 is made to move to the retracted position. After that, the side end alignment cursors 60 are disposed at a position (reference position) at which the paper sheet P has been accepted or a position (shifted position) that is shifted from the reference position by a prescribed amount in a direction (paper sheet width direction) orthogonal to the discharge direction. Then, the roller holder 31 is made to move to the contact position so that the paper sheet is discharged. Thus, a paper sheet bundle is discharged alternately to a reference discharge position on the discharge tray 50 and to a shifted discharge position that is shifted from the reference discharge position by a prescribed amount in the direction (paper sheet width direction) orthogonal to the discharge direction, so that when discharged onto the discharge tray 50 (see FIG. 2), paper sheet bundles are sorted by being loaded so as to be staggered in the paper sheet width direction.

[0044] In the paper sheet post-processing device 20 of this embodiment, the discharge roll 29b that is a component of the second discharge roller pair 29 is configured to be rotatable only in a forward direction (the counterclockwise direction in FIG. 2 and FIG. 3) in which the paper sheet P is discharged onto the discharge tray 50.

[0045] By this configuration, as shown in FIG. 4, in drawing in a paper sheet P2 on the processing tray 30 by using the second discharge roller pair 29, in a state where the discharge roll 29b is stopped from rotating, only the discharge roller 29a is made to rotate reversely. As a result, a drawing-in force is exerted only on the paper sheet P2 being newly carried in and not on a paper sheet bundle P1 that has been butted against the butting portion

30a of the processing tray 30 and thus is already aligned. Accordingly, there is no fear that the paper sheet bundle P1 is drawn in together with the paper sheet P2 and thus is bent, so that an alignment property of a paper sheet bundle on the processing tray 30 can be effectively prevented from being decreased.

[0046] As a method for configuring the discharge roll 29b to be rotatable only in a forward direction, for example, a one-way mechanism that is rotatable only in one direction, such as a one-way gear or a one-way clutch, is built into a rotary shaft of the discharge roll 29b.

[0047] Furthermore, the roller holder 31 supporting the discharge roller 29a is configured to be swingable, and thus the discharge roller 29a can be easily switched in its position between the position (retracted position) away from the discharge roll 29b and the position (contact position) where the discharge roller 29a comes in contact with the discharge roll 29b.

[0048] Other than the above, the present invention is not limited to the above-described embodiment, and various modifications thereto are possible without departing from the spirit of the present invention. For example, while the above-described embodiment has been described by using, as an example, a configuration in which the image forming apparatus 100 and the paper sheet post-processing device 20 are directly connected to each other, the present invention is applicable also to a configuration in which an insertion device that inserts interleaving paper is installed between the image forming apparatus 100 and the paper sheet post-processing device 20.

[0049] The present invention is usable in a sheet post-processing device that loads sheets in an aligned manner on a processing tray by using a discharge roller pair. The use of the present invention can provide a sheet post-processing device that, in drawing in a sheet on a processing tray by using a discharge roller pair and aligning a sheet bundle, can prevent an alignment failure of the sheet bundle, and an image forming system provided with the same.

Claims

1. A sheet post-processing device, comprising:

a processing tray that accepts and loads thereon a prescribed number of sheets;
a discharge tray that is disposed on a downstream side of the processing tray in a sheet conveyance direction, and onto which sheets loaded on the processing tray are discharged; and
a discharge roller pair that is composed of a discharge roller that comes in contact with an uppermost surface of sheets loaded on the processing tray and a discharge roll that comes in contact with a lowermost surface of the sheets loaded on the processing tray,

wherein

a sheet is discharged from the processing tray onto the discharge tray by forwardly rotating the discharge roller pair, and a sheet is drawn in on the processing tray by reversely rotating the discharge roller in a state where the discharge roll is stopped from rotating.

2. The sheet post-processing device according to claim 1, further comprising:

a roller holder that is swingable and rotatably supports the discharge roller, wherein the roller holder swings so that the discharge roller is selectively disposed at a retracted position away from the discharge roll and a contact position where the discharge roller comes in contact with the discharge roll.

3. The sheet post-processing device according to claim 2, further comprising:

a biasing member that biases the roller holder downward, wherein in drawing in a sheet on the processing tray, the discharge roller is disposed at the contact position by using only a self-weight of the roller holder, and in discharging a sheet onto the discharge tray, the discharge roller is disposed at the contact position by, besides using the self-weight of the roller holder, biasing the roller holder downward using the biasing member.

4. The sheet post-processing device according to claim 1, wherein the discharge roll rotates forwardly following rotation of the discharge roller, and a one-way mechanism is provided that restricts reverse rotation of the discharge roll.

5. The sheet post-processing device according to claim 1, wherein the processing tray is provided so as to be inclined downward toward a downstream side with respect to a direction in which a sheet is drawn in on the processing tray.

6. An image forming system, comprising:

the sheet post-processing device according to claim 1; and
an image forming apparatus that is joined to the sheet post-processing device, forms an image on a sheet, and conveys the sheet on which the image has been formed to the sheet post-processing device.

Amended claims under Art. 19.1 PCT**1. A sheet post-processing device, comprising:**

a processing tray that accepts and loads thereon a prescribed number of sheets;
 a discharge tray that is disposed on a downstream side of the processing tray in a sheet conveyance direction, and onto which sheets loaded on the processing tray are discharged; and

a discharge roller pair that is composed of a discharge roller that comes in contact with an uppermost surface of sheets loaded on the processing tray and a discharge roll that comes in contact with a lowermost surface of the sheets loaded on the processing tray and is rotatable only in such a direction as to discharge a sheet onto the discharge tray,

wherein

a sheet is discharged from the processing tray onto the discharge tray by forwardly rotating the discharge roller pair, and a sheet is drawn in on the processing tray by reversely rotating the discharge roller in a state where the discharge roll is stopped from rotating.

2. The sheet post-processing device according to claim 1, further comprising:

a roller holder that is swingable and rotatably supports the discharge roller,
 wherein the roller holder swings so that the discharge roller is selectively disposed at a retracted position away from the discharge roll and a contact position where the discharge roller comes in contact with the discharge roll.

3. The sheet post-processing device according to claim 2, further comprising:

a biasing member that biases the roller holder downward,
 wherein in drawing in a sheet on the processing tray, the discharge roller is disposed at the contact position by using only a self-weight of the roller holder, and
 in discharging a sheet onto the discharge tray, the discharge roller is disposed at the contact position by, besides using the self-weight of the roller holder, biasing the roller holder downward using the biasing member.

4. The sheet post-processing device according to claim 1, wherein

the discharge roll rotates forwardly following rotation of the discharge roller, and
 a one-way mechanism is provided that restricts re-

verse rotation of the discharge roll.

5. The sheet post-processing device according to claim 1, wherein

the processing tray is provided so as to be inclined downward toward a downstream side with respect to a direction in which a sheet is drawn in on the processing tray.

6. An image forming system, comprising:

the sheet post-processing device according to claim 1; and
 an image forming apparatus that is joined to the sheet post-processing device, forms an image on a sheet, and conveys the sheet on which the image has been formed to the sheet post-processing device.

By the amendments made in "AMENDED CLAIMS" attached hereto, claim 1 has been amended to further include a limitation that the discharge roll is rotatable only in such a direction as to discharge a sheet onto the discharge tray.

The limitation that the discharge roll is rotatable only in such a direction as to discharge a sheet onto the discharge tray, which has thus been added to claim 1, is supported by the description in paragraphs [0036], [0044], etc. in the specification as originally filed. The amendments made this time, therefore, do not go beyond the disclosure of the international application as filed.

FIG. 1

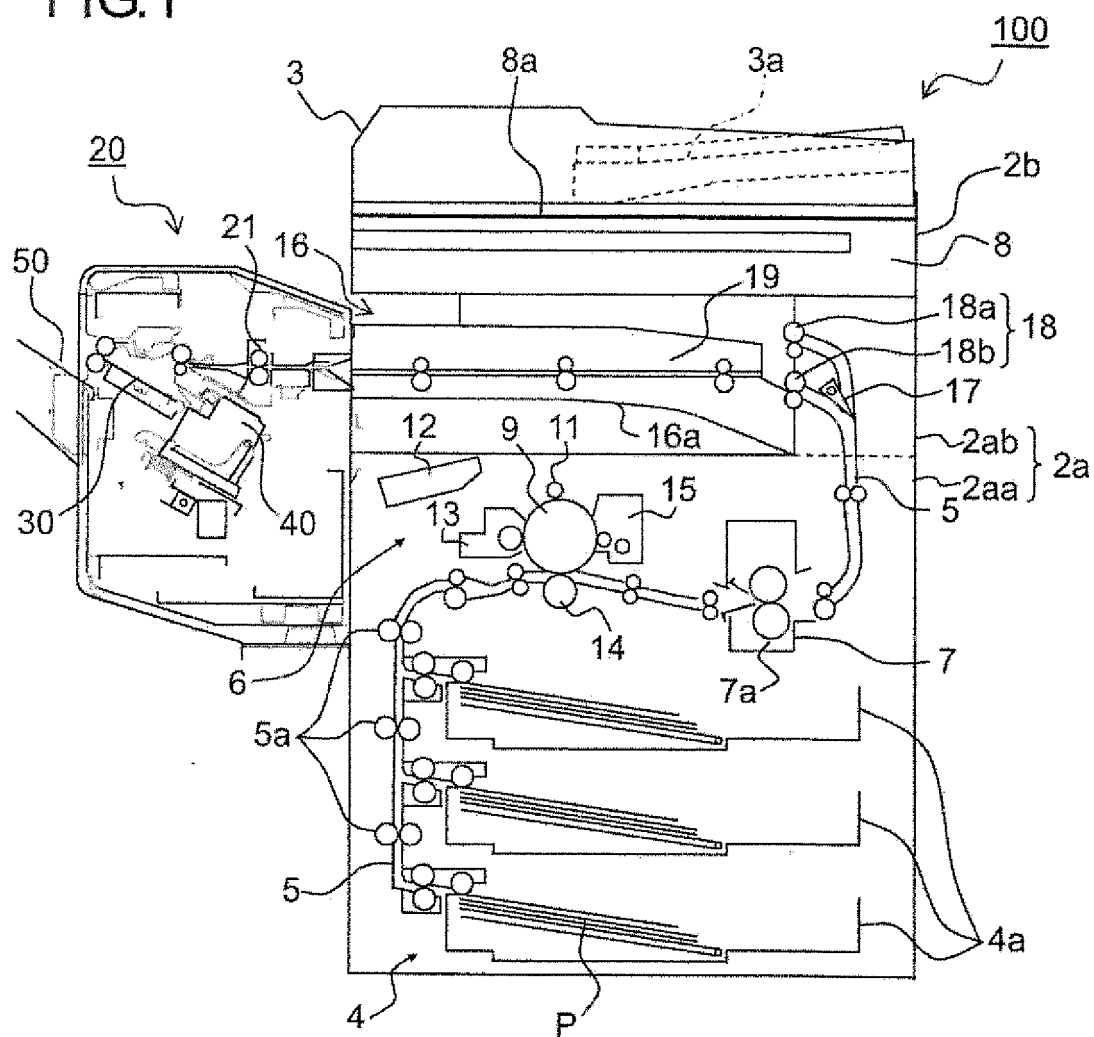


FIG.2

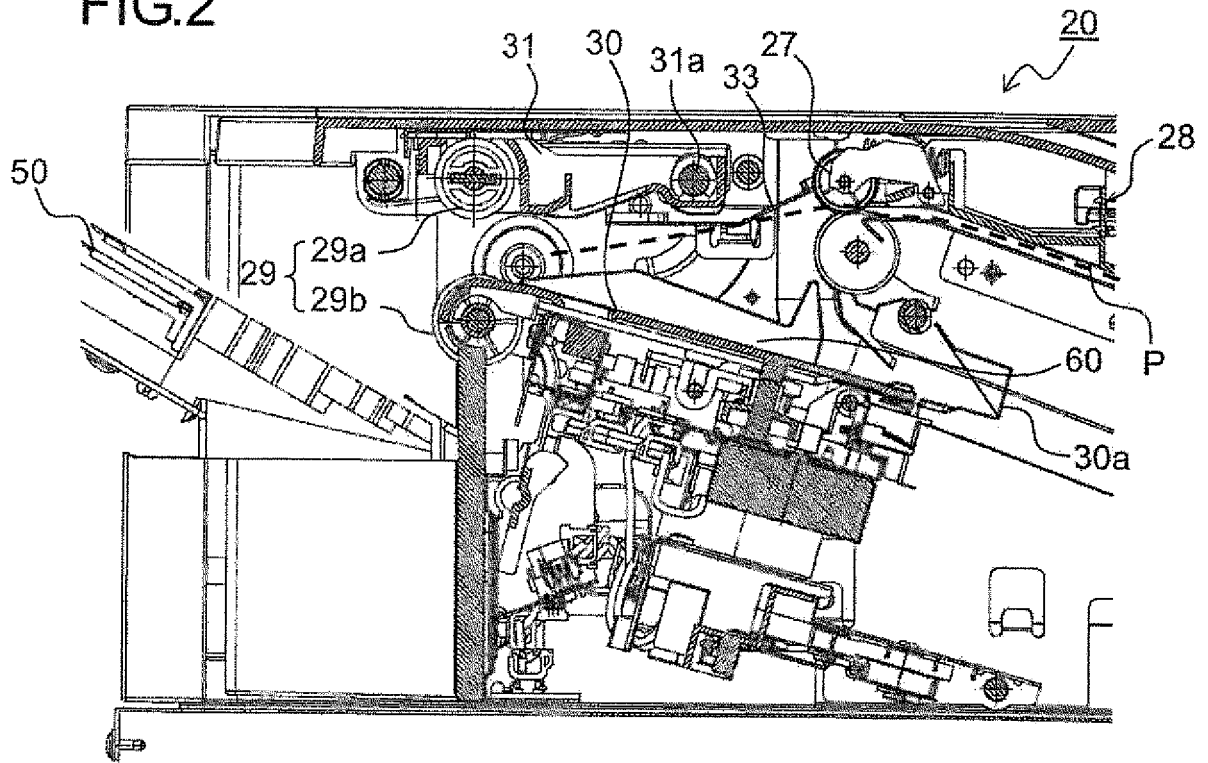


FIG.3

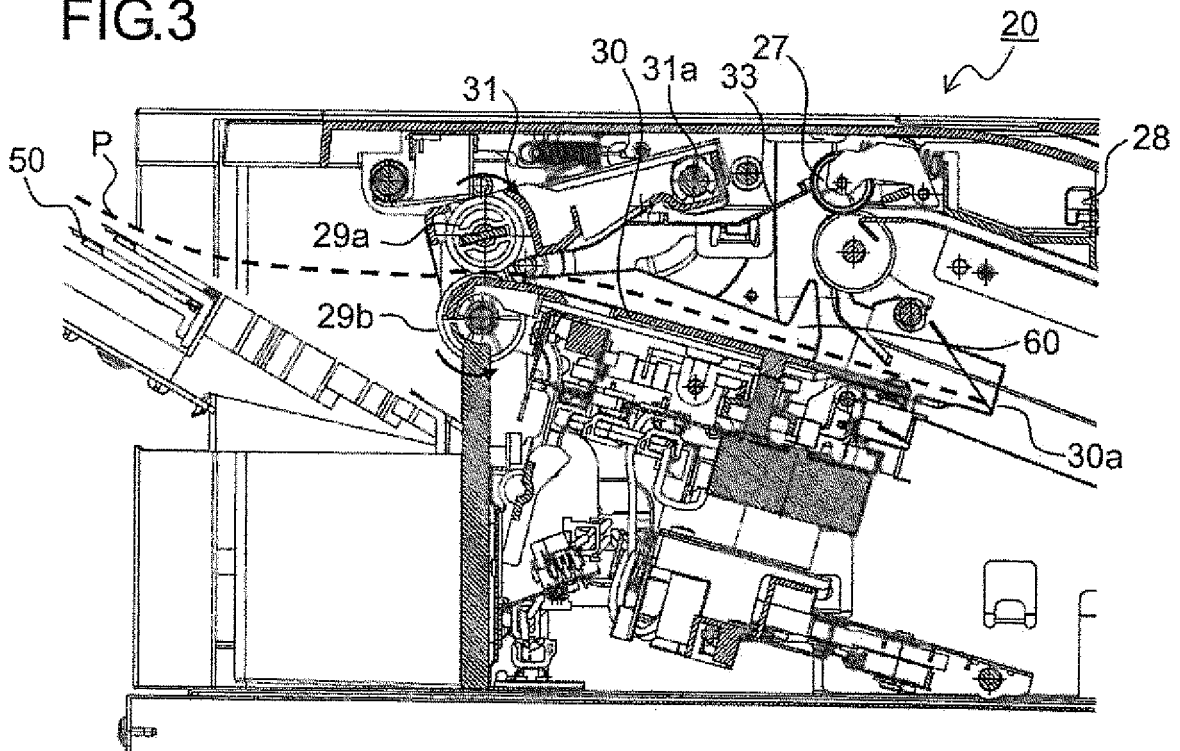


FIG.4

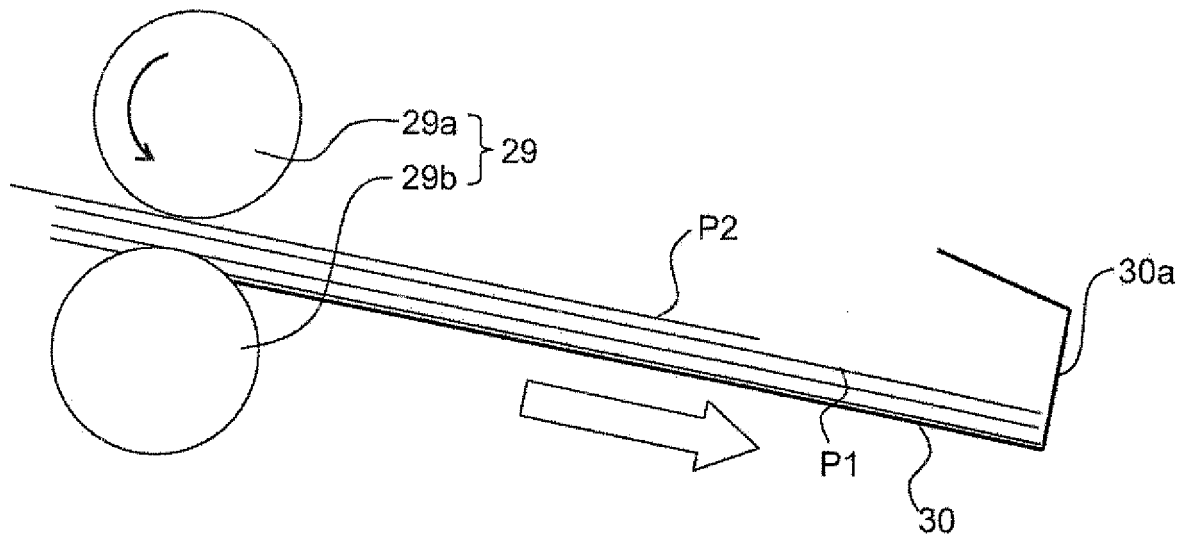
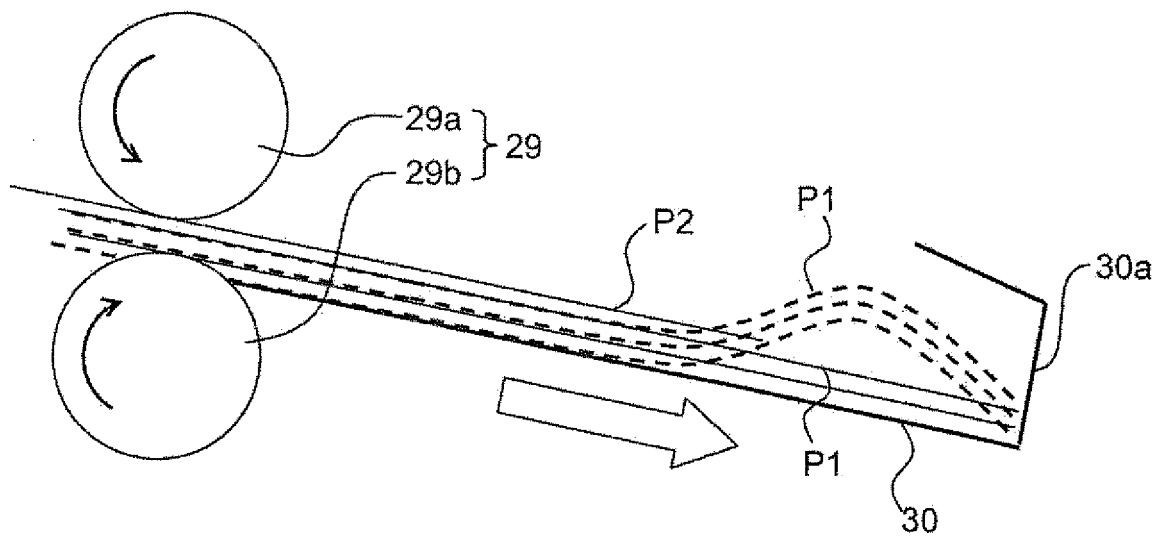


FIG.5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/080888

A. CLASSIFICATION OF SUBJECT MATTER

B65H31/34(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65H31/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 5518396 B2 (Nisca Corp.),	1-2, 5-6
Y	11 June 2014 (11.06.2014),	3
A	paragraphs [0016], [0028], [0041], [0045]; fig. 4 to 7 (Family: none)	4
Y	JP 5402592 B2 (Ricoh Co., Ltd.),	3
	29 January 2014 (29.01.2014),	
	paragraphs [0077] to [0080]; fig. 12 (Family: none)	
A	JP 3886134 B2 (Canon Inc.),	1-6
	28 February 2007 (28.02.2007),	
	& US 2004/0181309 A1 & US 2005/0263957 A1	
	& CN 1526622 A	

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search
06 January 2016 (06.01.16)Date of mailing of the international search report
19 January 2016 (19.01.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H09156820 A [0005]
- JP 2013224221 A [0005]